# Deliverable 23.2
# Services for Inclusive Rail-based Mobility Demonstration Results

| | |
|---|---|
| **Project acronym:** | MOTIONAL |
| **Starting date:** | 01/12/2022 |
| **Duration (in months):** | 46 |
| **Call (part) identifier:** | HORIZON-ER-JU-2022-01 |
| **Grant agreement no:** | 101101973 |
| **Due date of deliverable:** | Month 43 (30-06-2026) |
| **Actual submission date:** | 31-08-2026 |
| **Code** | FP1-WP23-D-GTS-002-02 |
| **Responsible/Author:** | Nihad BAHRI (GTSD – RCS-FR) |
| **Dissemination level:** | PU |
| **Status:** | Issued |

Reviewed: Yes
Hantz Krzysztof (PKP)
Jiménez Enrique (INDRA)

*This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101101973.*

| Document history | | |
|---|---|---|
| ***Revision*** | ***Date*** | ***Description*** |
| 1 | 16-01-2025 | Draft template |
| 2 | 30-06-2025 | 50% version for internal Review |
| 3 | 30-06-2026 | Final version for Review |
| 4 | 31-08-2026 | Final version after Review |
| | | |

| Report contributors | | |
|---|---|---|
| **Name** | **Beneficiary Short Name** | **Details of contribution** |
| Nihad BAHRI | GTSD – RCS | Initial draft and 50% version<br>Contribution to Task 23.3 – Demonstration in Amsterdam |
| Enrique JIMÉNEZ | INDRA | Contribution Task 23.1 – Demonstration in Madrid |
| Alba RODRIGUEZ | INECO | Contribution to Task 23.2 – Demonstration in Malaga |
| Christopher SCHUBERT | DB | Contribution to Task 23.4 – Demonstration in Berlin and Leipzig |
| Nihad BAHRI | GTSD – RCS | Consolidation of final version |
| Krzysztof HANTZ | PKP | Internal Review |
| Enrique JIMÉNEZ | INDRA | Internal Review |
| Nihad BAHRI | GTSD – RCS | Update following internal review |
| | | |

***Disclaimer***
*The information in this document is provided "as is", and no guarantee or warranty is given that the information is fit for any particular purpose. The content of this document reflects only the author's view – the Joint Undertaking is not responsible for any use that may be made of the information it contains. The users use the information at their sole risk and liability.*
*Funded by the European Union. Views and opinion expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Europe's Rail Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them.*

# Table of Contents

1. Executive Summary ..... 10
1.1 Abbreviations and Acronyms ..... 11
1.2 Referenced Documents ..... 13
2. Background ..... 14
3. Objective/Aim ..... 16
3.1 WP23 Demonstrations ..... 17
4. Methodology ..... 18
4.1 Demo Implementation Phase Description ..... 18
4.2 Demo Execution Phase Description ..... 19
4.3 Demo Evaluation Phase Description ..... 19
5. Task 23.2 – Demonstration in Madrid ..... 20
5.1 Demo implementation phase ..... 21
5.1.1 Recruitment of end-users ..... 21
5.1.2 Deployment of demonstration environment ..... 22
5.1.3 Collect and process demonstration data ..... 24
5.1.4 Validation of demonstration data ..... 26
5.1.5 Integration tests ..... 27
5.1.6 Develop training materials ..... 28
5.1.7 Perform installations (if necessary) ..... 29
5.1.8 Validation tests ..... 30
5.1.9 Communication and Dissemination before demonstration execution ..... 31
5.1.10 Implementation of measures to gather results and KPI measurements ..... 32
5.1.11 Questionnaire and interviews guides for stakeholders/end-users ..... 33
5.2 Demo execution phase ..... 34
5.2.1 Software distribution to end users ..... 34
5.2.2 End users/outsiders training ..... 35
5.2.3 Data collection for real-time demonstrations ..... 35
5.2.4 Validation Event ..... 36
5.2.5 Data collection for outcome and Performance indicator (PI) measurements ..... 37
5.2.6 End-user interviews ..... 38
5.2.7 Demonstration event summary ..... 38
5.3 Demo evaluation phase ..... 43
5.3.1 Dissemination Event ..... 43
5.3.2 TRL Validation ..... 45

5.3.3 Analyse feedback from stakeholders ....46
5.3.4 Evaluation of outcomes and Performance indicators (PI) ....46
5.3.5 Impact assessment ....51
6. Task 23.2 (1) – Demonstration in Malaga Robot ....52
6.1. Demo implementation phase ....52
6.1.1 Recruitment of end-users ....52
6.1.2 Deployment of demonstration environment ....53
6.1.3 Collect and process demonstration data ....56
6.1.4 Validation of demonstration data ....56
6.1.5 Integration tests ....56
6.1.6 Develop training materials ....59
6.1.7 Perform installations (if necessary) ....60
6.1.8 Validation tests ....60
6.1.9 Communication and Dissemination before demonstration execution ....61
6.1.10 Implementation of measures to gather results and KPI measurements ....63
6.1.11 Questionnaire and interviews guides for stakeholders/end-users ....64
6.2 Demo execution phase ....64
6.2.1 Software distribution to end users ....64
6.2.2 End users/outsiders training ....65
6.2.3 Data collection for real-time demonstrations ....66
6.2.4 Validation Event ....67
6.2.5 Data collection for outcome and Performance indicator (PI) measurements ....68
6.2.6 End-user interviews ....69
6.2.7 Demonstration event summary ....70
6.3 Demo evaluation phase ....71
6.3.1 Dissemination Event ....71
6.3.2 TRL validation ....72
6.3.3 Analyse feedback from stakeholders ....73
6.3.4 Evaluation of outcomes and Performance indicators (PI) ....74
6.3.5 Impact assessment ....75
7. Task 23.2 (2) – Demonstration in Malaga Accessible SW + Totem ....76
7.1 Demo implementation phase ....77
7.1.1 Recruitment of end-users ....77
7.1.2 Deployment of demonstration environment ....78
7.1.3 Collect and process demonstration data ....86

7.1.4 Validation of demonstration data ....87
7.1.5 Integration tests....88
7.1.6 Develop training materials ....89
7.1.7 Perform installations (if necessary) ....90
7.1.8 Validation tests ....90
7.1.9 Communication and Dissemination before demonstration execution ....93
7.1.10 Implementation of measures to gather results and KPI measurements ....96
7.1.11 Questionnaire and interviews guides for stakeholders/end-users ....97
7.2 Demo execution phase ....98
7.2.1 Software distribution to end users....98
7.2.2 End users/outsiders training ....98
7.2.3 Data collection for real-time demonstrations ....99
7.2.4 Validation Event ....99
7.2.5 Data collection for outcome and Performance indicator (PI) measurements ....101
7.2.6 End-user interviews....101
7.2.7 Demonstration event summary ....111
7.3 Demo evaluation phase....113
7.3.1 Dissemination Event....113
7.3.2 TRL validation ....114
7.3.3 Analyse feedback from stakeholders ....114
7.3.4 Evaluation of outcomes and Performance indicators (PI)....118
7.3.5 Impact assessment....118
8. Task 23.2 (3)– Demonstration in Malaga – Gobos ....120
8.1 Demo implementation phase....120
8.1.1 Recruitment of end-users....120
8.1.2 Deployment of demonstration environment ....120
8.1.3 Collect and process demonstration data....121
8.1.4 Validation of demonstration data ....122
8.1.5 Integration tests....122
8.1.6 Develop training materials ....123
8.1.7 Perform installations (if necessary) ....123
8.1.8 Validation tests ....123
8.1.9 Communication and Dissemination before demonstration execution ....124
8.1.10 Implementation of measures to gather results and KPI measurements ....125
8.1.11 Questionnaire and interviews guides for stakeholders/end-users ....126

8.2 Demo execution phase ..... 126
8.2.1 Software distribution to end users ..... 126
8.2.2 End users/outsiders training ..... 126
8.2.3 Data collection for real-time demonstrations ..... 127
8.2.4 Validation Event ..... 127
8.2.5 Data collection for outcome and Performance indicator (PI) measurements ..... 127
8.2.6 End-user interviews ..... 128
8.2.7 Demonstration event summary ..... 128
8.3 Demo evaluation phase ..... 129
8.3.1 Dissemination Event ..... 129
8.3.2 TRL validation ..... 130
8.3.3 Analyse feedback from stakeholders ..... 131
8.3.4 Evaluation of outcomes and Performance indicators (PI) ..... 131
8.3.5 Impact assessment ..... 131
9. Task 23.2 (4) – Demonstration in Asturias (Villalegre) - Gap Filler ..... 133
9.1 Demo implementation phase ..... 133
9.1.1 Recruitment of end-users ..... 133
9.1.2 Deployment of demonstration environment ..... 133
9.1.3 Collect and process demonstration data ..... 135
9.1.4 Validation of demonstration data ..... 137
9.1.5 Integration tests ..... 139
9.1.6 Develop training materials ..... 140
9.1.7 Perform installations ..... 141
9.1.8 Validation tests ..... 142
9.1.9 Communication and Dissemination before demonstration execution ..... 143
9.1.10 Implementation of measures to gather results and KPI measurements ..... 144
9.1.11 Questionnaire and interviews guides for stakeholders/end-users ..... 145
9.2 Demo execution phase ..... 148
9.2.1 Software distribution to end users ..... 148
9.2.2 End users/outsiders training ..... 148
9.2.3 Data collection for real-time demonstrations ..... 148
9.2.4 Validation Event ..... 149
9.2.5 Data collection for outcome and Performance indicator (PI) measurements ..... 149
9.2.6 End-user interviews ..... 150
9.2.7 Demonstration event summary ..... 150

9.3 Demo evaluation phase ..... 150
9.3.1 Dissemination Event ..... 150
9.3.2 TRL validation ..... 152
9.3.3 Analyse feedback from stakeholders ..... 152
9.3.4 Evaluation of outcomes and Performance indicators (PI) ..... 153
9.3.5 Impact assessment ..... 154
10. Task 23.3 – Demonstration in Amsterdam ..... 155
10.1 Demo implementation phase ..... 157
10.1.1 Recruitment of end-users ..... 157
10.1.2 Deployment of demonstration environment ..... 158
10.1.3 Collect and process demonstration data ..... 159
10.1.4 Validation of demonstration data ..... 160
10.1.5 Integration tests ..... 161
10.1.6 Develop training materials ..... 163
10.1.7 Perform installations (if necessary) ..... 165
10.1.8 Validation tests ..... 166
10.1.9 Communication and Dissemination before demonstration execution ..... 167
10.1.10 Implementation of measures to gather results and KPI measurements ..... 168
10.1.11 Questionnaire and interviews guides for stakeholders/end-users ..... 169
10.2 Demo execution phase ..... 173
10.2.1 Software distribution to end users ..... 173
10.2.2 End users/outsiders training ..... 174
10.2.3 Data collection for real-time demonstrations ..... 175
10.2.4 Validation Event ..... 175
10.2.5 Data collection for outcome and Performance indicator (PI) measurements ..... 178
10.2.6 End-user interviews ..... 179
10.2.7 Demonstration event summary ..... 180
10.3 Demo evaluation phase ..... 182
10.3.1 Dissemination Event ..... 182
10.3.2 TRL validation ..... 184
10.3.3 Analyse feedback from stakeholders ..... 186
10.3.4 Evaluation of outcomes and Performance indicators (PI) ..... 188
10.3.5 Impact assessment ..... 191
11. Task 23.4 – Demonstration in Berlin and Leipzig ..... 193
11.1 Demo implementation phase ..... 194

11.1.1 Recruitment of end-users ....194
11.1.2 Deployment of demonstration environment ....194
11.1.3 Collect and process demonstration data ....196
11.1.4 Validation of demonstration data ....197
11.1.5 Integration tests ....198
11.1.6 Develop training materials ....198
11.1.7 Perform installations (if necessary) ....199
11.1.8 Validation tests ....201
11.1.9 Communication and Dissemination before demonstration execution ....203
11.1.10 Implementation of measures to gather results and KPI measurements ....203
11.1.11 Questionnaire and interviews guides for stakeholders/end-users ....204
11.2 Demo execution phase ....204
11.2.1 Software distribution to end users ....204
11.2.2 End users/outsiders training ....204
11.2.3 Data collection for real-time demonstrations ....205
11.2.4 Validation Event ....205
11.2.5 Data collection for outcome and Performance indicator (PI) measurements ....207
11.2.6 End-user interviews ....207
11.2.7 Demonstration event summary ....208
11.3 Demo evaluation phase ....209
11.3.1 Dissemination Event ....209
11.3.2 TRL validation ....211
11.3.3 Analyse feedback from stakeholders ....211
11.3.4 Evaluation of outcomes and Performance indicators (PI) ....212
11.3.5 Impact assessment ....213
12. TRL validation summary ....215
13. Conclusions ....218
14. Annexes ....221
14.1 Annex 1: Example of feedback from users through google forms questionnaire (Robot) 221
14.2 Annex 2: Test cases accessible tool ....222

# List of Tables

Table 1. Acronyms table ....11
Table 2. Referenced documents ....13
Table 3. WP23 Demonstrations ....17
Table 4. TRL summary ....215

# List of Figures

Figure 1. MOTIONAL Workstream 1.3 “Integration of Rail Traffic with Door-to-Door Mobility” – WP22/23 “Services for inclusive rail-based mobility” ....15
Figure 2. Loading screen MaaS App ....23
Figure 3. Photos of UWB antennas and beacons installed ....24
Figure 4. 3D model and guidance inside station ....25
Figure 5. Application ABT ....26
Figure 6. User Manual – MaaS app ....29
Figure 7. Validation process ....31
Figure 8. Line 10 Metro de Madrid ....36
Figure 9. Validation event photos ....39
Figure 10. Online questionnaire ....40
Figure 11. Extract of surveys results ....41
Figure 12. Video intro ....42
Figure 13. Some LinkedIn posts ....43
Figure 14. Event agenda ....44
Figure 15. Some event photos ....44
Figure 16. Overview of application usage during the Validation Event (active users, engagement time and number of events). ....48
Figure 17. Distribution of application events during the demonstration, highlighting user interaction patterns. ....49
Figure 18. Distribution of user interactions across mobile device types. ....50
Figure 19. Figure Y3 Sample of the list of waypoints ....55
Figure 20. Figure Y9 Totem and Renfe App endpoint to book a service ....59
Figure 21. Figure Y16 Application form to request the App ....65
Figure 22. Figure Y17 Dashboard data collection ....66
Figure 23. Figure Y18 Logs of each demonstration ....67
Figure 24. Figure Y19 Sample Commit to version v2.0.0 ....69
Figure 25. Figure Y20 Resolved bug errors ....69
Figure 26. Hitachi Rail (RCS France) representative at the Dissemination Event ....183

# 1. Executive Summary

Deliverable **D23.2 – Services for Inclusive Rail-based Mobility – Demonstration Results** presents the final implementation, validation and evaluation of the demonstrations carried out within **Work Package 23 (WP23)** of the Europe's Rail **FP1 MOTIONAL** project.

Building upon the specification activities reported in **Deliverable D19.1**, the technical developments described in **Deliverable D22.1**, and the demonstrations' plans documented in **Deliverable D23.1**, this deliverable reports the execution of the Validation Events and assesses the performance, maturity and operational relevance of the developed demonstrators.

WP23 addresses **Technical Enablers (TEs) 20, 21 and 22**, covering innovative services for **platform-based passenger guidance, hands-free travelling and seamless validation, and travel assistance for Persons with Reduced Mobility (PRM)**. The demonstrations were conducted in representative operational environments across several European locations and involved transport operators, infrastructure managers, technology providers and representative end-users.

For each demonstrator, the report documents the deployment of the demonstration environment, execution of the validation activities, collection of technical evidence and user feedback, assessment of performance indicators, validation of the targeted Technology Readiness Levels (TRLs), and dissemination of the obtained results. The demonstrations provide evidence of the feasibility and operational value of the proposed solutions while highlighting the lessons learned and recommendations for future deployment.

Overall, the results confirm the successful validation of innovative services supporting **inclusive, accessible, and passenger-centric rail mobility**. They demonstrate the potential of the developed solutions to improve passenger experience, facilitate accessibility, optimise passenger guidance and enable more seamless travel across multimodal transport networks, thereby contributing to the future implementation of interoperable and inclusive mobility services within the Europe's Rail ecosystem.

## 1.1 Abbreviations and Acronyms

**Table 1. Acronyms table**

| Abbreviation / Acronym | Description |
|---|---|
| ABT | Account Based Ticketing |
| API | Application Programming Interface |
| APK | Android Application Package |
| APP | Application |
| B2B | Business to Business |
| CSM | Common Safety Method |
| EIGV | Eisenbahn-Inbetriebnahmegenehmigungsverordnung |
| FCM | Face Capture Module |
| FP | Flagship Project |
| FRS | Face Recognition Server |
| GA | Grant Agreement |
| GPS | Global Positioning System |
| GTFS | General Transit Feed Specification |
| HFCS | Hands-Free Control System |
| HMI | Human Machine Interface |
| ICT | Information and Communication Technology |
| JSON | JavaScript Object Notation |
| KPI | Key Performance Indicator |
| MaaS | Mobility as a Service |
| MAWP | Multi Annual Working Plan |
| MQTT | Message Queuing Telemetry Transport |
| MVP | Model View Presenter |
| PAD | Presentation Attack Detection |
| PRM | Person with Reduced Mobility |
| PTO | Public Transport Operator |
| QR | Quick Response |
| RTLS | Real Time Location Service |
| SaaS | Software as a Service |
| SDK | Software Development Kit |
| SG | Subgroup |
| TE | Technical Enabler |
| TRL | Technology Readiness Level |
| TSP | Transport Service Provider |
| UI | User Interface |
| UWB | Ultra-Wide Band |
| WP | Work Package |
| WS | Work Stream |

| | |
|---|---|
| XML | Extensible Markup Language |

## 1.2 Referenced Documents

**Table 2. Referenced documents**

| Reference Number | Document |
|---|---|
| [R1] | D19.1 – Specification Report of Enablers 18-27 |
| [R2] | D2.4 – Demonstration Strategy |
| [R3] | D2.5 – Use Cases for Project Demonstrations |
| [R4] | D22.1 – Services for Inclusive Rail-based Mobility – Development Report |
| [R5] | D23.1 – Services for Inclusive Rail-based Mobility – Demonstration Plan |

## 2. Background

This deliverable is part of the **Europe's Rail FP1 MOTIONAL** project and belongs to **Work Package 23 (WP23) – Services for Inclusive Rail-based Mobility**, one of the work packages contributing to **Workstream 1.3 – Integration of Rail Traffic with Door-to-Door Mobility**.

WP23 represents the final stage of the innovation cycle for a set of passenger-oriented services that were **specified in WP19**, **developed, and integrated in WP22**, and **validated through operational demonstrations in WP23**. The work focuses on improving the inclusiveness, accessibility, and quality of multimodal rail journeys by developing innovative digital services that better support passengers before, during and after their journey.

More specifically, WP23 addresses three complementary **Technical Enablers (TEs)**:

- **TE20 – Travel Assistance Across Modes**, providing digital services that support Persons with Reduced Mobility (PRM) and other passengers requiring additional assistance throughout the multimodal journey.
- **TE21 – Hands-free Solutions**, enabling seamless passenger identification and validation to simplify access to transport services and improve the travel experience.
- **TE22 – Platform-based Guidance**, delivering intelligent passenger guidance solutions that provide contextual information adapted to different user profiles and accessibility needs.

Together, these Technical Enablers contribute to the development of more inclusive, interoperable, and passenger-centric mobility services, supporting seamless door-to-door travel across different transport modes and operators.

The work performed within WP22 and WP23 is organized around three complementary innovation domains illustrated in **Figure 1**: **Hands-free Solutions**, **Platform-based Guidance**, and **Travel Assistance Across Modes (PRM)**. These domains constitute the functional framework for all demonstrations presented in this deliverable.

This deliverable has been prepared following the common demonstration methodology defined by the WP2 Technical Coordination in **Deliverable D2.4 – Demonstrations Strategy** [1], ensuring consistency with the demonstration, validation and evaluation processes applied across the FP1 MOTIONAL project.

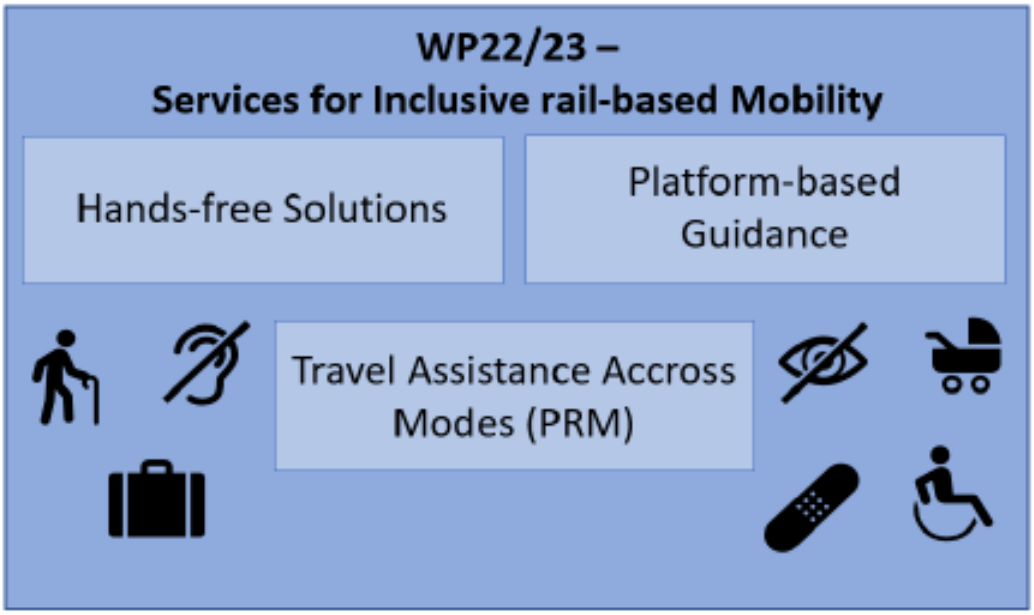



**Figure 1. MOTIONAL Workstream 1.3 "Integration of Rail Traffic with Door-to-Door Mobility" – WP22/23 "Services for inclusive rail-based mobility"**

# 3. Objective/Aim

The objective of Deliverable **D23.2** is to document and assess the execution of the demonstration activities carried out within **WP23 – Services for Inclusive Rail-based Mobility**, following the demonstration plans established in Deliverable **D23.1**.

More specifically, this deliverable aims to:

- Document the deployment of the demonstration environments and the execution of the Validation Events;
- Assess the technical performance, operational feasibility and maturity of the developed demonstrators;
- Evaluate the achievement of the expected outcomes, performance indicators and targeted Technology Readiness Levels (TRLs);
- Analyse the feedback collected from end-users, transport operators and other stakeholders;
- Identify lessons learned and recommendations supporting the future industrialization and deployment of the demonstrated solutions.

The demonstrations were performed in representative operational environments and evaluated according to the common demonstration methodology defined within FP1 MOTIONAL. Each demonstration follows the same overall lifecycle, covering:

- **Implementation Phase** – deployment of the demonstration environment, software and hardware installation, system integration, data preparation and validation;
- **Execution Phase** – preparation of end-users, execution of the Validation Event, data collection and evidence gathering;
- **Evaluation Phase** – analysis of demonstration results, assessment of KPIs and TRLs, stakeholder feedback, impact assessment and dissemination of the achieved outcomes.

Together, these activities provide a consistent framework for evaluating the readiness of the developed solutions and their potential contribution to future inclusive and interoperable rail-based mobility services.

## 3.1 WP23 Demonstrations

WP23 comprises four complementary demonstrations addressing different aspects of inclusive rail-based mobility across representative operational environments in Europe. Each demonstration focuses on one or more Technical Enablers (TE20–TE22) and validates a dedicated set of operational use cases.
All demonstrations in WS1.3 can be seen in **Error! Reference source not found.**.

**Table 3. WP23 Demonstrations**

| Demo number | Short description | TEs | Related use case | Participants | Infra manager/ location/data provider |
|---|---|---|---|---|---|
| 23.1 | Demonstration in Madrid of PRM assistance and hands-free access (seamless validation) | TE21<br>TE22 | UC-FP1-WP19-19<br>UC-FP1-WP19-20<br>UC-FP1-WP19-21 | INDRA, MDM | Madrid, Spain |
| 23.2 | Demonstration in Malaga station: PRM info sharing and platform guidance systems (Smart platform) | TE20<br>TE22 | UC-FP1-WP19-12<br>UC-FP1-WP19-13<br>UC-FP1-WP19-14<br>UC-FP1-WP19-15<br>UC-FP1-WP19-16<br>UC-FP1-WP19-17<br>UC-FP1-WP19-18 | ADIF, INECO, RENFE | Malaga, Spain |
| 23.3 | Demonstration in Amsterdam intermodal hub: hands-free solutions and assistive tools | TE20<br>TE21 | UC-FP1-WP19-22<br>UC-FP1-WP19-23<br>UC-FP1-WP19-24<br>UC-FP1-WP19-25<br>UC-FP1-WP19-26<br>UC-FP1-WP19-27 | GTSD | Amsterdam, Netherlands |
| 23.4 | Demonstration in Berlin and Leipzig: Platform-based passenger guidance using smart LED-floor elements (Illuminated Platform Edge) | TE22 | UC-FP1-WP19-28<br>UC-FP1-WP19-29<br>UC-FP1-WP19-30 | DB | Berlin and Leipzig, Germany |

The following chapters present the implementation, execution, and evaluation of each demonstration according to the common reporting structure adopted across FP1 MOTIONAL.

# 4. Methodology

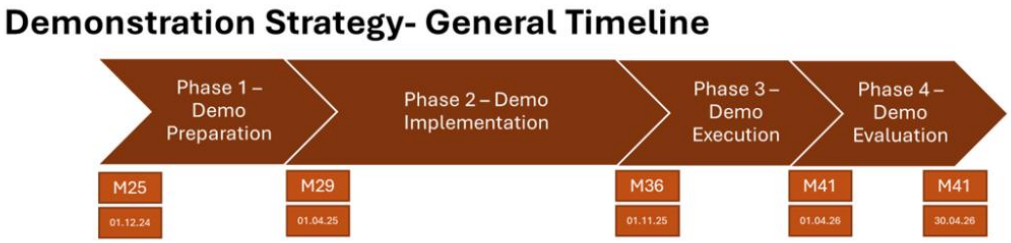
The methodology adopted for this deliverable follows the common demonstration framework defined by the WP2 Technical Coordination in **Deliverable D2.4 – Demonstrations Strategy** [2]. It provides a harmonised approach for preparing, executing, and evaluating demonstrations across the FP1 MOTIONAL project, ensuring consistency between Work Packages while allowing each demonstrator to address its own technical objectives and operational context.

Building upon the demonstration planning activities documented in **Deliverable D23.1**, this report focuses on the implementation, execution, and evaluation of the WP23 demonstrations. The methodology ensures that all demonstrators are assessed using a common structure, enabling a consistent evaluation of technical performance, operational feasibility, user acceptance and Technology Readiness Level (TRL) achievement.

According to the common demonstration strategy, each demonstration follows a four-phase lifecycle. As the planning activities were already documented in D23.1, the present deliverable concentrates on the last three phases, namely:

- **Phase 2 – Demonstration Implementation**, covering the deployment and preparation of the demonstration environment;
- **Phase 3 – Demonstration Execution**, covering the Validation Event and the collection of technical and user evidence;
- **Phase 4 – Demonstration Evaluation**, covering the assessment of results, stakeholder feedback, TRL validation and dissemination activities.

This common methodology enables direct comparison of demonstration outcomes across the different WP23 demonstrators while maintaining sufficient flexibility to accommodate their respective technical specificities and operational environments.




## 4.1 Demo Implementation Phase Description

This phase encompasses all preparatory activities required to set up the demonstration environment and ensure readiness for execution. Key activities include:

- **Recruitment of End-Users**: Identification and engagement of relevant end-users and stakeholders to participate in the validation events.
- **Deployment of Demonstration Environment**: Installation and configuration of software and hardware components, ensuring full operational integration.
- **Data Collection and Validation**: Gathering and verifying demonstration data, including real-time and simulated datasets.

- **Integration and Validation Tests**: Execution of tests to confirm interoperability and functionality across B2B interfaces and systems.
- **Training and Communication Preparation**: Development of training materials and execution of communication plans to inform stakeholders and participants.
- **KPI Measurement Setup**: Implementation of mechanisms to collect performance indicators and feedback during the demonstration.
- **Preparation of Questionnaires and Interview Guides**: Design of tools to capture qualitative insights from stakeholders and end-users.

## 4.2 Demo Execution Phase Description

This phase involves the actual running of the demonstration and the collection of data and feedback. Activities include:

- **Software Distribution and Training**: Provision of necessary software and training sessions for end-users and external participants.
- **Real-Time Data Collection**: Monitoring and recording of data generated during the demonstration.
- **Validation Event Execution**: Conducting the core demonstration activities with expert users, validating the functionalities and interfaces.
- **Outcome and KPI Data Collection**: Gathering data to support the evaluation of performance indicators and demonstration outcomes.
- **End-User Interviews and Feedback**: Conducting interviews and collecting feedback to assess user experience and system effectiveness.
- **Demonstration Summary**: Compilation of key findings and observations from the validation event.

## 4.3 Demo Evaluation Phase Description

The final phase focuses on assessing the results of the demonstration and its impact. Activities include:

- **Dissemination Event**: Organization of events to present results to stakeholders, which may include public presentations, online sessions, or recorded materials.
- **TRL Validation**: Assessment of the Technology Readiness Level achieved, supported by evidence from the demonstration.
- **Stakeholder Feedback Analysis**: Evaluation of feedback collected through interviews, questionnaires, and discussions.
- **Outcome and Performance Indicator Evaluation**: Comparison of expected outcomes with actual results, assessing the effectiveness of the demonstrated solutions.
- **Impact Assessment**: Analysis of the potential impact of the demonstration on end-users, stakeholders, and future transport integration initiatives.

# 5. Task 23.2 – Demonstration in Madrid

The Madrid demonstration aims to validate innovative solutions designed to enhance accessibility and user experience in rail-based mobility, with a particular focus on inclusive services for passengers with reduced mobility (PRM). The demonstration showcases the integration of advanced technologies enabling hands-free validation, indoor guidance, and account-based ticketing within a real operational environment.

The demonstration is carried out in the Metro de Madrid context, leveraging the existing station infrastructure and operational conditions to assess the performance and usability of the developed solutions. It focuses on the practical implementation of accessibility-oriented services, enabling seamless interaction between passengers, station systems, and digital platforms.

By combining **frictionless validation**, **indoor guidance**, and **account-based ticketing**, the demonstration illustrates how different technological components can work together to support a barrier-free travel experience. These solutions reduce the need for physical interaction, simplify navigation within complex station environments, and provide a more flexible and personalised ticketing approach.

The demonstration builds upon the developments carried out in WP22, where the individual components, such as the validation equipment, indoor guidance tools, MaaS application, and ticketing systems, were designed and integrated. In WP23, these components are deployed and validated in a real operational setting, allowing the assessment of their maturity, interoperability, and effectiveness in addressing users' needs.

In this context, the demonstration contributes to the validation of Technical Enablers **TE20, TE21, and TE22**, targeting services focused on accessibility improvement, hands-free passenger interaction, and smart guidance within stations. The demonstration is expected to reach **TRL 6–7**, validating the solutions in a relevant operational environment and demonstrating their readiness for further deployment and scaling.

Particular attention is given to user experience and inclusiveness, evaluating how the solutions support end-users in real travel scenarios. Overall, the Madrid demonstration provides evidence of how integrated digital solutions can improve accessibility, streamline passenger flows, and enhance the overall travel experience, contributing to the development of a more inclusive and user-centric rail system.

Use cases

| Use case ID | TE's | Name | Description |
|---|---|---|---|
| *UC-FP1-WP19-19* | TE21<br>TE22 | Frictionless validation | A user is able to validate a ticket without showing any visual ticket to the validation equipment facilitating the access to public transport. |
| *UC-FP1-WP19-20* | TE21<br>TE22 | Indoor guidance | The user receives information of the map of the station and is guided to the platform facilitating the access of PRM |

| | | | |
|---|---|---|---|
| | | | to public transport. |
| *UC-FP1-WP19-21* | TE21<br>TE22 | Account based ticketing | Account-Based Ticketing is a ticketless way of allowing people to travel meaning they tap or scan using a secure token, linked to an account in the back office, to make a journey. The location and number of taps calculates the fare, which is charged to the passenger during or post journey. This means riders no longer need to buy a ticket and can benefit from best fare policies. |

## 5.1 Demo implementation phase

### 5.1.1 Recruitment of end-users

To support a user-centred validation of the accessibility and inclusive mobility services demonstrated in Madrid, a targeted recruitment of end-users was carried out as part of the preparation phase of the Validation Event. The objective was to involve real users representing different accessibility needs and travel profiles in order to assess the usability, inclusiveness, and overall effectiveness of the demonstrated solutions under realistic operational conditions.

***Recruitment Approach***

End-users were recruited through collaboration with **Metro de Madrid**, leveraging its operational context and existing communication channels. Given that the demonstration was conducted jointly with other project work packages in the same environment, the same group of participants was involved across demonstrations to ensure consistency and comparability of results.

The recruitment focused on users familiar with the Madrid public transport system, enabling interaction with the demonstrated solutions in scenarios aligned with their real travel behaviour. Special attention was given to the inclusion of **persons with reduced mobility (PRM)**, in line with the project's objective of promoting inclusive rail-based mobility.

***Target User Profiles***

The end-users involved in the Madrid demonstration covered the following main profiles:

- **Regular public transport users**, capable of interacting with the system in typical urban travel scenarios.
- **Passengers with Reduced Mobility (PRM)**, allowing the evaluation of accessibility-related functionalities such as hands-free validation and indoor guidance.
- **Users with different levels of digital skills**, ensuring that the usability assessment reflects a wide range of user capabilities and expectations.

This diversity of participants ensured a comprehensive validation of the solutions, covering both standard and accessibility-focused use cases.

***Participation and Validation Activities***

Recruited end-users interacted with the demonstrated solutions during the Validation Event, using the mobile application and associated systems to perform realistic travel scenarios within the station environment.

Their participation focused on:

- Testing **frictionless validation** functionalities enabling seamless access to the system.
- Evaluating **indoor guidance** capabilities for navigation within the station.
- Assessing the usability of **account-based ticketing** and its integration within the overall user experience.
- Providing qualitative feedback on accessibility, ease of use, and overall travel experience.

The involvement of the same user group across the joint demonstrations ensured coherence in the evaluation process and supported the validation of the solutions at **TRL 6–7** in a real operational environment.

### 5.1.2 Deployment of demonstration environment

To support the execution of the Madrid demonstration, a dedicated demonstration environment was deployed and configured, combining software services and on-site hardware components required for the validation of the selected use cases.

The environment was designed to ensure proper interaction between user devices, station infrastructure, and backend systems, enabling the execution of validation, guidance, and ticketing functionalities under real operational conditions.

***Software installation and configuration***

The software environment is based on the components developed in previous project phases and deployed in a cloud-based architecture, ensuring scalability and interoperability between systems.

The main software elements include:

- **MaaS application.** The application provides the main interaction point for users, allowing access to validation, guidance, and ticketing functionalities within a unified interface.
- **Account-Based Ticketing (ABT) system.** The backend system manages user accounts, processes validation events, and calculates fares based on user journeys.
- **Indoor guidance services.** These services enable navigation within the station by processing positioning data and generating route instructions adapted to user needs.

- **Validation and control services.** These services manage the interaction between the user and the validation infrastructure, ensuring seamless access and correct registration of validation events.




**Figure 2. Loading screen MaaS App**

All software components were configured and integrated prior to the demonstration to ensure stable communication between systems and consistent execution of the different functionalities.

***Hardware setup and installation***

To support the demonstration functionalities, several hardware components were installed in the Metro de Madrid infrastructure, enabling user detection, positioning, and interaction with the system.

The hardware deployment included:

- **Ultra-Wide Band (UWB) antennas.** UWB devices were installed at station access points in **Marqués de la Valdavia** and **Manuel de Falla**, enabling accurate user detection and supporting validation and ticketing functionalities.
- **Beacon infrastructure for indoor positioning.** A total of **17 beacons** were deployed in **Marqués de la Valdavia station** to provide positioning data required for indoor guidance services.
- **Validation and communication equipment.** Additional devices were used to support user interaction with the system and ensure communication with backend services.

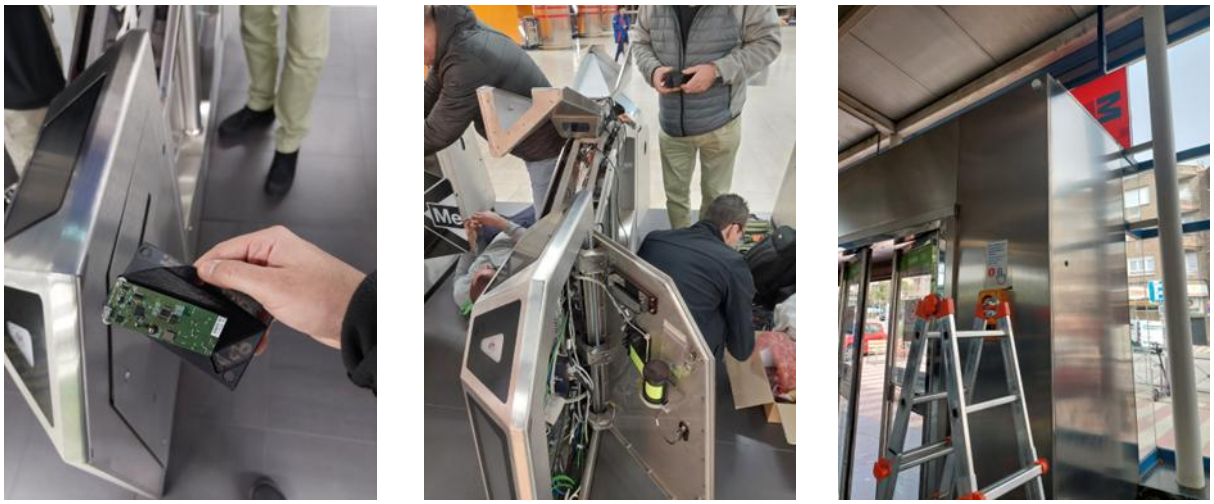


**Figure 3. Photos of UWB antennas and beacons installed**

All hardware components were installed and calibrated prior to the demonstration to ensure:

- **Accurate user positioning within the station environment.**
- **Reliable communication between infrastructure and backend systems.**
- **Proper operation within the constraints of the real station environment.**

The combined deployment of software and hardware components enabled a consistent and functional demonstration setup, supporting the validation of the integrated services in real usage conditions.

### 5.1.3 Collect and process demonstration data

The demonstration required the collection and processing of a limited but relevant set of data to support the configuration and validation of the implemented functionalities.

The data was primarily used to configure the system components, enable positioning and guidance services, and support the execution of ticketing and validation use cases under realistic conditions.

***Datasets used for the demonstration***

- **Station layout data.** Architectural plans of **Marqués de la Valdavia station** were provided to support the development of indoor guidance functionalities, including the definition of navigation paths and points of interest.
- **3D station modelling data.** The station layout information was used to generate a digital model of the environment, enabling accurate calibration of the indoor guidance system and alignment with the physical space.
- **Positioning calibration data.** Data collected during the deployment and calibration of the **beacon infrastructure** was used to fine-tune the indoor positioning system and ensure reliable location tracking within the station.

- **Fare and tariff data.** Metro fare information was required to configure the **account-based ticketing system**, enabling the calculation of fares based on user journeys.

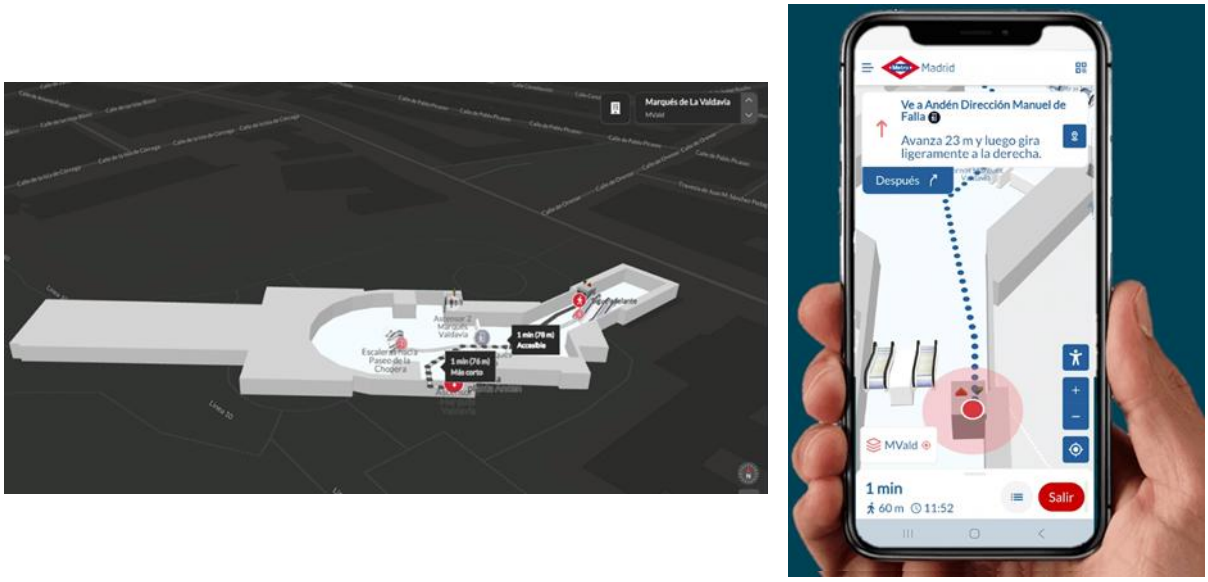



**Figure 4. 3D model and guidance inside station**

***Data usage and processing***

The collected data was processed within the different system components to support the execution of the demonstration scenarios:

- **Station layout and 3D model data** were used by the indoor guidance services to generate navigation routes and provide user instructions within the station.
- **Positioning data** from the beacons was processed to determine user location in real time and enable accurate guidance functionalities.
- **Fare data** was integrated into the ticketing backend to support journey calculation and user account management.

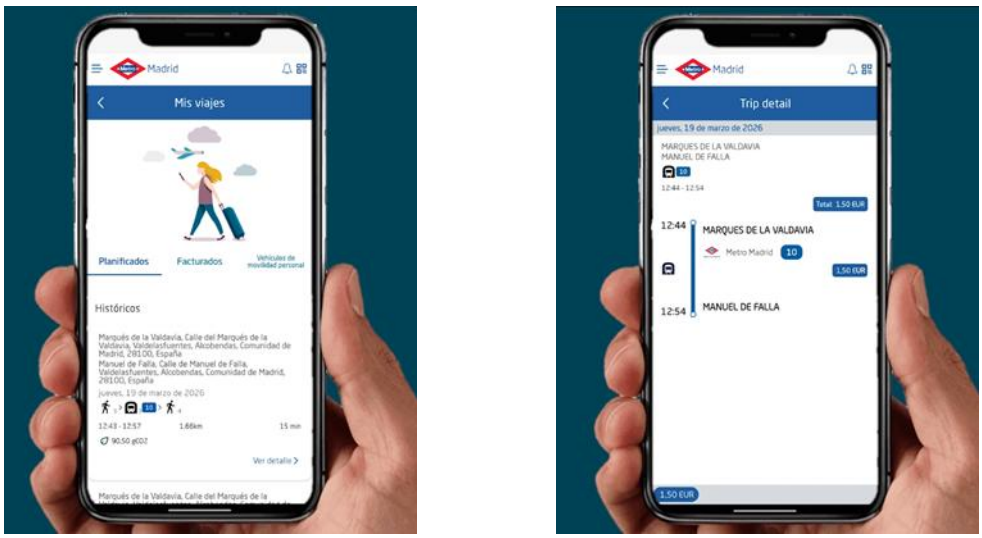



**Figure 5. Application ABT**

All data was configured and validated prior to the demonstration to ensure consistency with the real station environment and correct functioning of the different services during the execution phase.

### 5.1.4 Validation of demonstration data

Prior to the execution of the demonstration, all data used within the system was validated to ensure consistency, reliability, and alignment with the physical environment of the station.

The validation activities focused on confirming that the datasets used for positioning, guidance, and ticketing functionalities were correctly configured and suitable for real operational use.

***Data validation approach***

- **Station layout validation.** The station plans and the generated 3D model were verified against the real infrastructure to ensure accurate representation of spaces, access points, and navigation paths.
- **Indoor positioning validation.** The positioning data obtained from the beacon infrastructure was validated through on-site calibration tests, ensuring that user location could be determined with sufficient accuracy across different areas of the station.
- **System calibration checks.** The alignment between the digital model and the physical deployment of beacons was verified to guarantee correct mapping between real and virtual coordinates.
- **Fare data validation.** The tariff information used in the account-based ticketing system was checked to ensure correct fare calculation logic and consistency with the Metro de Madrid pricing scheme.

***Validation of data collection processes***

- **Testing of positioning data acquisition.** The data collection process from the beacon infrastructure was tested to ensure stable and continuous availability of positioning information.
- **Verification of data consistency.** The interaction between positioning data, guidance services, and user interfaces was validated to confirm that the information delivered to users was coherent and accurate.
- **Pre-demonstration functional checks.** End-to-end tests were carried out to ensure that all data-driven functionalities operated correctly before the Validation Event.

These validation activities ensured that all data used during the demonstration was reliable and suitable for supporting the different functionalities, enabling a consistent and controlled execution of the demonstration scenarios

### 5.1.5 Integration tests

As part of the preparation of the demonstration, integration tests were carried out to ensure that all components of the system operated correctly as a whole, with particular focus on the interaction between positioning infrastructure, validation systems, and backend services.

The objective of these tests was to verify that the different elements involved in the demonstration were properly connected and capable of supporting end-to-end functionalities under realistic conditions.

***Scope of integration testing***

The integration tests covered the interaction between the main system components involved in the demonstration:

- **User mobile application and backend services.** Communication between the application and backend systems was verified to ensure correct data exchange and response handling.
- **Positioning infrastructure and guidance services.** The integration between beacon-based positioning data and indoor guidance services was tested to confirm accurate user localisation and route generation.
- **Validation infrastructure and ticketing system.** The interaction between UWB-based detection systems and the account-based ticketing backend was validated to ensure correct registration of user access and associated transactions.
- **Communication between hardware and software components.** Data exchange between on-site devices and cloud-based services was tested to guarantee reliable system behaviour.

***Integration test activities***

The following activities were performed during the integration testing phase:

- **End-to-end functional tests.** Complete user scenarios were executed to verify that validation, guidance, and ticketing functionalities operated correctly across all components.
- **Positioning accuracy verification.** Tests were conducted within the station to evaluate the interaction between beacon infrastructure and guidance services under real conditions.
- **Validation flow testing.** The process of user detection, validation and transaction registration was tested to ensure correct system behaviour.
- **System stability checks.** Repeated tests were performed to confirm consistent performance and robustness of the integrated environment.

These integration tests confirmed that all components of the demonstration environment were properly interconnected and capable of supporting the defined use cases, ensuring readiness for the execution of the Validation Event.

### 5.1.6 Develop training materials

To support end-users participating in the demonstration activities, dedicated training materials were developed during Phase 2. The objective of these materials was to ensure that participants could clearly understand how to use the application and effectively interact with the demonstrated functionalities.

***User Manual***

A **user manual** was prepared and provided to all participating end-users prior to the Validation Event. The manual offered step-by-step guidance on how to use the application and covered all key functionalities relevant to the demonstration use cases.

The user manual included:

- **Instructions on how to access and navigate the application.**
- **Guidance on performing core actions such as user validation, navigation within the station, and interaction with ticketing functionalities.**
- **Explanations of the main features and interfaces presented during the demonstration.**
- **Illustrative examples aligned with the demonstration scenarios.**

The material was designed to be clear and easy to follow, enabling users with different levels of digital skills to interact confidently with the system without the need for extensive prior training.




**Figure 6. User Manual – MaaS app**

These training materials supported a smooth onboarding of participants and contributed to ensuring that users could meaningfully engage with the demonstration and provide relevant feedback during the validation activities.

### 5.1.7 Perform installations (if necessary)

As part of the preparation phase of the demonstration, specific hardware installations were carried out within the Metro de Madrid infrastructure to enable the execution of validation and guidance functionalities.

The installation activities focused on deploying the required positioning and detection technologies in selected areas of the station, ensuring their correct integration within the demonstration environment.

***Installation activities***

The following installations were performed prior to the Validation Event:

- **Deployment of Ultra-Wide Band (UWB) devices.** UWB antennas were installed at access points in **Marqués de la Valdavia** and **Manuel de Falla** stations to support user detection and validation functionalities.
- **Installation of beacon infrastructure.** A total of **17 beacons** were installed in **Marqués de la Valdavia station** to enable indoor positioning and guidance services.
- **Setup of supporting communication equipment.** Additional devices were configured to ensure proper communication between the installed hardware and backend systems.

***Installation process***

- **On-site setup and configuration.** All hardware components were physically installed in the station environment, taking into account infrastructure constraints and operational conditions.
- **Calibration and alignment.** The installed devices were calibrated to ensure correct positioning accuracy and proper interaction with the software components.
- **Verification of system readiness.** Functional checks were performed after installation to confirm that all devices were operational and correctly integrated into the overall system.

These installation activities ensured that the necessary infrastructure was in place to support the execution of the demonstration and the correct functioning of the different use cases.

### 5.1.8 Validation tests

Prior to the Validation Event, a set of validation tests was carried out to ensure the overall quality, stability, and readiness of the demonstration environment. These tests aimed to confirm that the system supported the intended functionalities and could be used reliably by end-users under real operational conditions.

***Scope of validation tests***

The validation tests focused on verifying the correct operation of the main functionalities demonstrated in the Madrid use case:

- **Mobile application usability and stability.** The application was tested to ensure correct behaviour during user interaction, including navigation between features and responsiveness under normal usage conditions.
- **Frictionless validation functionalities.** The user validation process was tested to verify correct detection, access authorisation, and registration of validation events.
- **Indoor guidance functionalities.** Navigation services were evaluated to ensure accurate route generation and consistency between the user's real position and the guidance instructions provided.
- **Account-based ticketing processes.** The interaction between validation events and backend systems was tested to confirm correct transaction processing and journey calculation.

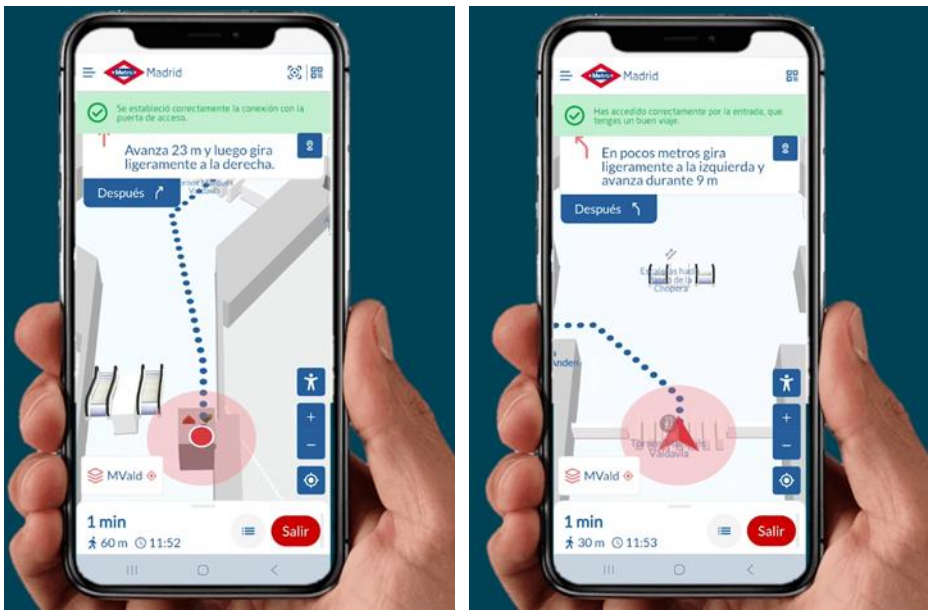



**Figure 7. Validation process**

***Validation test approach***

- **Scenario-based testing.** Representative use cases were defined and executed to simulate realistic user interactions within the station environment.
- **On-site testing in operational conditions.** Tests were performed directly in the station to assess system behaviour in real-world conditions, including different user movements and positioning scenarios.
- **User-oriented validation.** Participants were allowed to interact with the system freely, without strict test scripts, to evaluate usability and detect potential issues from an end-user perspective.

These validation tests ensured that the demonstration environment reached an adequate level of maturity and reliability, allowing end-users to participate effectively in the Validation Event and provide meaningful feedback on the demonstrated solutions.

### 5.1.9 Communication and Dissemination before demonstration execution

In preparation for the execution of the demonstration activities, targeted communication and dissemination actions were carried out in line with the communication plan defined in Phase 1. These actions aimed to inform relevant stakeholders, raise awareness of the upcoming demonstration and ensure adequate preparation of participants.

***Internal Promotion***

Prior to the demonstration, both **Metro de Madrid** and **INDRA** conducted internal communication activities to promote the demonstration among relevant staff and stakeholders. These actions highlighted the objectives and scope of the demonstration and helped ensure internal alignment and engagement ahead of the Validation Event.

Internal promotion activities contributed to familiarising potential participants with the demonstrated solutions and supported the coordination of technical and organisational aspects required for the demonstration execution.

***Dissemination at ITS Europe 2025***

As part of the dissemination activities preceding the demonstration, the project developments and the planned demonstration were presented at **ITS Europe 2025 in Seville**. During this event, the technical progress, system functionalities and demonstration concept were communicated to a wider audience, including industry stakeholders and experts.

The presentation at ITS Europe 2025 served to:

- Showcase the developed solutions and demonstration scope.
- Raise interest in the upcoming validation activities.
- Provide visibility to the demonstration that was subsequently executed in March 2026.

Overall, these communication and dissemination activities ensured that relevant stakeholders were informed in advance, expectations were properly managed, and sufficient awareness was built ahead of the demonstration execution.

### 5.1.10 Implementation of measures to gather results and KPI measurements

To support the assessment of the demonstration outcomes, specific measures were implemented to collect relevant data during the Validation Event. These measures were designed to capture both quantitative and qualitative information required for the evaluation of system performance and user experience.

The data collection approach focused on monitoring system behaviour and gathering feedback from end-users interacting with the demonstrated functionalities.

***KPI data collection approach***

The implementation of KPI measurement mechanisms was aligned with the demonstration objectives and the functionalities under evaluation, ensuring that relevant data could be collected in a structured and consistent way.

- **User interaction monitoring.** System interactions were tracked to analyse how users engaged with validation, guidance, and ticketing functionalities during the demonstration.
- **Validation and transaction recording.** Data related to user access and validation events was collected through the backend systems, enabling the analysis of system performance and reliability.

- **Positioning and guidance behaviour.** The indoor positioning system provided data on user movement and location, supporting the evaluation of navigation accuracy and guidance effectiveness.
- **System performance indicators.** The correct execution of the different functionalities was monitored during the demonstration, focusing on stability and response behaviour.

***Qualitative data collection***

In addition to system-generated data, qualitative feedback was gathered to complement the KPI evaluation:

- **End-user feedback.** Observations and feedback were collected from participants during their interaction with the system, focusing on usability, accessibility, and overall experience.
- **On-site observations.** The behaviour of users within the station environment was analysed to identify potential usability issues and improvement areas.

***Implementation considerations***

- **Non-intrusive data collection.** The measures implemented ensured that data was collected without affecting the normal interaction of users with the system.
- **Alignment with evaluation phase.** The collected data was structured to support the subsequent analysis of outcomes and performance indicators described in the evaluation phase.

These measures ensured that sufficient and relevant data was collected during the demonstration, enabling a consistent and structured assessment of the system performance and user experience in the following evaluation phase.

### 5.1.11 Questionnaire and interviews guides for stakeholders/end-users

To support the collection of qualitative feedback during the Validation Event, a structured questionnaire was developed and used with participating end-users. The objective was to capture user perceptions, assess usability, and gather insights related to the demonstrated functionalities.

***Questionnaire design***

A questionnaire was designed to evaluate the main aspects of the demonstration from the end-user perspective, covering usability, functionality, and overall experience.

The questionnaire included the following types of questions:

- **User profile identification.** Participants were classified according to their profile, including standard users and persons with reduced mobility (PRM), enabling differentiated analysis of results.
- **Usability and interaction assessment.** Questions were included to evaluate the ease of use of the application and the clarity of the information provided to users.
- **Frictionless validation evaluation.** Users were asked about their experience with the validation system, including reliability, ease of access, and perceived usefulness.
- **Indoor guidance assessment.** The questionnaire covered aspects such as positioning accuracy, quality of navigation, and correctness of points of interest displayed in the application.
- **Ticketing and overall experience.** Questions were included to evaluate user satisfaction with the ticketing approach and the overall travel experience.
- **Open feedback and improvement suggestions.** Participants were given the opportunity to provide qualitative feedback and suggestions for improvement based on their experience.

***Data collection approach***

- **Post-demonstration questionnaire.** The questionnaire was completed by participants after interacting with the system during the Validation Event.
- **Digital format.** The survey was distributed and collected electronically, ensuring easy access and efficient data processing.
- **Combination of quantitative and qualitative inputs.** The questionnaire included both closed questions for structured evaluation and open questions to capture detailed user feedback.

The use of this questionnaire enabled the systematic collection of user feedback, supporting the subsequent analysis of the demonstration results and the evaluation of the demonstrated solutions from an end-user perspective.

## 5.2 Demo execution phase

### 5.2.1 Software distribution to end users

For the execution of the Validation Event, end-users required access to the mobile application integrating functionalities developed within WP23.

The application developed in WP21/23, frictionless validation, indoor guidance functionalities and ABT, is compatible with standard Android mobile devices. In order to facilitate user onboarding prior to the Validation Event, the application was distributed in advance as an APK file via email, together with the corresponding user manual.

This approach allowed participants to install the application on their personal devices and become familiar with its main functionalities before the demonstration, ensuring that they could effectively interact with the system during the validation activities.

During the Validation Event, the application was also made available in a pre-configured environment to ensure full functionality across all demonstrated features. No additional installation steps were required from the users during the event itself.

### 5.2.2 End users/outsiders training

To ensure that all participants were adequately prepared for the Validation Event, a set of preparatory actions was defined prior to the execution of the demonstration.

Following the distribution of the application and the user manual, end-users were given the opportunity to participate in an optional online preparatory session, intended to clarify any doubts and provide additional guidance on the use of the application before the event. However, this session was ultimately not required, as no specific requests for support were raised by the participants at that stage.

Instead, a brief in-person introduction session was conducted at the beginning of the Validation Event. During this session:

- The main functionalities of the application were reiterated.
- key aspects relevant to the demonstration scenarios were highlighted.
- participants were provided with final guidance to ensure a smooth interaction with the system.

This approach proved sufficient to align all participants and ensure that users clearly understood the objectives of the demonstration and how to interact with the application during the validation activities.

### 5.2.3 Data collection for real-time demonstrations

During the Validation Event, real-time data was collected to monitor the behaviour of the system and support the evaluation of the demonstrated functionalities under operational conditions.

The data collection focused on capturing user interactions and system responses during the execution of validation, guidance, and ticketing use cases.

***Real-time data collection approach***

The following types of data were collected during the demonstration:

- **User validation events**. Data related to user access at station entry and exit points was collected, including successful and failed validation attempts.
- **Positioning and movement data**. The indoor positioning system provided real-time information about user location within the station, supporting the analysis of guidance functionalities.
- **Guidance system interactions**. Data on route generation and user navigation behaviour was captured to evaluate the performance of indoor guidance services.

- **System response behaviour**. The interaction between user devices, hardware infrastructure, and backend systems was monitored to assess system responsiveness during operation.

***Data collection conditions***

- **Real operational environment**. Data was collected directly in the station during normal user interaction with the system.
- **User-driven interactions**. Data was generated based on real usage scenarios defined during the Validation Event.
- **Controlled test context**. Although performed in a real environment, the demonstration followed predefined scenarios to ensure consistency in the collected data.

The collection of real-time data provided valuable input for understanding system behaviour during operation and supported the subsequent evaluation of the demonstrated solutions.

### 5.2.4 Validation Event

The Validation Event constituted the core activity of the demonstration, where the developed solutions were executed in a real operational environment and evaluated by end-users. The objective was to validate the functionality, usability, and overall performance of the system through direct user interaction in realistic travel scenarios.

The event was carried out in the Metro de Madrid network, specifically involving **Marqués de la Valdavia** and **Manuel de Falla** stations (Line 10 of Metro de Madrid) on the 19th of March 2026, where the deployed infrastructure supported the execution of the demonstration use cases.

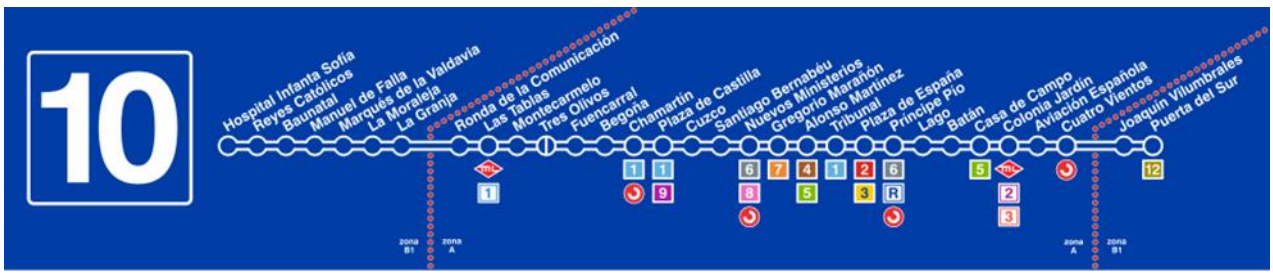



**Figure 8. Line 10 Metro de Madrid**

***Event execution***

During the Validation Event, passengers interacted with the system by performing predefined travel scenarios within the station environment. These scenarios were designed to reflect typical user journeys and to ensure that all functionalities were tested under consistent conditions.

The main activities performed by end-users included:

- **Accessing the station using frictionless validation.** Users interacted with the system at entry and exit points, enabling the evaluation of the validation process and system response.
- **Navigating within the station using indoor guidance.** Participants followed routes generated by the application to reach specific destinations, allowing the assessment of navigation accuracy and usability. The routes were automatically calculated depending on the passenger profile (standard or PRM).
- **Interacting with account-based ticketing functionalities.** User interactions generated validation events and associated transactions, supporting the validation of backend processes.

***User participation***

End-users followed predefined scenarios while being free to interact naturally with the system, ensuring both structured validation and realistic usage conditions:

- **Scenario-driven interaction.** Participants executed defined tasks to ensure coverage of all demonstration functionalities.
- **Free interaction.** Users were allowed to explore the system beyond predefined scenarios, providing additional insights into usability and behaviour.
- **Inclusion of different user profiles.** Both standard users and PRM participants were involved, allowing the evaluation of accessibility-related aspects.

***Monitoring and Support***

- **On-site supervision.** Technical staff monitored the execution of the demonstration to ensure correct operation and to address any issues in real time.
- **Observation of user behaviour.** User interactions were observed to identify usability challenges and system limitations.
- **Technical support.** Assistance was provided to participants when required, ensuring a smooth execution of the demonstration activities.

The Validation Event enabled the practical verification of the integrated functionalities in a real environment, providing direct feedback from users and supporting the overall assessment of the demonstrated solutions.

### 5.2.5 Data collection for outcome and Performance indicator (PI) measurements

During the Validation Event, specific data was collected to support the evaluation of the demonstration outcomes and the defined Performance Indicators (PIs). The collection process aimed to gather both system-generated data and user feedback required for a comprehensive assessment of the demonstrated functionalities.

***Collected data for evaluation***

The following types of data were gathered during the execution of the demonstration:

- **Validation and transaction data**. Information related to user access events, including successful and unsuccessful validations, was recorded to assess system reliability and operation.
- **Positioning and navigation data**. Data generated by the indoor positioning system was collected to evaluate the accuracy of user location and the effectiveness of guidance functionalities.
- **User interaction data**. Interactions between users and the mobile application were monitored to analyse usability and system behaviour during real usage scenarios.
- **System performance observations**. The functioning of the different components was observed during the demonstration to identify issues related to responsiveness and stability.

***Qualitative data collection***

In addition to system data, qualitative inputs were gathered to complement the evaluation:

- **User feedback from questionnaires**. Responses collected after the demonstration provided insight into user satisfaction, usability perception, and overall experience.
- **On-site observations**. The behaviour of participants during the demonstration was analysed to identify usability issues and potential improvement areas.

The structured collection of these data sets ensures that the demonstration outcomes can be assessed in a consistent and reliable manner during the evaluation phase.

### 5.2.6 End-user interviews

No formal structured or recorded interviews were conducted during the Validation Event.

Instead, informal interactions and direct discussions were held with end-users throughout the demonstration. These exchanges allowed participants to share their impressions, highlight any issues encountered and provide immediate qualitative feedback on their experience with the application.

In addition, structured feedback was collected through the online questionnaire, which complemented the insights gathered during the on-site discussions.

This combined approach provided sufficient qualitative input to support the evaluation of the demonstration outcomes without the need for formal interview sessions.

### 5.2.7 Demonstration event summary

The Validation Event for the Madrid demonstration was successfully conducted at **Marqués de la**

**Valdavia station (Line 10 of Metro de Madrid) on 19th March 2026**, involving a group of end-users interacting with the integrated application in a real operational context.

During the event, the main functionalities demonstrated included:

- **Frictionless validation**, allowing users to access the station without physical interaction with validation equipment.
- **Indoor guidance**, providing navigation support within the station based on real-time positioning.
- **Account-based ticketing**, enabling ticketless travel through backend processing of user journeys.



**Figure 9. Validation event photos**

The demonstration confirmed the feasibility of integrating these functionalities into a single system, enabling a seamless user experience in a real station environment. Users were able to interact with the application and infrastructure under realistic conditions, validating the overall concept and its applicability to real-world scenarios.

***User feedback***

Feedback collected from participants through questionnaires provided valuable insights into the performance and usability of the system.

Users generally highlighted:

- **Positive perception of the overall experience.** Most users found the system useful and intuitive, especially in terms of simplifying access to the station.
- **Usability of indoor guidance.** Navigation functionalities were well received, although improvements in positioning accuracy were suggested.
- **Acceptance of frictionless validation.** Users appreciated the convenience of accessing the station without physical interaction, although some reliability issues were identified.
- **Interest in accessibility features.** The functionalities focused on PRM users were considered valuable and beneficial for improving inclusivity in the station environment.

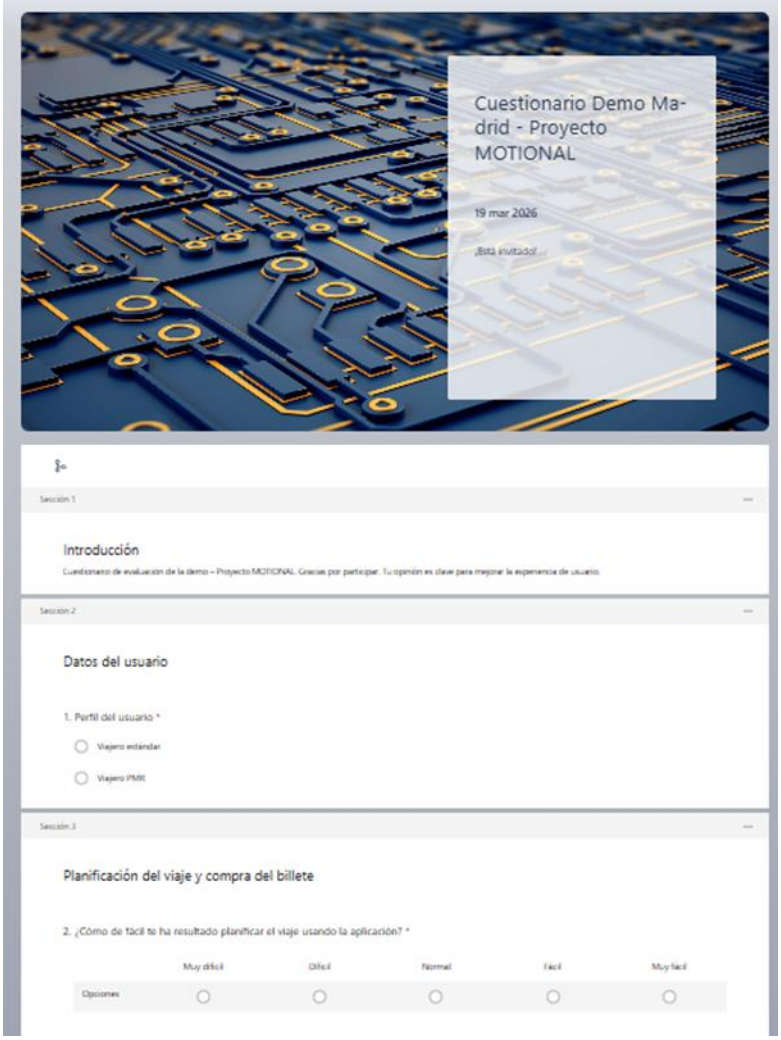



**Figure 10. Online questionnaire**

These results validate the effectiveness of the WP22/23 developments in providing a reliable and user-oriented solution for integrated journey planning and ticketing.

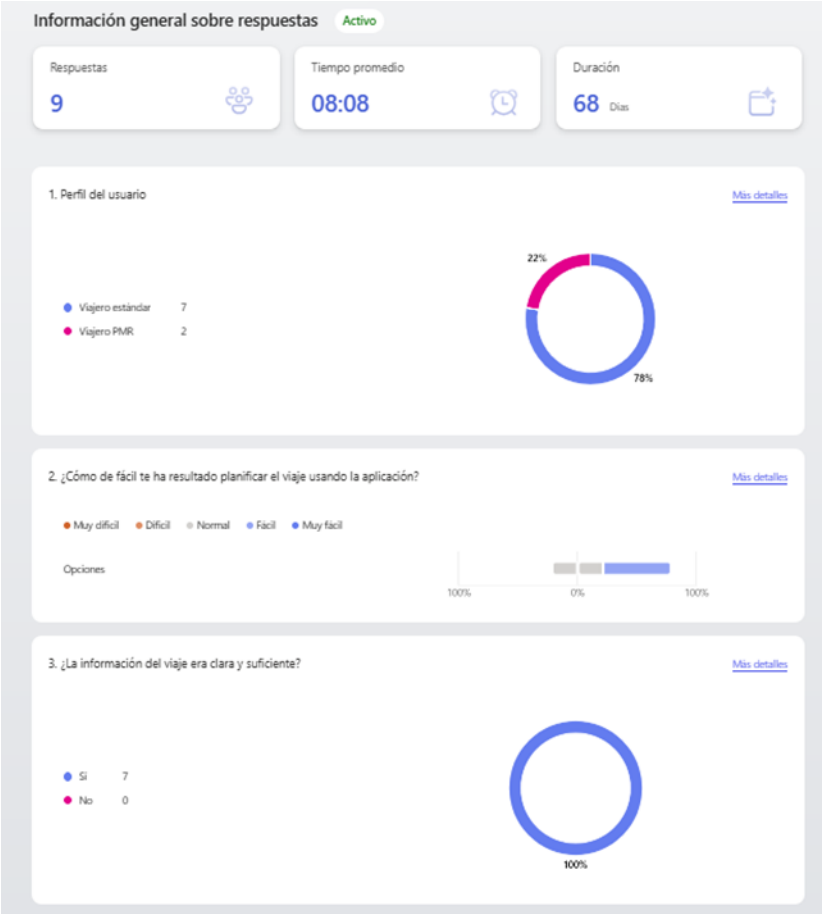



**Figure 11. Extract of surveys results**

***Dissemination activities***

The Validation Event also contributed to the dissemination and visibility of the project results. A 4-minute **demonstration video** was produced as dissemination material.




**Figure 12. Video intro**

Link to the video: https://www.youtube.com/watch?v=5wlubAOf1IQ




Also, several **LinkedIn publications** were shared to showcase the demonstration outcomes and promote developed solutions to a wider audience.

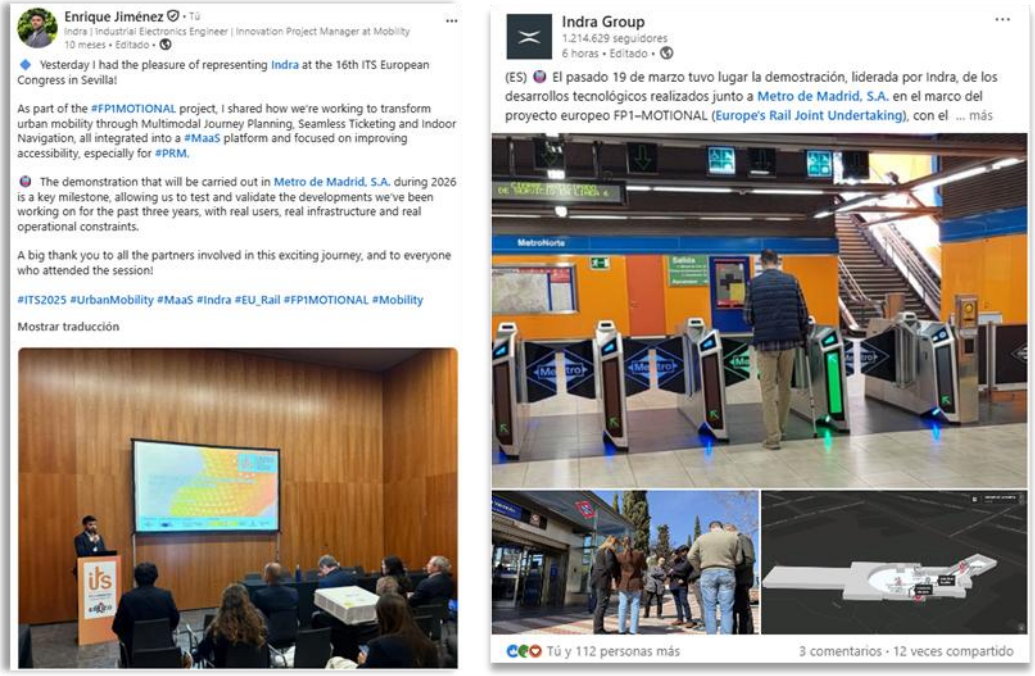



**Figure 13. Some LinkedIn posts**

Overall, the Validation Event provided strong evidence of both **technical readiness and user acceptance** of the WP22/23 functionalities, confirming the viability of standard-based integration for multimodal journey planning and ticketing in a realistic urban transport context.

## 5.3 Demo evaluation phase

### 5.3.1 Dissemination Event

The dissemination of the demonstration results was carried out during the **FP1 MOTIONAL event held in Madrid on 7 May 2026**, organised as a hybrid event combining both on-site and online participation. The event took place at **ADIF's Training Center in Madrid** and gathered project partners, stakeholders, and external participants to present the main outcomes of the project and the results of the demonstration activities.

The event included an opening session, a keynote, and a project storyline presentation supported by a demonstration video. This was followed by two demonstration showcase sessions, where different developments across the project were presented, and concluded with a roundtable discussion focused on challenges, lessons learned and future opportunities.

## Agenda

| Start | Duration | Description |
|---|---|---|
| 10:00-10:10 | 10 min | **Welcome and Opening Remarks**<br>- Objectives of the dissemination event 5 and overview |
| 10:10-10:20 | 10 min | **Keynote** |
| 10:20-10:35 | 15 min | **Storyline Presentation**<br>- "A Seamless Rail Journey: Connecting Travellers and Operators" - showcase of video |
| 10:35-11:20 | 45 min | **Demonstrations Showcase (Part 1)** |
| 11:20-12:05 | 45 min | **Coffee break** |
| 12:05-12:50 | 45 min | **Demonstrations Showcase (Part 2)** |
| 12:50-13:50 | 60 min | **Lunch** |
| 13:50-14:50 | 60 min | **Roundtable discussion**<br>- Challenges, Lessons learned and collaboration, opportunities in the future & beyond!<br>- Impact and EU benefit |
| | | **End of Meeting** |
| 15:00-16:00 | 60 min | **Guided visit to the Railway Museum (Optional)** |

**Figure 14. Event agenda**

During these showcase sessions, INDRA presented the developments corresponding to several Work Packages, including WP20/21, WP22/23 and WP24/25. In particular, for WP22/23, the presentation highlighted the frictionless validation, indoor guidance and ABT functionalities integrated within the MaaS application, as well as the results obtained from the Madrid demonstration.

The dissemination activities were supported by a combination of materials, including a demonstration video illustrating the main use cases and functionalities, and a technical presentation explaining the developed solutions and validation outcomes. These materials facilitated an effective communication of both the technical approach and the user-oriented benefits of the demonstrated system.

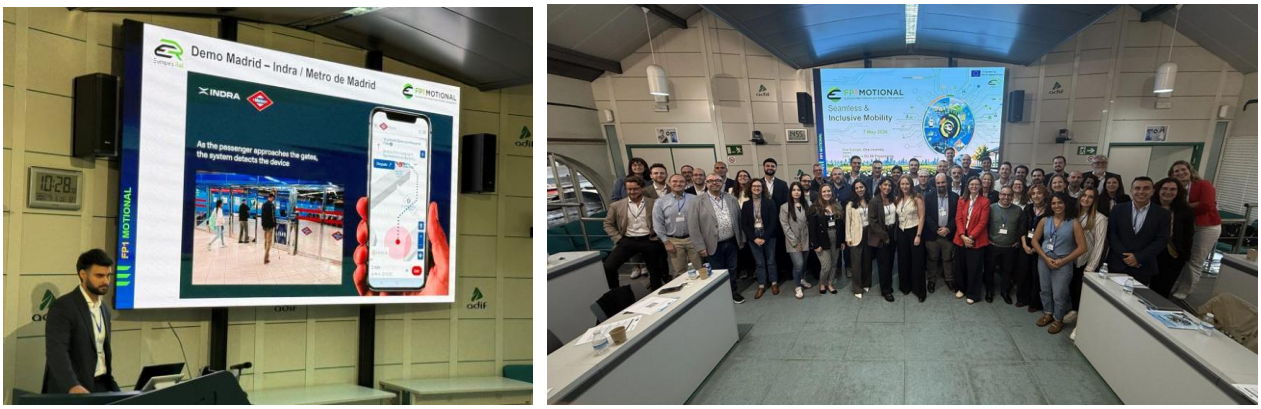



**Figure 15. Some event photos**

Overall, the dissemination event provided an opportunity to present the demonstration results to a broader audience, increasing the visibility of the project and enabling interaction with relevant

stakeholders. It also contributed to fostering discussion on the applicability, future development and potential deployment of the demonstrated solutions in real operational contexts.

### 5.3.2 TRL Validation

The Madrid demonstration validated the achieved maturity of the developed solution, reaching **TRL 6–7**, corresponding to a system prototype demonstrated in a relevant operational environment.

This TRL attainment was evidenced through the implementation and execution of an integrated system combining **frictionless validation**, **indoor guidance**, and **account-based ticketing** functionalities within the MaaS application. The system was deployed within a real station environment in the Metro de Madrid network, integrating on-site hardware infrastructure with cloud-based backend services.

The demonstration relied on realistic configuration data and actual station infrastructure. This included the use of real station layouts for indoor guidance, calibrated positioning systems based on beacon infrastructure, and operational fare structures to support ticketing functionalities. Although the demonstration was conducted in a controlled context, the system behaviour and interactions were representative of real-world operational conditions.

System-level validation was achieved through the successful integration of multiple components, including mobile applications, backend systems, positioning infrastructure, and validation devices. The interaction between these components enabled the execution of complete end-to-end scenarios, covering user access, navigation within the station, and the processing of validation events and associated transactions.

An essential aspect of the TRL validation was the demonstration with real end-users, carried out during the Validation Event. Participants interacted with the system in a realistic environment and provided structured feedback through questionnaires and direct observations. The collected feedback confirmed the usability, functionality, and relevance of the demonstrated solution from a user perspective.

Based on:

- The use of real station infrastructure and realistic configuration data.
- The successful integration of software and hardware components within a unified system.
- The execution of complete end-to-end user scenarios in a real operational environment.
- The validation with real end-users interacting with the system.

The demonstrated solution fulfils the criteria for **TRL 6–7**, confirming its readiness for further development and future deployment in operational railway environments.

### 5.3.3 Analyse feedback from stakeholders

Stakeholder feedback was collected during the demonstration through online questionnaires (Microsoft Forms) and on-site interactions and discussions with end-users. The collected inputs were analysed qualitatively, focusing on aspects directly related to the WP23 scope, namely frictionless validation, indoor guidance, and account-based ticketing functionalities.

Overall, the feedback was predominantly positive. Participants consistently highlighted the ease of use of the application, indicating that the system was intuitive and straightforward to operate. The information provided during navigation and validation was generally perceived as clear and sufficient, enabling users to successfully complete the proposed scenarios without major difficulties.

From a functional perspective, users confirmed that the system enabled effective interaction with the different services demonstrated. The indoor guidance functionality was particularly valued, as users were able to navigate within the station and identify key points of interest. However, several users indicated that improvements in positioning accuracy would enhance the overall experience, especially in complex areas of the station.

Regarding frictionless validation, participants appreciated the convenience of accessing the station without the need for physical interaction with gates or buying a ticket in advance. The process was generally perceived as comfortable and innovative, although some users reported inconsistencies in specific scenarios, such as detection delays or issues when multiple users were present.

The account-based ticketing functionality was well received as part of the overall system, as it contributed to a simplified travel experience. Users highlighted the potential benefits of such an approach, particularly in terms of reducing the need for traditional tickets and improving flexibility.

In addition, users expressed a positive overall perception of the application and its functionalities, with a general willingness to adopt similar solutions in real scenarios. At the same time, participants provided constructive feedback, identifying several improvement areas, including:

- **Improvement of indoor positioning accuracy.**
- **Enhancement of validation reliability in specific situations.**
- **Better feedback mechanisms for user interaction (visual, audio or vibration).**

The feedback collected confirms that the WP23 developments provide a robust and user-oriented solution, successfully addressing the objectives of improving accessibility, user experience, and interaction within the station environment. The results also support the potential of these solutions for further development and deployment in real operational contexts.

### 5.3.4 Evaluation of outcomes and Performance indicators (PI)

The evaluation of the Madrid demonstration confirms that the objectives defined for WP23 have been successfully achieved and that the implemented solution meets the expected performance indicators defined for the project. The assessment combines technical validation of functionalities, system usage analytics and user feedback collected during the Validation Event.

***Demonstration Outcomes***

The demonstration validated the correct implementation and execution of integrated **frictionless validation**, **indoor guidance**, and **account-based ticketing** functionalities. The system successfully executed end-to-end workflows, covering user access to the station, navigation within the station environment, and the processing of validation events associated with user journeys.

A key outcome of the demonstration is the confirmation that the integration of these services enables seamless interaction between users, infrastructure, and backend systems, supporting a more accessible and user-friendly travel experience.

This approach provides the following benefits:

- **Improved accessibility for users**, especially for persons with reduced mobility, through guidance and hands-free interaction.
- **Reduction of physical interaction with infrastructure**, enabling more efficient and comfortable access to transport services.
- **Integration of validation, guidance, and ticketing** within a unified system, simplifying user experience.

In addition, the demonstration confirmed that the developed solution is capable of operating in a **realistic scenario**, using representative datasets and non-production but operationally relevant environments, supporting its alignment with TRL 6–7.

***System Usage and Performance Indicators***

The analysis of application usage during the Validation Event provides quantitative evidence of system performance and user interaction.

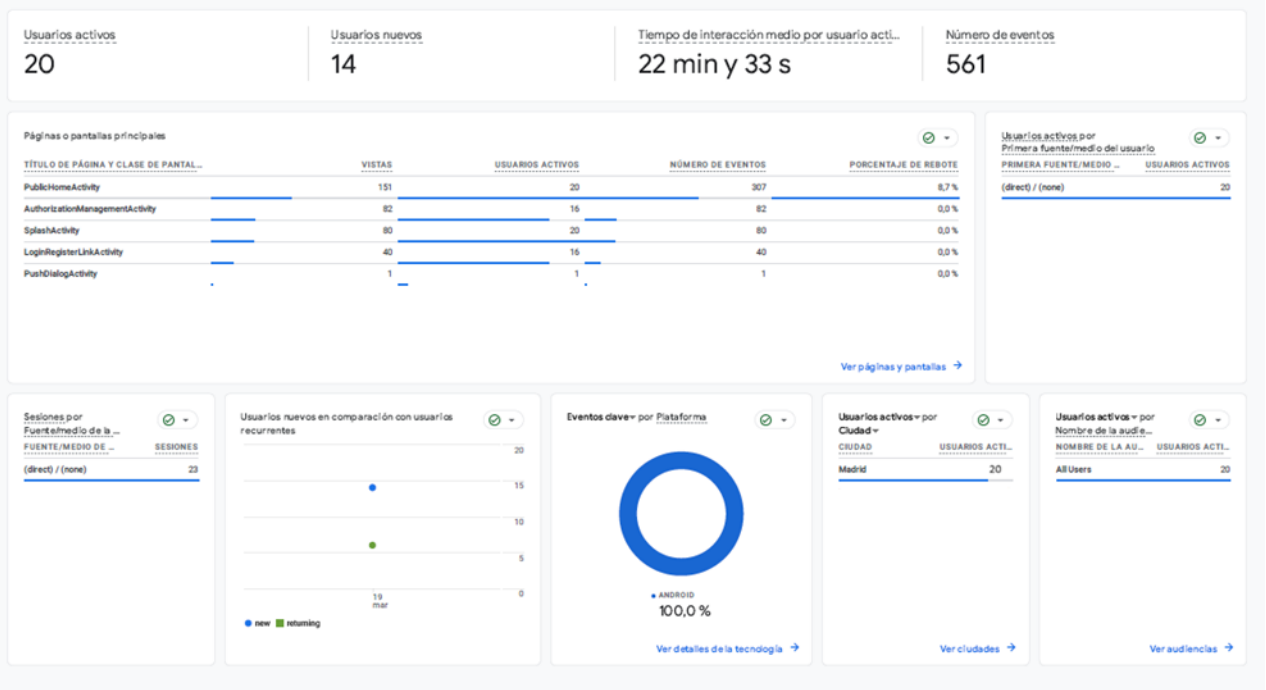



**Figure 16. Overview of application usage during the Validation Event (active users, engagement time and number of events).**

During the testing and demonstration:

- A total of **20 active users** interacted with the application, with **14 new users onboarded** during the session (some users used the testing profiles due to problems with credentials).
- The system registered **561 events**, indicating continuous and active usage of the application functionalities.
- The **average user interaction time was approximately 22.5 minutes**, demonstrating sustained engagement with the system. Reminder that this demonstration is a conjunction with WP23.
- The interaction intensity reached an average of **28 events per user**, confirming that users actively explored multiple features during the demonstration.

User activity was mainly concentrated in Madrid, where the demonstration took place, confirming that the collected data is representative of the validation context.

The event-based analysis shows that the most relevant interactions correspond to:

- **screen_view events (354 occurrences)**, indicating navigation across application views,
- **user_engagement events (148 occurrences)**, confirming active interaction,
- and **session_start events (23 occurrences)**, reflecting repeated usage sessions.

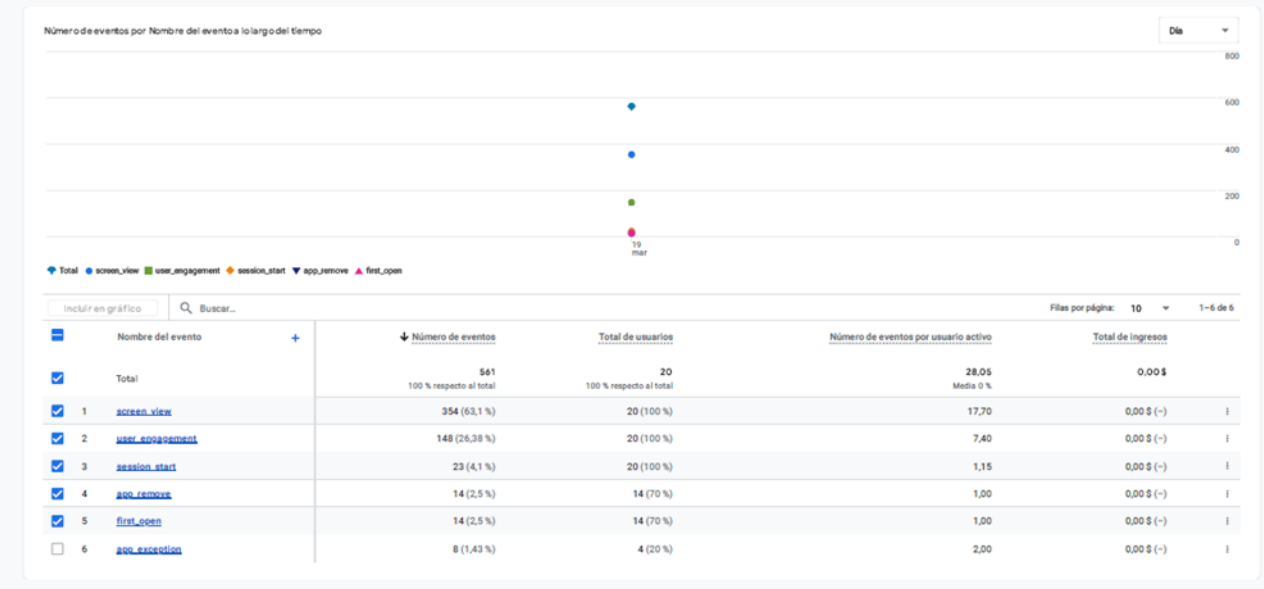



**Figure 17. Distribution of application events during the demonstration, highlighting user interaction patterns.**

These metrics demonstrate that the application was not only accessed but effectively used to interact with the different functionalities provided.

***Functional Performance and Stability***

From a system performance perspective, the demonstration showed **stable behaviour under real usage conditions**.

All core functionalities, including:

- Application access and Navigation.
- User validation and interaction with station access points.
- Indoor guidance and positioning-based navigation.

They were executed without critical failures. The event logs confirm a consistent flow of user interactions across the different application modules, indicating that the system was able to support the demonstration scenarios reliably.

The distribution of events across key application screens (e.g., home, login, validation feedback) further confirms that users were able to complete the expected workflows during the demonstration.

***User-Oriented Performance Indicators***

The evaluation of user-related performance indicators is based on the feedback collected through questionnaires and direct interactions.

The results confirm that:

- Users were able to successfully complete **validation and navigation tasks**.
- The application provided **clear and usable information**.
- The system supported **smooth interaction during the demonstration scenarios**.

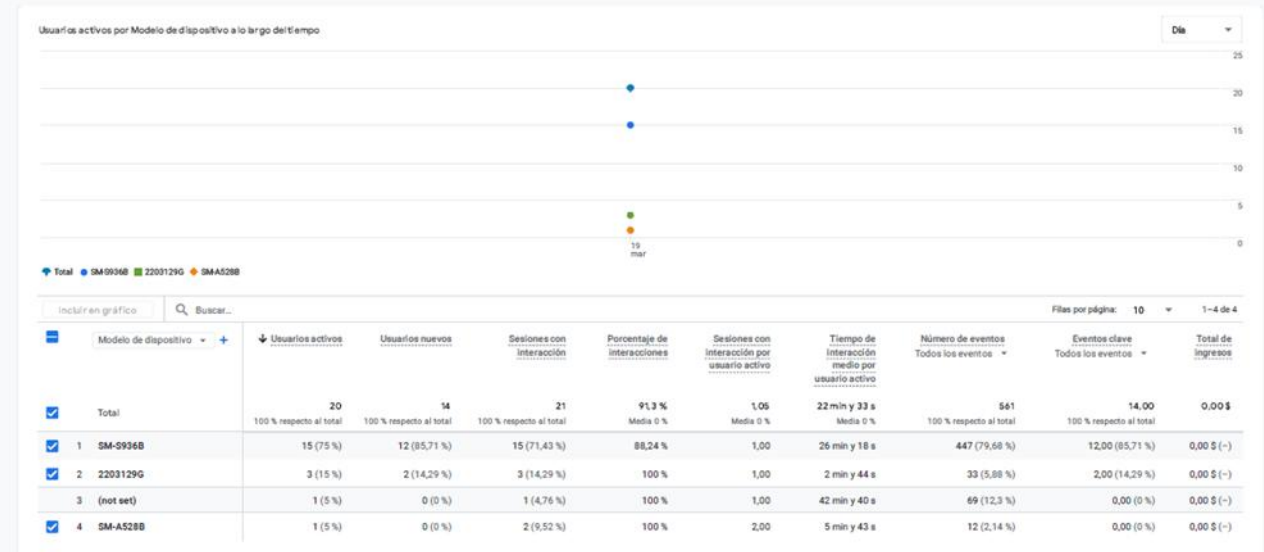



**Figure 18. Distribution of user interactions across mobile device types.**

These findings are reinforced by the high levels of engagement observed in the analytics data, indicating that users were willing to interact with the system for extended periods and explore its functionalities.

***Overall Assessment***

The combination of:

- Successful execution of **end-to-end workflows**.
- Strong **user engagement metrics**.
- Consistent **system stability**
- Positive **qualitative feedback**.

Provides clear evidence that the defined performance indicators for WP23 have been achieved.

The demonstration confirms that the developed solution:

- Meets the functional and technical objectives of the Work Package.
- Operates reliably in a realistic environment.
- Provides a solid basis for further development and future deployment.

### 5.3.5 Impact assessment

The Madrid demonstration highlights the potential impact of integrating **frictionless validation**, **indoor guidance**, and **account-based ticketing** functionalities, particularly in urban railway environments where accessibility and user experience are key factors.

From the perspective of end-users, the main impact lies in the ability to access a set of integrated services within a single application, supporting a more seamless interaction with station infrastructure. The demonstrated solution enables users to access the station without physical interaction, navigate efficiently within complex environments, and manage/paying their journeys without relying on traditional ticketing formats. This integration simplifies the travel experience and reduces friction in key interaction points, improving overall accessibility and convenience.

The demonstration results and user feedback confirm that such an approach can significantly enhance usability, especially for passengers with reduced mobility. The combination of hands-free validation and indoor guidance contributes to a more inclusive travel experience, allowing users to move more independently within the station. The positive perception of the application in terms of ease of use and functionality indicates strong potential for adoption in real-world contexts.

From the perspective of infrastructure managers and transport operators, the key impact lies in the integration of digital services with physical station infrastructure. The demonstrated approach enables the combination of positioning technologies, validation systems, and backend services to support advanced passenger interactions. This reduces the reliance on traditional infrastructure elements and opens the door to more flexible and scalable solutions.

In addition, the demonstration shows that the integration of positioning and validation technologies can improve passenger flow management and support more efficient operation of station environments. The ability to detect user presence, guide passengers, and process validation events in a coordinated manner contributes to more efficient utilisation of infrastructure and improved service quality.

The demonstrated solution also supports scalability and future extensibility, as additional services, functionalities, or stations can be integrated into the system. This flexibility allows gradual deployment and adaptation to different operational contexts, facilitating the broader adoption of similar solutions across railway networks.

Overall, the demonstrated solution has a clear potential to support the development of more accessible, efficient, and user-centric mobility services. The results obtained during the demonstration confirm both the relevance and applicability of the **WP22/23 developments**, as well as their potential impact on the future evolution of digital and inclusive rail-based mobility systems.

# 6. Task 23.2 (1) – Demonstration in Malaga Robot

The use case for the ACCESSIBLE ROBOT focused on users with different disabilities (physical, cognitive, or sensory - visual and hearing impairments -) who travel from Málaga to Madrid and use the train as a mean of transportation.

The ACCESSIBLE ROBOT makes it possible for them to navigate the station with autonomy and safety, from the entrance to the head of their platform, in addition to carrying their luggage. The ROBOT provides the user accompaniment during the time before their train departs to visit the station, make stops at leisure or dining services, and load luggage, as well as assisting the user through the security arches to the head of the platform assigned to their train.

To carry out the demonstration we have completed the following phases:

- User recruitment phase: selecting people with different disability profiles.
- Demonstration phase: the selected users were welcomed at the station and proposed to carry out a complete service flow, from booking the accompaniment to being guided to final destination.
- Report phase: a small interview based on NPS (Net Promoting Score) was conducted with the users to collect feedback.

## 6.1. Demo implementation phase

| Use case ID | TE's | Name | Description |
|---|---|---|---|
| UC-FP1-WP19-16 | TE22 | Accessible Robot | Guiding of people with disabilities inside of the multimodal railway station |

### 6.1.1 Recruitment of end-users

Among the various methods used to reach end-users, such as face-to-face meetings, phone calls, and video conferences, email invitations proved to be the most appropriate and effective approach. Invitation emails were sent to:

- Entities of the disability movement (physical, cognitive, and sensory Málaga Associations)
- Asoc Inserta Innovation R&D database
- Asoc Inserta Empleo database
- Fundacion ONCE DAUI database

The invitation email included detailed instructions for recipients, guiding them through the process of downloading the app and reserving a specific date and time to participate in the trial.

To ensure inclusivity and accessibility, the content of the email was tailored to accommodate the

needs of people with various disabilities, making sure instructions were concise, language was straightforward, and support contacts were provided for additional assistance. See Figure Y1 Sample invitation email Spanish and Figure Y2 Sample invitation email English.

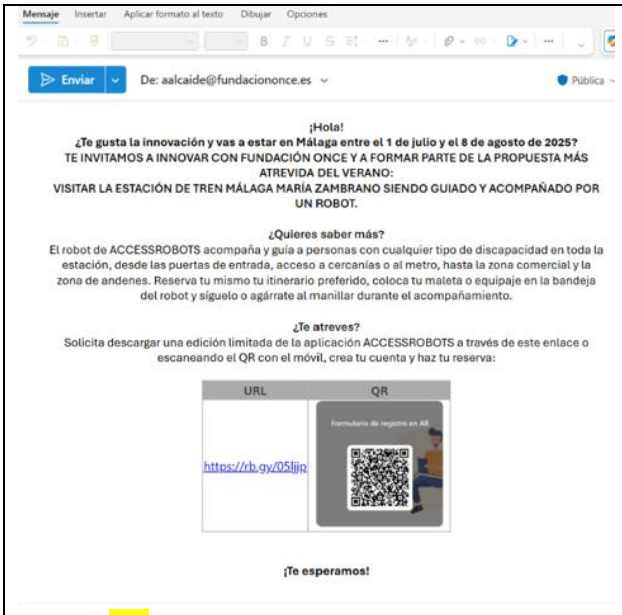



Figure Y1 Sample invitation email Spanish

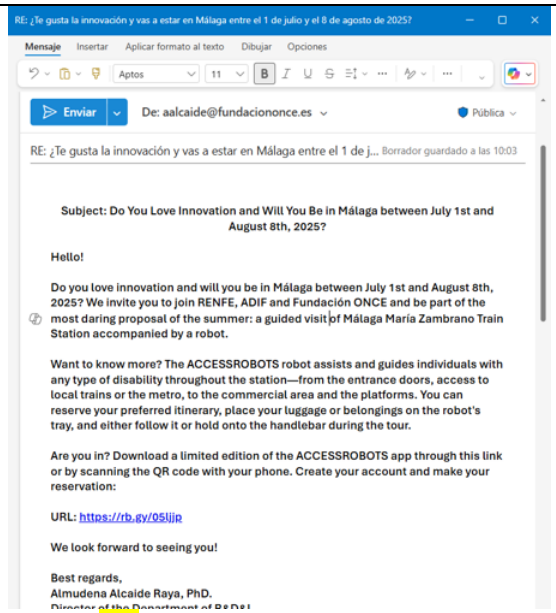



Figure Y2 Sample invitation email English

Furthermore, end-users were referred to the testing of the ACCESSIBLE ROBOT in Málaga María Zambrano trough national and regional TV coverage and social networks campaigns:

- https://www.linkedin.com/posts/fundacion-once-inserta_accessrobots-maerlaga-discapacidad-activity-7355537888589049856-3fSO?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA2Yd-8BhHFjYBcxJqZXABuQuPPrSHnj1XI
- https://www.instagram.com/p/DMpsVakCKw0/

By the end of the recruitment period, we encountered the following results:

| | |
|---|---|
| Number of users invited | +500 |
| Number of users responding to the invitation | +150 |

## 6.1.2 Deployment of demonstration environment

Next, is the description of the installation and configuration of the software and hardware that were used in the demonstration environment to ensure that it was fully operational and integrated with other necessary systems.

At software level:

- Configuration of the Access robot's software platform included the following tasks:
  - Mapping of the whole facility and processing of the waypoints in the map
  - Registry of the facility into the ACCESSROBOTS PLATFORM:

- Definition and configuration of waypoints of interest: entrance, destination, and intermediate points (see sample list in Figure Y3 Sample of the list of waypoints)

- Definition and configuration of the platform according to the dynamics of passenger flow:
  - high density or meetings points to be preferable avoided during accompaniment
  - speed, security robot footprint and turning angles
  - forbidden areas
  - most common passenger flows
  - passage through the luggage security arch
- Configuration of two cloud environments in AWS:
  - Production environment in an AWS cloud
  - Development (Pre-production) environment in an AWS cloud
- Configuration of software to connect and collect train and platform information from Adif Elcano and Renfe data.


```
[
  {
    "name" : "Andén 2",
    "id" : "platform2"
  },
  {
    "name" : "Andén 3",
    "id" : "platform3"
  },
  {
    "name" : "Andén 4",
    "id" : "platform4"
  },
  {
    "name" : "Andén 5",
    "id" : "platform5"
  },
  {
    "name" : "Aseos",
    "id" : "toilet"
  },
  {
    "name" : "Cafetería",
    "id" : "coffee"
  },
  {
    "name" : "Tienda",
    "id" : "shop"
  },
  {
    "name" : "Puerta de entrada",
    "id" : "entry"
  },
  {
    "name" : "totem",
    "id" : "totem"
  }
]
```

**Figure 19. Figure Y3 Sample of the list of waypoints**

At software level, the following hardware components were needed:

- 2 robots:
    1. **Robot demo-unit,** linked to AWS Production environment, deployed and functioning at the Maria Zambrano station (Figure Y4 Robot Demo Unit and Figure 7 Demo-unit and totem)
    2. **Robot back-unit,** linked to AWS Development environment, deployed and functioning at ASCO INSERTA INNOVACIÓN laboratory (Figure Y5 Robot Back Unit).



Figure Y4 Robot Demo Unit




Figure Y5 Robot Back Unit

- Charging bay (see Figure 6 Robot at charging bay)
- Five (5) electrical plugs in 4 different locations, distributed throughout the station.
- A WIFI network needed to be set up with a router and 2 repeaters (3 electrical outlets 220 V in different locations).
- The roll-up according to regulation to notify that there is a robot in testing.




Figure Y6 Robot at charging bay




Figure Y7 Demo unit and totem

### 6.1.3 Collect and process demonstration data

As previously mentioned, the demonstration environment consisted of two robotic units: demo-unit linked to Production environment (the station) and back-unit linked to the Dev & Pre-production environment (laboratory). One was deployed in the real environment of the Málaga Maria Zambrano station, and the other was deployed in the INSERTA INNOVACIÓN laboratory facilities, with a recreation of the real environment. This allowed us, on the one hand, to have a replacement robot in case of a breakdown, and on the other hand, to use the second robot as a test bench for enhancement developments during trials, without affecting the robot deployed at the station.

Particularly, during the implementation phase of the demo, the technical team worked over the back unit robot and the data collected on the following tasks:

- Carrying out configuration changes and tests to find the causes of initial connectivity problems with the Wi-Fi network, due to the nature of the environment, and testing solutions in which both the R&D team of INSERTA INNOVACIÓN and the technicians of the robot manufacturer and the Wi-Fi network installation were involved.
- Solving the first issues detected at the station and testing them in the preproduction environment to improve the user experience. In this case, aspects such as speed, sound volume, or navigation methods were addressed to provide fluidity in movement during demo execution phase.
- Fixing small errors detected in some specific tests. In this case, the second robot was used to reproduce these tests at the INSERTA INNOVACIÓN facilities, which caused the error, solved the problem, and test the changes to integrate the new solution into the pre-pro (station) environment once verified.
- Developing further functionalities for specific cases at the station, such as queues for access to baggage control scanners.
- Experimenting robot navigation strategies for cases where there was a large accumulation of people both in the station hall and in the platform area. These areas are very open and require a different strategy than other areas of the station and the shopping centre.
- After tests on Preproduction all changes were submitted to Production environment.

### 6.1.4 Validation of demonstration data

The use of a second robot was of vital importance to validate the demonstration data collected in real time and to carry out the aforementioned tasks without affecting the proper functioning of the demo robot at the station and allowing these tasks to go unnoticed by users and participants in the tests.

### 6.1.5 Integration tests

The integration tests carried out in the Implementation phase, prior the execution phase, aimed to cover the following three areas:

- Connectivity Tests for the integration of RENFE App with the ACCESSROBOTS Reservation System: The tests consisted of the Renfe app providing access to the ACCESSROBOTS

reservation system. The ACCESSROBOTS reservation system registers the user, their request, and confirm the availability of the service for the date, start time, and end time of the accompaniment service. At the time of reservation, the user can also choose which points of interest within the station they wish to visit, defining an itinerary of stops from the meeting point to the final destination at the entrance of their platform.

- Connectivity Tests for the integration from ACCESSROBOTS to the ADIF Elcano Platform: This connection allows ACCESSROBOTS to determine the final destination point of the accompaniment, which will be the platform from which the traveller's train departs, and to report any schedule incidents.

- Connectivity Tests for the integration of the TOTEM with the ACCESSROBOTS Reservation System: This connection allows the user can also access the ACCESSROBOTS reservation system through the totem.

All connections were implemented through API Rest services developed in both AWS Production and Pre-production environments and referred to as "Access robots external partners API". Endpoints samples and connectivity tests are evidenced in the following figures (Figure 8 Get train info required – connectivity test to ADIF platform and Figure 9 Totem and Renfe's App, developed in the project, endpoint to book a service).

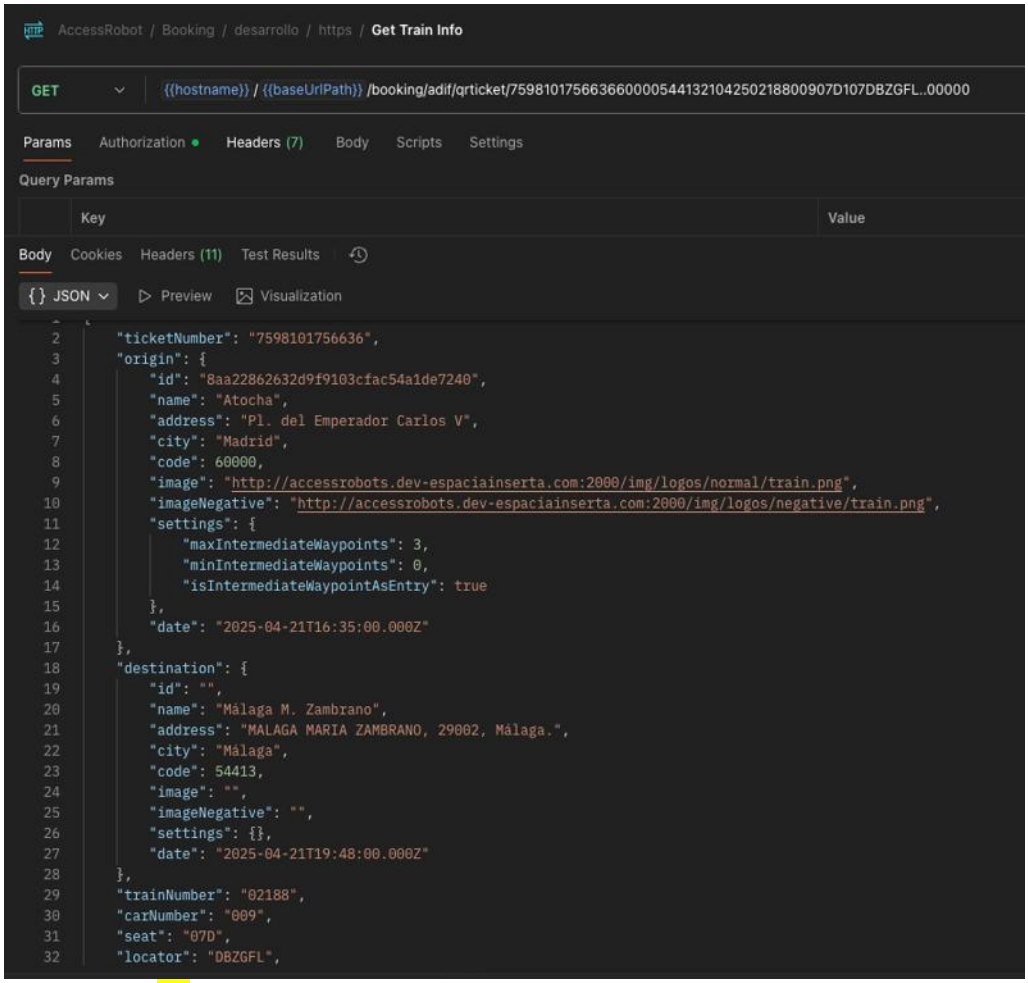



Figure Y8 Get train into required – connectivity test to ADIF platform

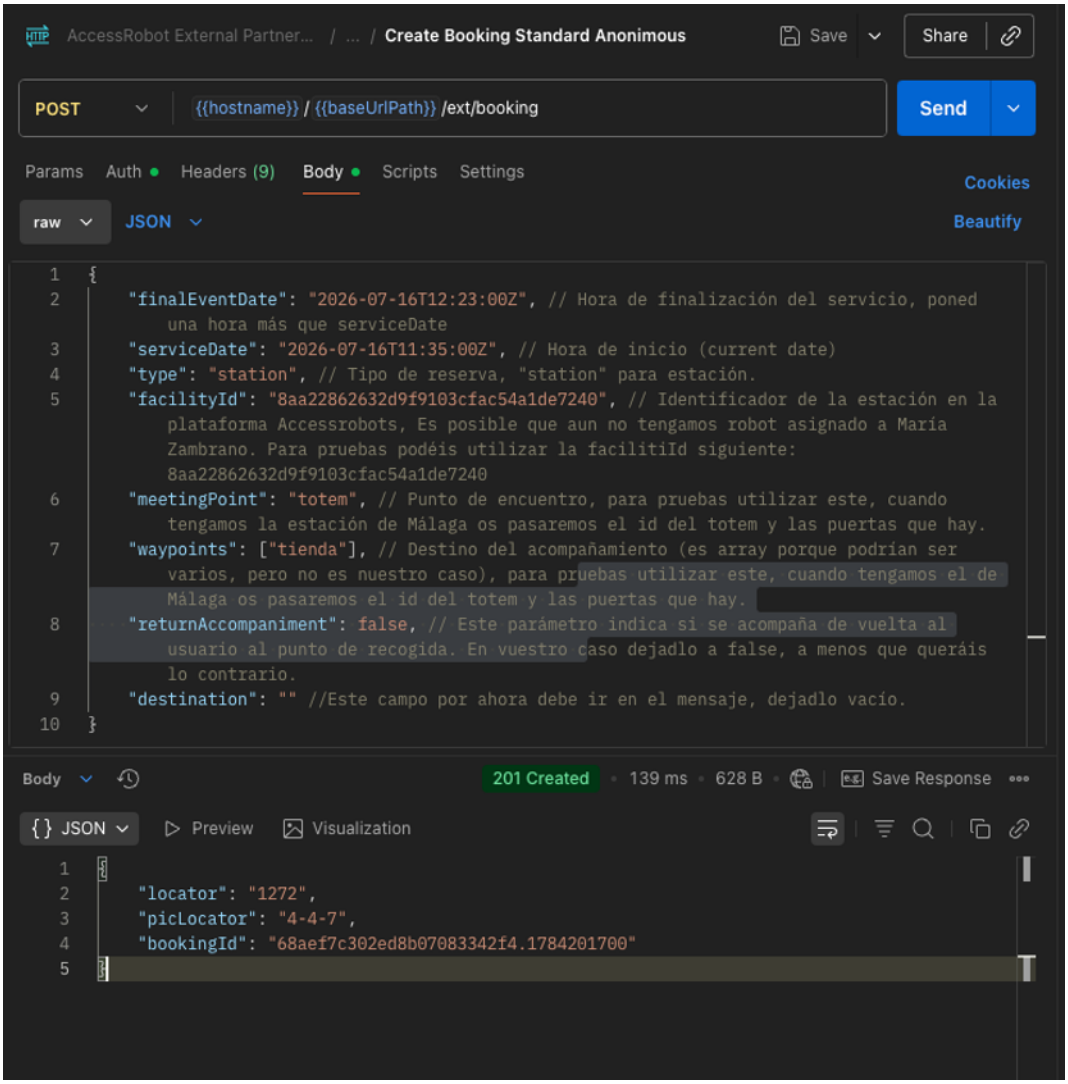



**Figure 20. Figure Y9 Totem and Renfe App endpoint to book a service**

## 6.1.6 Develop training materials

To ensure that all users and stakeholders could confidently engage with the ACCESSROBOTS system, comprehensive training and app online tutorial materials were prepared in advance of the Validation Event. In particular, the app online tutorials aimed to facilitate a smooth onboarding process, reduce the learning curve, and promote effective utilization of the platform during demonstrations.

The materials provided included:

- Presentation during workshop for all stakeholders (see figure Y10)
- Tutorials along the different screens of the app ACCESSROBOTS (see figure Y11)

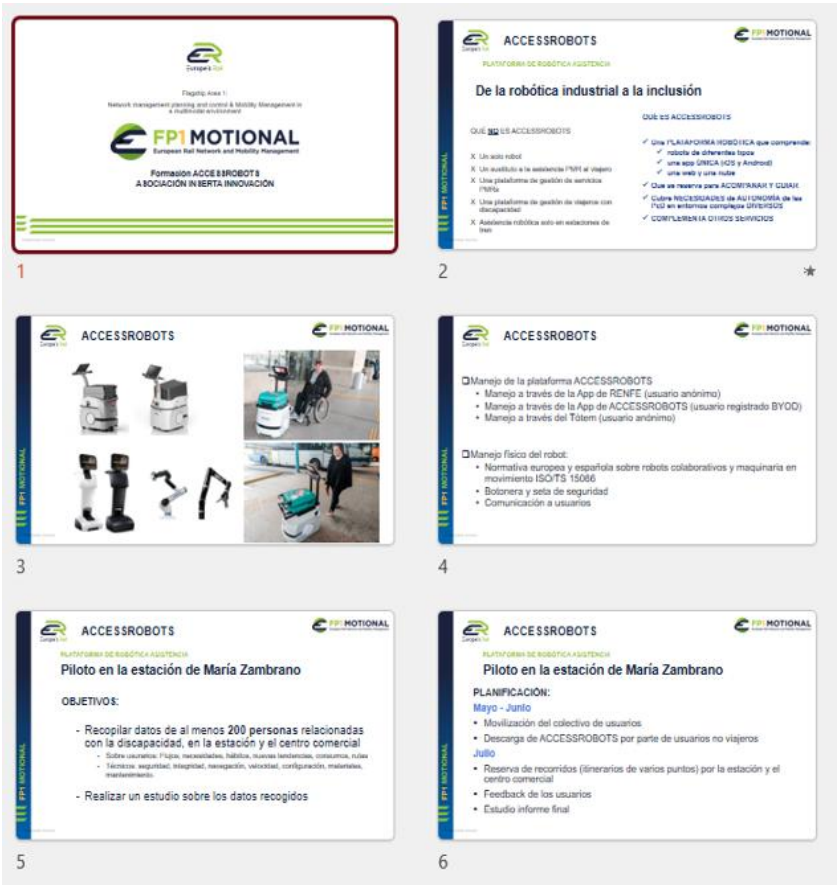



Figure Y10 Training material workshop

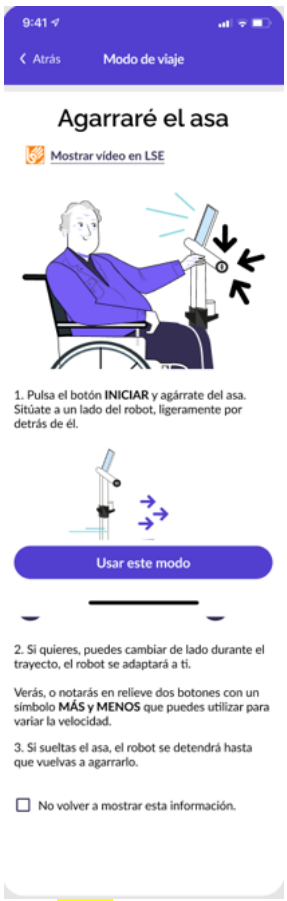



Figure Y11 App tutorial for users

## 6.1.7 Perform installations (if necessary)

A WIFI network needed to be set up with a router and 2 repeaters (3 electrical outlets 220 V in different locations). The final location of these outlets depended on the coverage provided by each of the deployed WIFI points. This definition was made during the mapping carried out by the robot itself and the map configuration (carried out by the technical team). Coverage tests were carried out throughout the station to ensure that the robot never lost signal during its user escort services.

## 6.1.8 Validation tests

Validation tests to ensure sufficient quality before the Validation Event included:

- Tests on the Start Navigation procedure:
  - Autonomous Navigation: The robot must move autonomously and at the correct day and time of service reservation from the charging bay to the meeting point where the traveller is awaiting.
  - Robot Localization and Pairing with the Assigned Robot: Tests will be conducted to ensure the correct pairing process between the user and the assigned robot:

  - Pairing using a code
  - Pairing using pictograms.
  - Pairing using user's own personal device.
- Guidance Modes: Navigation tests will be conducted in two modes:
  - User Follows the robot to be guided
  - User Holds onto the robot to be guided.

- Tests During Navigation procedure:
  - The robot makes stops at the reserved intermediate points of interest.
  - The robot stops and resumes its movement from the robot's tablet or the user's mobile device with the start and pause buttons.
  - The robot passes through the security arch through a predefined and preconfigured path.
  - At the time dictated by the Adif platform, the robot accompanies the user to the head of the platform where their train is located.

- Tests End Navigation procedure:
  - The tests will aim to validate that the robot returns to its charging point autonomously.

### 6.1.9 Communication and Dissemination before demonstration execution

As previously mentioned, end-users were referred to the trial of the ACCESSIBLE ROBOTS trough national and regional TV coverage and social networks campaigns, as well as by email invitation disseminated across the different disability entities.

Additionally, cards were displayed at the station to inform about the validation event. See figures for examples.




Figure Y12 Sample communication card




Figure Y13 Sample reverse of card



Figure Y14 Sample communication display

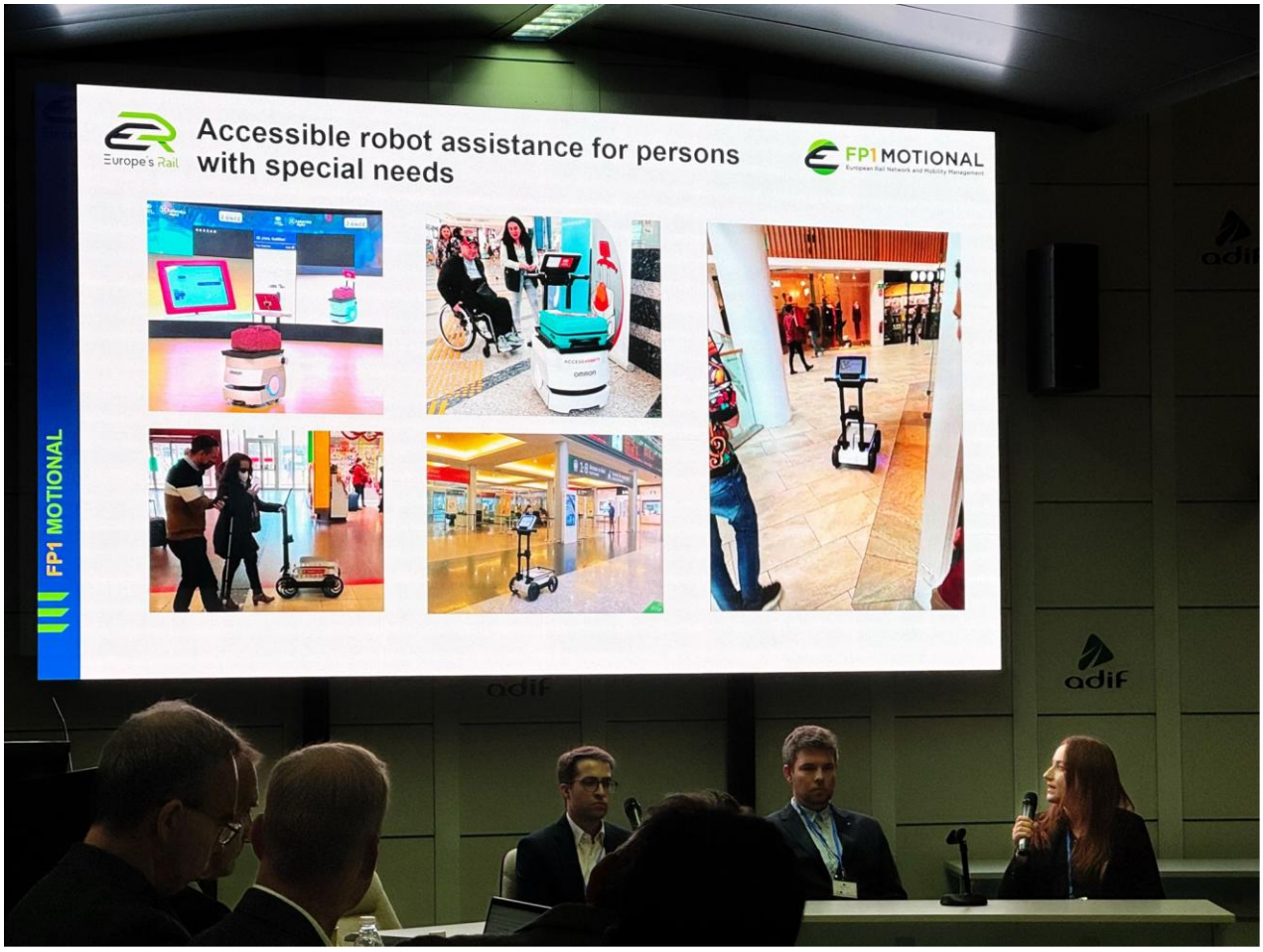
In preparation for the demonstration phase, several targeted communication and dissemination

activities were carried out to promote the gap filler solution and engage relevant stakeholders, both internally and within the project consortium.

**Internal and Project-Level Dissemination**

Prior to the execution of the demonstration, the developments related to the design, safety assessment and implementation of the gap filler solution were actively shared within the project consortium during key project events.

- In particular, this work was presented during the Mid-Term Event held in Madrid on 30 October 2024, where the solution was showcased to a broad audience of project partners and stakeholders, highlighting its objectives, constraints and expected impact on platform–train interface safety and accessibility. You can see part of the presentation in the next photo:




Additionally, the topic was further discussed during the plenary meeting held in Munich on 29 October 2025, where each partner presented their respective contributions. This ensured alignment across partners and facilitated knowledge exchange on technical, operational and safety aspects associated with the deployment of the gap filler solution.

Internally, the work was also disseminated across relevant expert departments within the organisations involved—particularly infrastructure, safety and operations teams—ensuring that key stakeholders were aware of the developments and could provide feedback prior to the demonstration phase.

Also, a meeting in May 2024 was held in Metro of Malaga's Quarters not only to communicate, as also to understand better end-users needs:



In addition, several meetings were held with end users with different disabilities in order to communicate the solution and refine the technical approach throughout the project.

### 6.1.10 Implementation of measures to gather results and KPI measurements

In order to measure KPIs/PIs and quality during the Demo/Validation Event, we utilized Microsoft Forms as our primary tool for data collection. Microsoft Forms was chosen for its robust analytics functionalities, which enabled us to efficiently track responses, generate visual summaries, and analyse key metrics in real time. This facilitated seamless implementation of measurement activities and ensured reliable data for evaluation.

### 6.1.11 Questionnaire and interviews guides for stakeholders/end-users

As previously mentioned, we used Microsoft Forms to collect data from end-users. The following table shows the questionnaires presented at the end to the validation test.

1.How likely are you to recommend Access robots to a family member, friend, or co-worker? Response required. Net Promoter Score.

2.Overall, how satisfied are you with Access robots?

3.What is your level of satisfaction with each aspect of the service?

4.To what extent did the support meet your expectations?

5.How could the service be improved?

6.Please provide your email address if you would like us to contact you regarding your comments.

7.Additional comments. If you'd like to comment on anything else, this is the place for you.

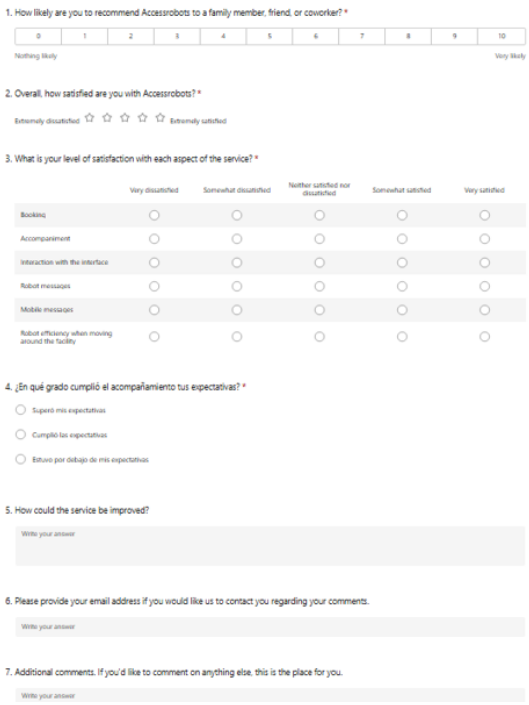



**Figure Y15 End-user questionnaire**

## 6.2 Demo execution phase

### 6.2.1 Software distribution to end users

In the invitation email and QR code provided to participants, a direct link was included allowing users to request download the ACCESSROBOTS application prior to the demonstration. This ensured that all interested end-users could access the required software on their devices well in advance. Additionally, the download process was designed to be user-friendly and accessible to screen readers on both platforms: VoiceOver in iOS and Talkback in Android. Figure 16 shows the application form for the download request of the software.

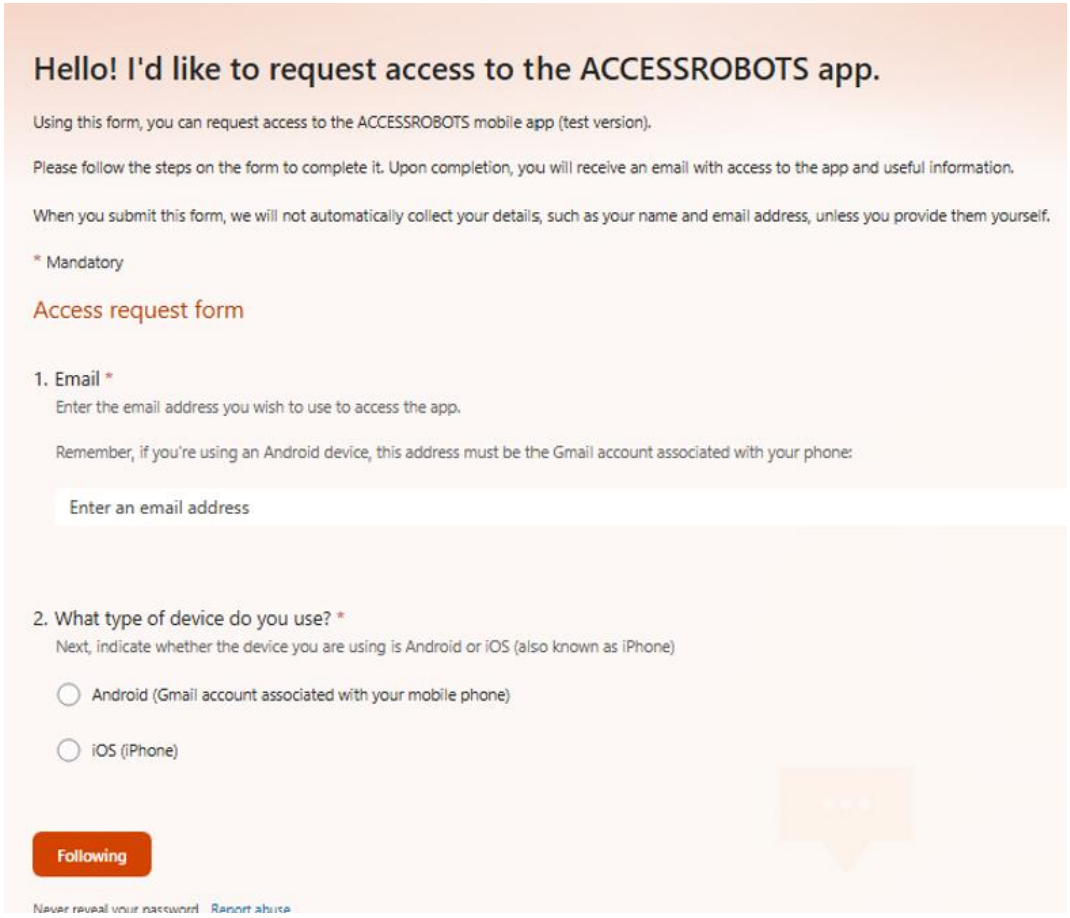



**Figure 21. Figure Y16 Application form to request the App**

During Demo execution phase the final numbers were:

| | |
|---|---|
| Number of users requesting the app | 114 |
| Numbers of users registered | 51 |

## 6.2.2 End users/outsiders training

Brief demonstration kick-off meetings took place while welcoming end-users, however, autonomy and clarity of the solutions were also part of the demonstration itself.

The demonstration kick-off meetings served not only to introduce participants to the objectives of the event, but also to foster a sense of autonomy and confidence in using the ACCESSROBOTS solutions. These introductory sessions often included brief walkthroughs of the application's core features, guidance on accessing support materials, and clarification of how participants could engage independently with the technology throughout the demonstration period.

Special attention was given to accessibility and user experience, with organisers available to answer any questions or troubleshoot potential barriers on the spot.

### 6.2.3 Data collection for real-time demonstrations

During demonstrations, for each accompaniment service provided, we meticulously recorded a database of performance indicators and relevant data points. These included details such as:

- the type of user (registered, anonymous, or dummy),
- how the booking was made (totem, mobile device, or web),
- time and location of service,
- interaction quality, and
- any incidents or feedback received during the session.

This comprehensive data collection allowed us to track participation trends, measure support effectiveness, and identify areas for improvement in real time, as well as for outcome purposes.

The compiled series of indicators were shared in real time with the technical team through a dedicated web dashboard, facilitating swift analysis and supporting iterative enhancements throughout the validation process (see Figures Y17 and Y18).

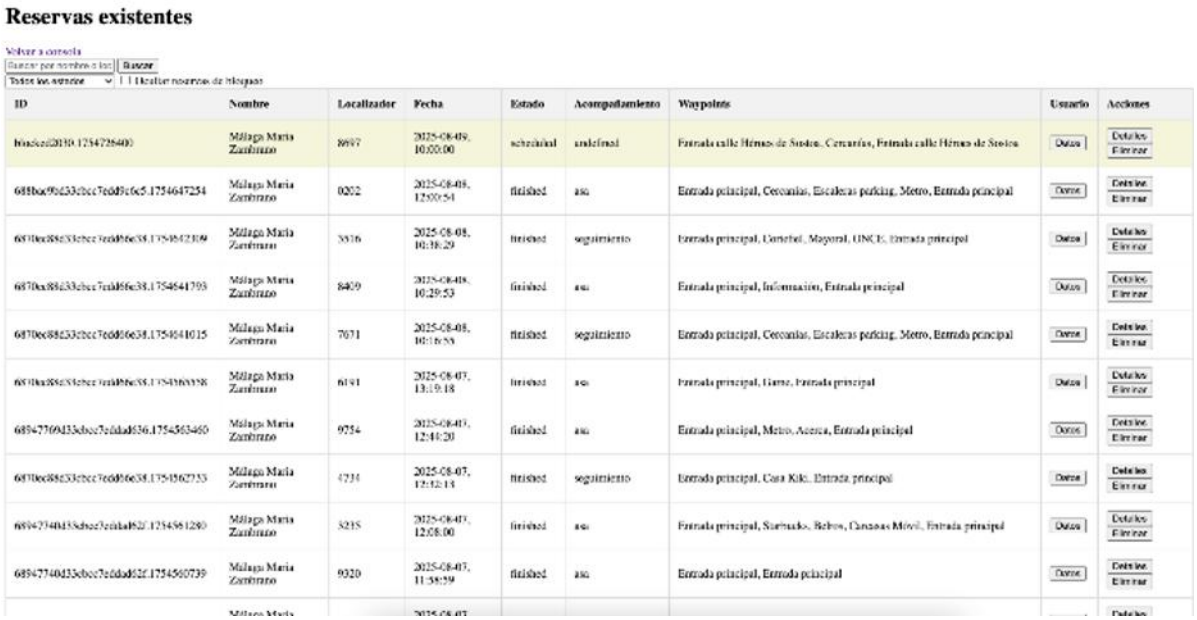



**Figure 22. Figure Y17 Dashboard data collection**

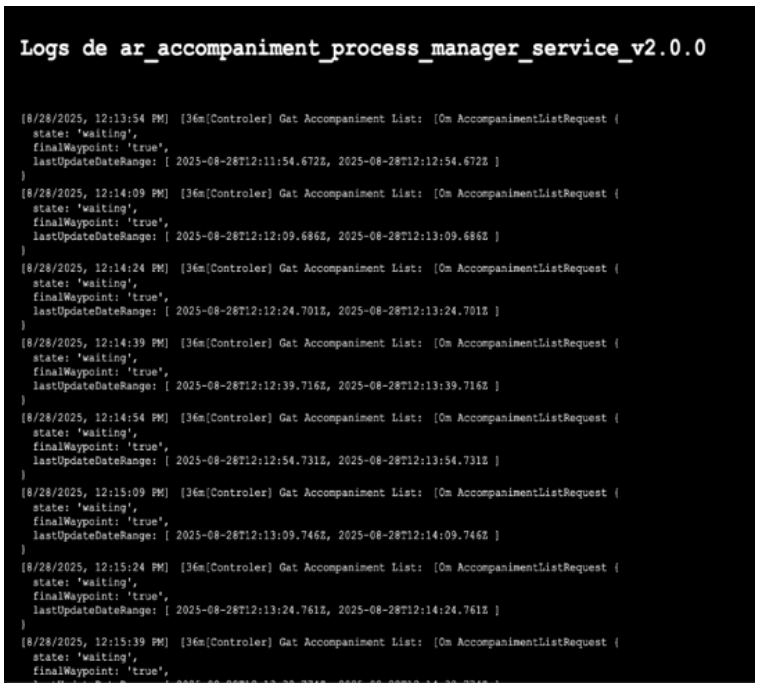



**Figure 23. Figure Y18 Logs of each demonstration**

## 6.2.4 Validation Event

For INSERTA INNOVACION, the validation phase ran from **July 15th to August 8th**. Throughout the validation event (**July 15th-17th**) and in the days that followed, we applied similar validation protocols. The table below provides a brief overview, along with the email distributed to all team members involved during the validation event and in the days thereafter:

1. **App Download**: Users need to request the app download through a form. Invitations will be sent on July 8, 2025, via email and a QR code on a printed card.

2. **Registration and Booking**: Users will register on the app and directly book the service through their accounts.

3. **Handling Requests**: Ensure that the email used is active on the device. Access the play console, add the user to the whitelist, and attempt immediate acceptance.

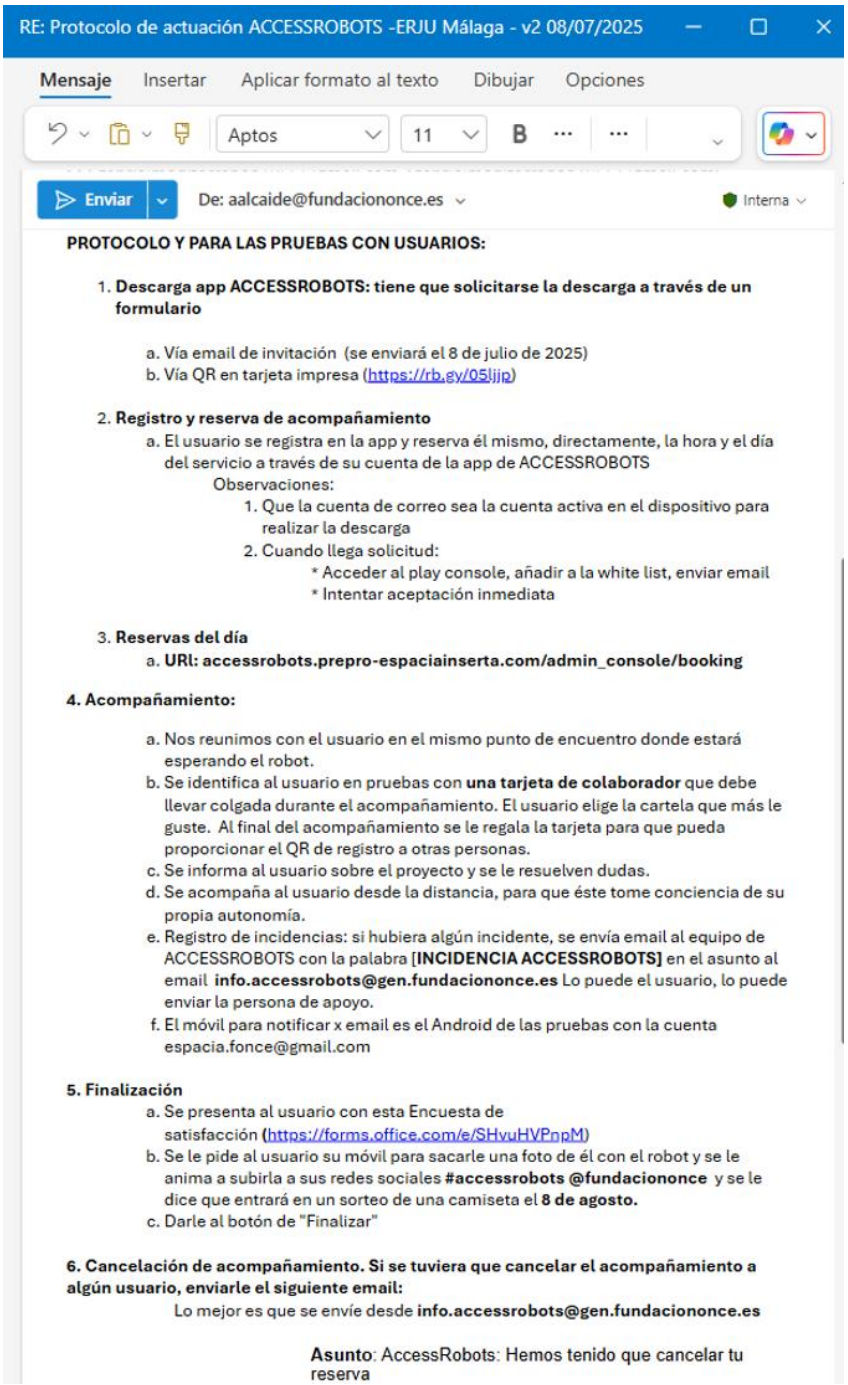
4. **Daily Bookings**: Manage daily bookings through the provided URL.

5. **User Accompaniment**: Meet the user at the robot's location, identify them with a collaborator card, which they can keep. Inform them about the project and answer any questions they may have. Accompany them from a distance to encourage autonomy.

6. **Incident Reporting**: If any incidents occur, fill out the form provided. The support person or the user can send it. The phone for notifications is the test Android with the email espacia.fonce@gmail.com.

7. **Conclusion**: Present the user with a satisfaction survey, ask for a photo with the robot to share on social media, and inform them about a t-shirt draw on August 8.

8. **Cancellation**: If cancellation is necessary, send an email from info.accessrobots@gen.fundacionONCE.es to inform them of the cancellation and encourage them to book another date.



RE: Protocolo de actuación ACCESSROBOTS -ERJU Málaga - v2 08/07/2025

Mensaje Insertar Aplicar formato al texto Dibujar Opciones

Aptos 11 B

Enviar De: aalcaide@fundacionONCE.es Interna

**PROTOCOLO Y PARA LAS PRUEBAS CON USUARIOS:**

1. **Descarga app ACCESSROBOTS: tiene que solicitarse la descarga a través de un formulario**
   a. Vía email de invitación (se enviará el 8 de julio de 2025)
   b. Vía QR en tarjeta impresa (https://rb.gy/05ljjp)
2. **Registro y reserva de acompañamiento**
   a. El usuario se registra en la app y reserva él mismo, directamente, la hora y el día del servicio a través de su cuenta de la app de ACCESSROBOTS
      Observaciones:
      1. Que la cuenta de correo sea la cuenta activa en el dispositivo para realizar la descarga
      2. Cuando llega solicitud:
         * Acceder al play console, añadir a la white list, enviar email
         * Intentar aceptación inmediata
3. **Reservas del día**
   a. **URl: accessrobots.prepro-espaciainserta.com/admin_console/booking**

**4. Acompañamiento:**

a. Nos reunimos con el usuario en el mismo punto de encuentro donde estará esperando el robot.
b. Se identifica al usuario en pruebas con **una tarjeta de colaborador** que debe llevar colgada durante el acompañamiento. El usuario elige la cartela que más le guste. Al final del acompañamiento se le regala la tarjeta para que pueda proporcionar el QR de registro a otras personas.
c. Se informa al usuario sobre el proyecto y se le resuelven dudas.
d. Se acompaña al usuario desde la distancia, para que éste tome conciencia de su propia autonomía.
e. Registro de incidencias: si hubiera algún incidente, se envía email al equipo de ACCESSROBOTS con la palabra **[INCIDENCIA ACCESSROBOTS]** en el asunto al email **info.accessrobots@gen.fundacionONCE.es** Lo puede el usuario, lo puede enviar la persona de apoyo.
f. El móvil para notificar x email es el Android de las pruebas con la cuenta espacia.fonce@gmail.com

**5. Finalización**

a. Se presenta al usuario con esta Encuesta de satisfacción (https://forms.office.com/e/SHvuHVPnpM)
b. Se le pide al usuario su móvil para sacarle una foto de él con el robot y se le anima a subirla a sus redes sociales **#accessrobots @fundacionONCE** y se le dice que entrará en un sorteo de una camiseta el **8 de agosto.**
c. Darle al botón de "Finalizar"

**6. Cancelación de acompañamiento. Si se tuviera que cancelar el acompañamiento a algún usuario, enviarle el siguiente email:**

Lo mejor es que se envíe desde **info.accessrobots@gen.fundacionONCE.es**

**Asunto**: AccessRobots: Hemos tenido que cancelar tu reserva

### 6.2.5 Data collection for outcome and Performance indicator (PI) measurements

As previously mentioned, for each accompaniment service provided, we meticulously recorded a database of performance indicators and relevant data points. These included details such as:

- the type of user (registered, anonymous, or dummy),
- how the booking was made (totem, mobile device, or web),
- time and location of service,
- interaction quality
- any incidents or feedback received during the session.

This comprehensive data collection allowed us to track participation trends, measure support effectiveness, and identify areas for improvement.

Another one of the Performance Indicators were the number of Gitlab technical software bugs opened and resolved during Demo implementation and Demo Execution.

The data collected from the code management and issue tracking platforms (specifically Gitlab) provide the following figures:

- Number of issues on the Android platform: 3
- Number of issues on the iOS platform: 3
- Number of issues on the robot iPad platform: 1
- Number of commits to new system versions during the testing period: 8

Samples of this activity are given in the following snapshoots of the issues management tool:

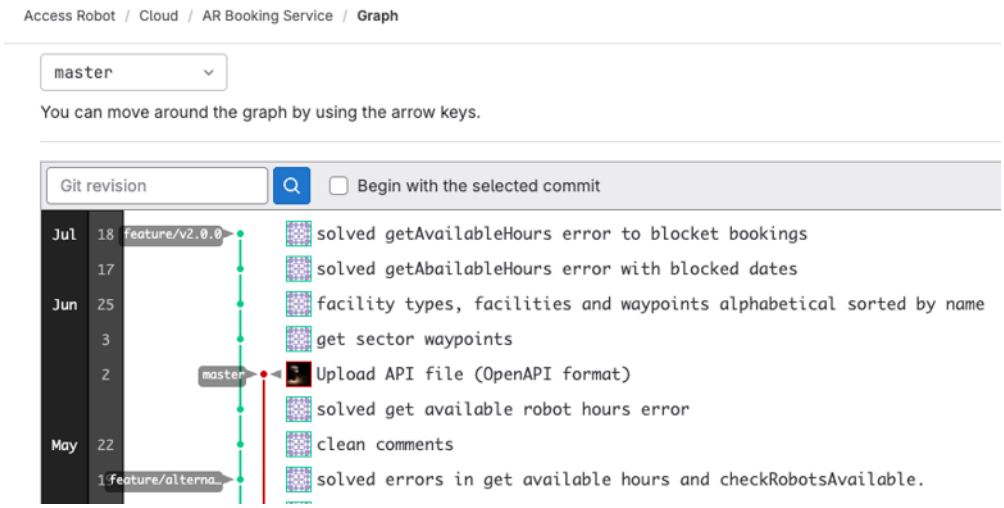



**Figure 24. Figure Y19 Sample Commit to version v2.0.0**

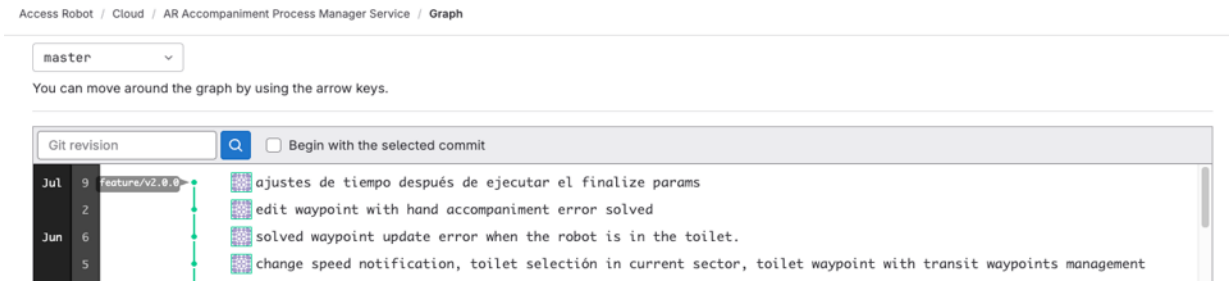



**Figure 25. Figure Y20 Resolved bug errors**

## 6.2.6 End-user interviews

As previously mentioned, we used Google forms to collect data from end-users. The following

table shows the questionnaires presented at the end to the validation test.

The end-user validation activities were supported by a structure of the questionnaire based on the approach presented in the section 6.1.11 and is reproduced below for completeness and ease of reference.

1.How likely are you to recommend Access robots to a family member, friend, or co-worker? Response required. Net Promoter Score.

2.Overall, how satisfied are you with Access robots?

3.What is your level of satisfaction with each aspect of the service?

4.To what extent did the support meet your expectations?

5.How could the service be improved?

6.Please provide your email address if you would like us to contact you regarding your comments.

7.Additional comments. If you'd like to comment on anything else, this is the place for you.

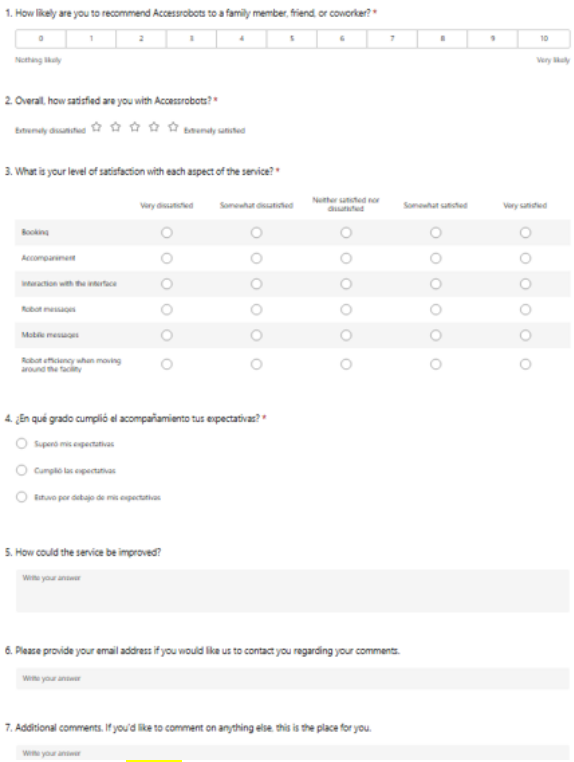



Figure Y21 End-user validation test via Microsoft forms

The total number of accompaniment services carried out during trial period were 187.
Out of the total 187, there were different type of users:

- many accompaniment services were carried out from the totem which were referred into the system as “Nonregistered anonymous user”
- most commonly, the same user would book several services during demonstration period (registered user)
- in other cases, users were serviced using our own mobile devices (registered as dummy users)

## 6.2.7 Demonstration event summary

The following table offers a comprehensive summary of the actual scope of the Demo execution phase and the data collected throughout the trial period.

| | |
|---|---|
| Total number of accompaniment services carried out during trial period | 187 |
| Total number of end-user interviews during the validation event (July 15-17th ) | 25 |
| Total number of end-user questionnaires complete after the accompaniment service | 22 |

The collected information has played a crucial role in guiding the ongoing evolution of our solution, offering valuable insights that have informed design improvements and operational adjustments.

The detailed data collected has enabled us to assess the solution's effectiveness and adapt the platform to better meet people with disabilities needs.

Furthermore, our rigorous analysis of these findings has provided strong validation as we progress toward higher Technology Readiness Levels (TRL), ensuring the solution is robust, scalable, and aligned with stakeholder and end-users expectations.

## 6.3 Demo evaluation phase

### 6.3.1 Dissemination Event

The demonstration received broad exposure through both national and regional television broadcasts. In parallel, a social media campaign amplified the event's visibility, utilising Fundacion ONCE and INSERTA platforms LinkedIn and Instagram:

- https://www.linkedin.com/posts/fundacion-once-inserta_accessrobots-maerlaga-discapacidad-activity-7355537888589049856-3fSO?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA2Yd-8BhHFjYBcxJqZXABuQuPPrSHnj1XI
- https://www.instagram.com/p/DMpsVakCKw0/
- https://www.linkedin.com/posts/activity-7352964783861592064-VQjm?utm_source=social_share_send&utm_medium=member_desktop_web&rcm=ACoAAA2Yd-8BhHFjYBcxJqZXABuQuPPrSHnj1XI
- https://www.linkedin.com/posts/NaviLens_rail-travel-is-becoming-more-inclusive-in-ugcPost-7354150546913554433-gVEQ?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
- https://forbes.es/economia/744045/adif-renfe-e-ineco-instalan-un-punto-de-ayuda-para-facilitar-la-movilidad-de-personas-con-discapacidad/
- https://www.linkedin.com/feed/update/urn:li:activity:7352611982576865281/
- https://www.linkedin.com/feed/update/urn:li:activity:7349346782046269441/

- Links of the dissemination event 2 "Seamless & Inclusive Mobility":
  - https://www.linkedin.com/posts/metro-de-m%C3%A1laga_fp1motional-euabrrail-railinnovation-activity-7458529935553593345-

8aKi/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE

- https://www.linkedin.com/posts/adif_fp1motional-euabrrail-railinnovation-activity-7458215368789196802-0YPW?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
- https://www.linkedin.com/posts/implaser99_encaminamiento-podotaerctil-ugcPost-7459510666014519298-2DMm/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
- https://www.linkedin.com/posts/renfe_fp1motional-euabrrail-railinnovation-activity-7458445783953227776-aUlY/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE

- Further details, supporting materials and dissemination outputs are available through the following links:
  - https://forbes.es/economia/744045/adif-renfe-e-ineco-instalan-un-punto-de-ayuda-para-facilitar-la-movilidad-de-personas-con-discapacidad/
  - https://www.linkedin.com/posts/NaviLens_rail-travel-is-becoming-more-inclusive-in-ugcPost-7354150546913554433-gVEQ?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
  - https://www.linkedin.com/feed/update/urn:li:activity:7352611982576865281/
  - https://www.linkedin.com/feed/update/urn:li:activity:7349346782046269441/

### 6.3.2 TRL validation

The validation of the TRL (Technology Readiness Level) has been primarily based on two main indicators:

- User validation: feedback from users' interviews and questionnaires.
- The number of errors detected in the software during the demo process, which were registered and reported by the technical team assisting the user during demonstrations.

Regarding the latter indicator, the data collected from the code management and issue tracking platforms (specifically GitLab) provide the following figures:

- Number of issues on the Android platform: 3
- Number of issues on the iOS platform: 3
- Number of issues on the robot iPad platform: 1
- Number of commits to new system versions during the testing period: 8

These metrics demonstrate both the level of user interaction and feedback received, as well as the

technical adjustments carried out throughout the testing phase.

The relatively low number of issues reported across all platforms suggests a stable software environment, while the eight commits indicate active development and prompt resolution of detected problems.

Overall, these results reinforce the reliability of the validation process and support the readiness of the technology for further deployment or scaling, hence attaining targeted TRL levels.

### 6.3.3 Analyse feedback from stakeholders

As aforementioned, we summarized the NPS (network promoting score) of 22 users who gave us feedback through the questionnaire provided. See annex 1 for complete results.

It should be noted that different evaluation metrics were used during the validation activities. The recommendation question was assessed using the Net Promoter Score (NPS) methodology on a 0-10 scale, while the satisfaction-related questions were rated on a 1-5 scale. Consequently, the resulting indicators are based on different scales and should not be interpreted as directly comparable.

| Il | Hora de inicio | Hora de finalización | Correo electrónico | NPS - ¿Qué probabilidad hay de que recomiendes Accessrobots a una persona familiar, amiga o compañera de trabajo? | En general, ¿cuál es tu grado de satisfacción con Accessrobots? | ¿En qué grado cumplió el acompañamiento tus expectativas? | Observaciones adicionales. Si quieres comentar cualquier cosa adicional, este es tu sitio. |
|---|---|---|---|---|---|---|---|
| 1 | 7/18/25 11:24:31 | 7/18/25 12:38:42 | anonymous | 10 | 4 | Cumplió las expectativas | |
| 2 | 7/24/25 13:09:46 | 7/24/25 13:14:44 | anonymous | 10 | 4 | Superó mis expectativas | ruedas , |
| 3 | 7/25/25 10:53:20 | 7/25/25 11:04:45 | anonymous | 9 | 4 | Superó mis expectativas | Utilización con ASA |
| 4 | 7/25/25 12:34:40 | 7/25/25 12:54:18 | anonymous | 10 | 5 | Superó mis expectativas | guia |
| 5 | 7/28/25 11:23:43 | 7/28/25 11:32:35 | anonymous | 10 | 5 | Cumplió las expectativas | Ciego. |
| 6 | 7/28/25 12:01:26 | 7/28/25 12:11:12 | anonymous | 10 | 5 | Superó mis expectativas | Usuario con agarre |
| 7 | 7/30/25 11:02:01 | 7/30/25 11:08:39 | anonymous | 10 | 4 | Superó mis expectativas | • |
| 8 | 7/30/25 11:24:42 | 7/30/25 11:40:44 | anonymous | 10 | 5 | Cumplió las expectativas | comenté arriba en |
| 9 | 7/31/25 13:47:08 | 7/31/25 13:52:03 | anonymous | 10 | 5 | Superó mis expectativas | personas autismo |
| 10 | 8/1/25 10:51:29 | 8/1/25 10:53:47 | anonymous | 10 | 5 | Superó mis expectativas | persona invidente |
| 11 | 8/1/25 10:54:37 | 8/1/25 10:56:15 | anonymous | 10 | 5 | Superó mis expectativas | Persona invidente |
| 12 | 8/1/25 12:08:29 | 8/1/25 12:13:14 | anonymous | 10 | 5 | Superó mis expectativas | Usuario invidente |
| 13 | 8/4/25 12:25:42 | 8/4/25 12:29:50 | anonymous | 10 | 5 | Superó mis expectativas | Persona invidente |
| 14 | 8/5/25 10:29:34 | 8/5/25 10:32:09 | anonymous | 10 | 5 | Superó mis expectativas | Persona invidente |
| 15 | 8/5/25 10:40:48 | 8/5/25 10:43:38 | anonymous | 10 | 5 | Superó mis expectativas | Persona invidente |
| 16 | 8/5/25 11:22:00 | 8/5/25 11:24:56 | anonymous | 10 | 5 | Superó mis expectativas | Persona invidente |
| 17 | 8/7/25 10:52:24 | 8/7/25 10:56:22 | anonymous | 9 | 4 | Cumplió las expectativas | Persona invidente |
| 18 | 8/7/25 10:57:00 | 8/7/25 11:02:06 | anonymous | 10 | 4 | Cumplió las expectativas | Persona invidente |
| 19 | 8/7/25 11:02:14 | 8/7/25 11:51:31 | anonymous | 10 | 4 | Superó mis expectativas | Persona invidente |
| 20 | 8/7/25 12:41:04 | 8/7/25 12:45:45 | anonymous | 10 | 4 | Cumplió las expectativas | Persona invidente |
| 21 | 8/7/25 13:16:22 | 8/7/25 13:22:06 | anonymous | 9 | 4 | Cumplió las expectativas | Persona invidente |
| 22 | 8/7/25 13:22:11 | 8/7/25 13:33:20 | anonymous | 6 | 4 | Cumplió las expectativas | Persona invidente |

The analysis reveals that most users are very satisfied with Access robots and consider that the service has exceeded or met their expectations. Open responses highlight the main suggestions for improvement as increasing the robot's speed, improving the volume and quality of sound, and optimizing turns.

In summary:

- There are a high overall satisfaction and a strong willingness to recommend the service.
- The most requested improvements focus on speed and sound.

### 6.3.4 Evaluation of outcomes and Performance indicators (PI)

The validation of the Technology Readiness Level (TRL) has been assessed through a combination of qualitative and quantitative performance indicators, focusing on user feedback and technical system performance.

1. **User Validation Indicators**
    - Total number of accompaniment services carried out during trial period, July 15th to August 8th: 187
    - Number of users involved in Validation Event, July 15th-17th: 25
    - Number of users questionnaires complete during trial period: 22
    - Net Promoter Score **(NPS**): Calculate as users who have given a rating of 9–10 out of 10 are recommended promoters (see Figure XXXX): 21 out of 22, which is **95%**
    - User satisfaction level: High overall satisfaction, with most users reporting that expectations were met or exceeded.
        - Expectations met or exceeded: 22 out of 22: 100%
        - Expectations exceeded: 14 out of 22: 64%
    - Qualitative feedback:
        - Positive perception of the system usability and usefulness
        - Main improvement areas identified:
            1. Increase robot speed
            2. Improve sound quality and volume
            3. Optimize turning performance

2. **Technical Performance Indicators**
    - Number of issues detected during trial period and demonstration phase:
        - Android platform: 3
        - iOS platform: 3
        - Robot iPad platform: 1
    - Total number of **issues**: 7 (**3,7%** calculated as 7 out of 187)
    - Number of commits during testing period: 8
    - Issue tracking source: GitLab (code management and issue tracking platform)

3. **System Stability and Responsiveness**
    - Low issue density across platforms (3,7%), indicating stable software performance

- Active development cycle, demonstrated by 8 commits addressing detected issues
- Efficient issue resolution, with all identified problems tracked and managed during the testing phase

### 6.3.5 Impact assessment

- *"I hope new pilots happen soon, maybe in another station or shopping centre in Madrid. Honestly, I think it has enormous potential, and if I'm being truthful, it would already make my life easier in its current state."*
- *"I was amazed when I tried it. It represents a turning point in assistance for passengers with special needs."*
- *"I had never tried anything like it before. I feel safe and motivated to travel without relying on anyone else."*
- *"The robot carries my suitcase, and I follow behind without worrying about it—a real luxury."*
- *"The robot is here to reinforce autonomy and confidence for people with autism as they move through a station independently."*

These testimonies paint a vivid picture of the transformative impact that Access robots can have on individuals with disabilities. The recurring themes of increased autonomy, safety, and confidence highlight the primary benefits for the intended user group: people who face barriers in public spaces, particularly transportation hubs like railway stations.

For individuals with physical disabilities, the robot's luggage assistance and navigation support diminish their dependency on others, fostering dignity and independence. Users with neurodiverse conditions, such as autism, find reassurance and confidence in the robot's reliable guidance, which supports them to move freely and securely in complex environments.

Moreover, the emotional responses captured in the testimonials illustrate the psychological impact: users are not only supported logistically but are also empowered to expand their horizons and participate more fully in daily life and travel.

# 7. Task 23.2 (2) – Demonstration in Malaga Accessible SW + Totem

The Accessible Tool is an integrated software solution that brings together multiple components within a single system, including a mobile application, the T-Ais totem system, an accessible route calculation module based on available accessibility data, an assistance robot, and an intelligent guidance tool. All these elements are interconnected and managed through the Accessible Tool platform.

The primary objective of this solution is to support travellers with diverse needs by enabling them to identify and access appropriate services. These services include the provision of relevant travel information (e.g., timetables and incident notifications), the identification of accessible routes within the multimodal Málaga María Zambrano station, and access to various accessibility support tools, such as assistance robots, pod tactile guidance paths, and mobile-enabled information codes facilitating navigation.

End users can access the system either through the T-Ais totem installed in the station or via the "Motional" mobile application, available on both iOS and Android platforms.

RENFE plays a central role in this use case, acting as the main promoter and implementer of the solution. In particular, RENFE has led the definition of the solution, design, procurement and deployment of all key components, including the development of the software platform, the installation of the T-Ais totem, the deployment of NaviLens codes, and the implementation of pod tactile guidance paths within the station. RENFE has also been responsible for launching and managing the corresponding procurement procedures and has actively contributed to all design and implementation phases.

ADIF, as infrastructure manager, provides access to Málaga María Zambrano station and supports the installation and deployment of the solution. Commercial Center of Vialia, as concessionaire of the commercial area within the station, facilitates the use of relevant spaces required for the demonstrations. Associations representing persons with disabilities contribute by providing end users participating in the testing activities.

In parallel, it should be noted that Ineco also participates in the ERJU programme as a member of the Adif–Ineco–Renfe membership. In this capacity, Ineco contributed at a conceptual and advisory level to the use case, supporting the high-level definition of the solution and proposing design concepts, including the outer casing of the T-Ais totem.

This role should be clearly distinguished from Ineco's separate involvement as technical assistance provider to RENFE, acting as its in-house provider, which was carried out under a direct arrangement with RENFE.

## 7.1 Demo implementation phase

| Use case ID | TE's | Name | Description |
|---|---|---|---|
| UC-FP1-WP19-12 | TE22 | Totem T-Ais: 1 specific spot for people with visual disability | Totem receives information from transportation information sources, offering specific information to people according to their requests. |
| UC-FP1-WP19-13 | TE22 | Totem T-Ais: 2 specific spots for people with hearing impairment, PRM, motor disability, cognitive impairment, language misunderstanding and some visual impairments; also can be used by persons with no disabilities | Totem receives information from transportation information sources, offers specific information in text by screen, loudspeaker and magnetic induction loop, to people according to their requests. |
| UC-FP1-WP19-17 | TE22 | Guiding Accessible Software | Guiding of people with disabilities inside of the multimodal railway station |
| UC-FP1-WP19-18 | TE22 | Guiding Accessible Intelligent Tool with physical complementary signage in different languages | Guiding of people with disabilities inside of the multimodal railway station |

### 7.1.1 Recruitment of end-users

Although Accessible Tool solution is useful for every type of rail user, the primary target are users with different disabilities, in particular users with visual impairment, hearing impairment, cognitive disability and reduced mobility travellers.

On the one hand, the RENFE supplier providing the assistance robot, Inserta Innovación, sent invitations by email as indicated in point 6.1.1.

On the other hand, during all developments in María Zambrano, ADIF FM and Metro of Málaga have maintained close communication with local organizations representing multiple disabilities that have given their inputs and valuable feedback during this project. In this case, for Accessible Tool's validation and demonstration, the following organizations agreed to participate in the events:

- *Agrupación de Desarrollo Málaga Accesible*
- *Fácilmente APROINLA*

- *FIAPAS*
- *Plena Inclusión*
- *ATOLMI* (Asoc. terapia ocupacional y laboral de minusválidos)
- *ONCE*

In addition, sign language interpretation services were contracted to ensure possibility of testing for deaf users.

Around twenty of their representatives who had previous experience on testing different transport solutions or improvements for other entities, tested Accessible Tool and gave their feedback.

Association staff accompanied participants throughout the sessions, together with project staff acting as facilitators/observers to ensure safety and consistent data capture.

### 7.1.2 Deployment of demonstration environment

As mentioned above in the Description, Accessible Tool is a software that integrates different elements in the same system.

There are two main access points to the software: via the T-Ais totem and through the test mobile devices. Initially, the solution was planned to be hosted on RENFE's servers, which would have required the use of SIM cards from RENFE's network on the test devices to ensure connectivity. However, the software was ultimately deployed on Ineco's servers, and consequently, the devices have been operated using SIM cards from Ineco's network.

In this context, Ineco acted as RENFE's in-house provider, supporting the technical deployment under RENFE's responsibility, rather than as an affiliated entity.

Next, is the description of the installation and configuration of the **software** for every element of the system that were used in the demonstration environment, to ensure that it was fully operational and integrated.

**Accessible Tool Core**

- Backend services were deployed on INECO's servers.
- Include a map of Málaga María Zambrano Station showing accessible routes.
- Definition and configuration of waypoints of interest: entrance, destination, and intermediate points. (See Figure XX1).
- Assign an ID to each common waypoint with the Assistance Robot and NaviLens (Guiding intelligent tool).
- Configure the possible routes by linking the waypoints that are physically connected (see Figure XX2).
- Set weights between waypoints to enable the calculation of accessible routes.
- Configuration of APIs for data exchange between the Accessible Tool and AccessRobot (the system that manages the Assistance Robot).

- Configuration of APIs for data exchange between the Accessible Tool and NaviLens.
- Configuration of software to connect and collect train and platform information from Adif Elcano data (Elcano is Adif's system that integrates data on planning, train operations, incidents, and more, and distributes it).
- Configuration of software to connect and collect train frequency from Metro Málaga data.
- Controlled test mobile devices (Android and iOS) were provisioned with INECO intranet connectivity (via SIM cards) and prepared with the required applications: Accessible Tool (core services), AccessRobot and NaviLens.
- Consistent functional configuration was ensured across both interfaces (T-Ais Totem and Motional mobile): accessible information retrieval, ticket QR scanning to determine the track, accessible route calculation (map-based), and invocation/handover to complementary guidance (robot request and NaviLens guidance).




Figure XX1: Map of Málaga María Zambrano Station and waypoints of interest.




Figure XX2: Map of Málaga María Zambrano Station and waypoints of interest.

**Mobile phones for the demonstrator**

Users will access Accessible Tool via the T-Ais kiosk and two mobile devices, one running Android and the other running iOS, and each phone has been the following applications installed:

- AccessRobot application (related to the Assistance Robot)
- NaviLens application (offers intelligent guidance with the mobile).
- Motional application, that offers the same services as the T-Ais totem, such as providing accessible train and Underground timetable information, calculates accessible routes shown on a map, indicates the track on which a train is parked by scanning the ticket and is integrated with the AccessRobot application and with NaviLens.

**Guiding intelligent tool**

As the provider of the "Guiding Intelligent Tool," NaviLens performed the following tasks related to the integration of its software with *Accessible Tool Core*:

- Registration and configuration of a private space on its NaviLens.com cloud platform.
- Reservation and assignment of NaviLens codes for the project.
- API integration with *Accessible Tool Core*'s web services, enabling dynamic updates to the content of NaviLens codes.
- Definition and configuration of waypoints of interest: entrance, destination, and intermediate points. (see Figure XX3).
- Assign an ID to each common waypoint with the *Accessible Tool Core*. (see Figure XX4).
- Configure the possible routes by linking the waypoints that are physically connected (see Figure XX5).
- Multi-language support.




Figure XX3: Location of NaviLens codes and pod tactile pathways in an area of the station.

| NÚMERO | TAMAÑO (MM) | MATERIAL | TEXTO CORTO | UBICACIÓN |
|---|---|---|---|---|
| V1 | 300 | VINILO | Acceso estación Málaga-María Zambrano | Puerta automática cristal acceso |
| V2 | 300 | VINILO | Salida estación | Puerta automática cristal acceso |
| V3 | 300 | VINILO | Control equipaje para acceso a vías | Panel frontal acceso a andenes |
| V4 | 300 | VINILO | Salida estación | Puerta automática cristal acceso |
| V5 | 300 | VINILO | Acceso estación Málaga-María Zambrano | Puerta automática cristal acceso |
| V6 | 300 | VINILO | Salida estación | Puerta automática cristal acceso |
| V7 | 300 | VINILO | Acceso estación Málaga-María Zambrano | Puerta automática cristal acceso |
| V8 | 250 | VINILO | Venta de billetes | Puerta cristal interior |
| V9 | 250 | VINILO | Venta de billetes | Puerta cristal interior (Nueva At. cliente Renfe) |
| V10 | 250 | VINILO | Atención al cliente | Puerta cristal interior |
| V11 | 210 | VINILO | Mostrador de atención Acerca | Interior Atendo |
| V12 | 210 | VINILO | Centro de viajeros Renfe | Interior Atendo |
| V13 | 300 | VINILO | Hall cercanías planta baja | Frontal subida cercanías |
| V14 | 210 | VINILO | Máquina de venta automática de tickets | Máquinas ticket cercanías |
| V15 | 210 | VINILO | Mostrador de venta de billetes | Pto. info cercanías |
| V16 | 250 | VINILO | Ascensor | Ascensor cercanías |
| V17 | 100 | VINILO | Tomo | Tomos |
| V18 | 100 | VINILO | Tomo | Tomos |
| V19 | 250 | VINILO | Salida a centro comercial | Puerta cristal interior |
| V20 | 250 | VINILO | Acceso a cercanías | Puerta cristal interior |
| V21 | 210 | VINILO | Máquina de venta automática de tickets | Máquinas ticket cercanías |
| V22 | 250 | VINILO | Ascensor | Ascensor cercanías |
| V23 | 300 | VINILO | Hall cercanías planta baja | Frontal subida cercanías |
| V24 | 300 | VINILO | Salida estación | Puerta automática cristal acceso |
| V25 | 300 | VINILO | Acceso estación Málaga-María Zambrano | Puerta automática cristal acceso |
| V26 | 300 | VINILO | Salida estación | Puerta automática cristal acceso |
| V27 | 300 | VINILO | Acceso estación Málaga-María Zambrano | Puerta automática cristal acceso |
| V28 | 400 | GLASSPACK | Acceso vía 1 | Bajo TV |
| V29 | 400 | GLASSPACK | Acceso vía 2 | Bajo TV |
| V30 | 400 | GLASSPACK | Acceso vía 3 | Bajo TV |
| V31 | 400 | GLASSPACK | Acceso vía 4 | Bajo TV |
| V32 | 400 | GLASSPACK | Acceso vía 5 | Bajo TV |
| V33 | 400 | GLASSPACK | Acceso vía 6 | Bajo TV |
| V34 | 400 | GLASSPACK | Acceso vía 7 | Bajo TV |
| V35 | 210 | VINILO | Aseos | Acceso aseos (interior andenes) |
| V36 | 250 | VINILO | Acceso a vías | Puerta cristal interior (1ª puerta, visto desde CC) |
| V37 | 250 | VINILO | Acceso a vías | Puerta cristal interior (2ª puerta, visto desde CC) |
| V38 | 250 | VINILO | Salida a centro comercial | Puerta cristal interior (1ª puerta, visto desde vías) |
| V39 | 250 | VINILO | Salida a centro comercial | Puerta cristal interior (2ª puerta, visto desde vías) |
| H1 | 720 | POLIPROPILENO | Intersección | |
| H2 | 720 | POLIPROPILENO | Intersección | |
| H3 | 720 | POLIPROPILENO | Intersección | |
| H4 | 720 | POLIPROPILENO | Intersección | |
| H5 | 720 | POLIPROPILENO | Intersección | |
| H6 | 720 | POLIPROPILENO | Intersección | |
| H7 | 720 | POLIPROPILENO | Intersección | |
| H8 | 720 | POLIPROPILENO | Intersección | |
| H9 | 720 | POLIPROPILENO | Intersección | |
| H10 | 720 | POLIPROPILENO | Intersección | |
| H11 | 720 | POLIPROPILENO | Intersección | |
| H12 | 720 | POLIPROPILENO | Intersección | |
| H13 | 720 | POLIPROPILENO | Intersección | |
| H14 | 720 | POLIPROPILENO | Intersección | |
| H15 | 720 | POLIPROPILENO | Intersección | |
| H16 | 720 | POLIPROPILENO | Intersección | |
| H17 | 720 | POLIPROPILENO | Intersección | |
| H18 | 720 | POLIPROPILENO | Intersección | |
| H19 | 720 | POLIPROPILENO | Intersección | |
| H20 | 720 | POLIPROPILENO | Intersección | |
| H21 | 720 | POLIPROPILENO | Intersección | |
| H22 | 720 | POLIPROPILENO | Intersección | |
| H23 | 720 | POLIPROPILENO | Intersección | |
| H24 | 720 | POLIPROPILENO | Intersección | |
| H25 | 720 | POLIPROPILENO | Intersección | |

Figure XX4: Assigned IDs in NaviLens to each common waypoint with the Accessible Tool Core.

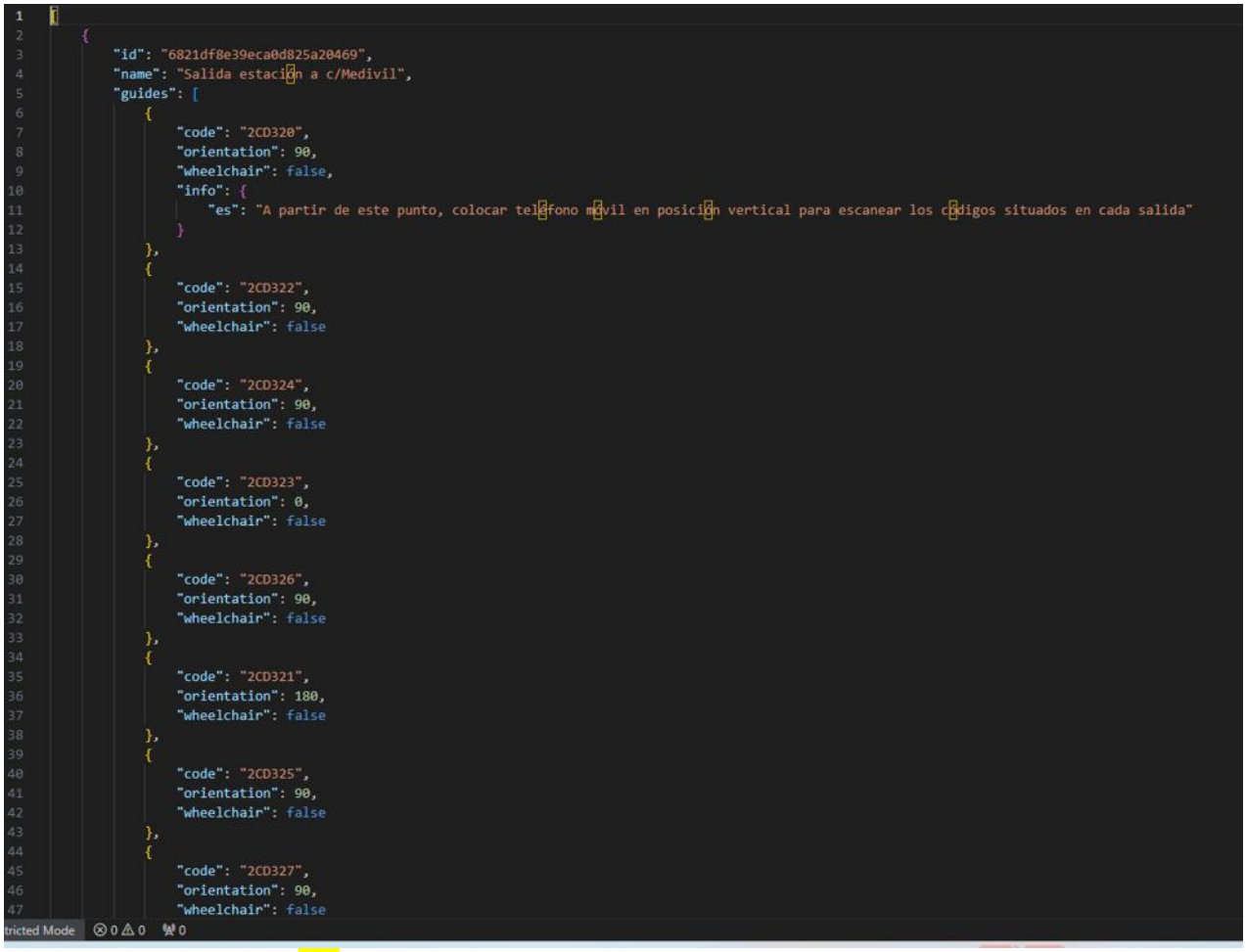



Figure XX5: NaviLens codes and instructions for every waypoint of interest.

With regard to set up and installation of all **hardware** components, the **Accessible Tool** demonstration required the following installations:

- Totem T-Ais: this element is an information device consisting of:
  - Outer casing made of solid surface material
  - 2 touchscreens
  - 4 speakers
  - Magnetic induction loops
  - 2 x 3.5 mm headphone jacks
  - 2 QR code readers
  - 2 QWERTY keyboards
  - 6 accessible buttons
  - 1 projector
  - Lighting-location system
  - Flexible circular general information screen
  - Fixed Braille signage
  - 3 computers
  - 1 5G router with Wi-Fi
  - Electrical power control panel




Figure XX6: Some components of Totem T-Ais, interior (left), exterior (right).

The installation and removal of the totem T-Ais was carried out by a subcontracted company specialized in large-format digital information device (Led&Go). This company was responsible for acquiring the various components of the totem, manufacturing the casing, integrating all the components with the casing, transport to the demonstration site, installation and calibration of the equipment used in the demonstration. They will also carry out the totem removal before the project deadline.

When choosing the location for the totem at the station, consideration was given to ensuring that it was visible and accessible but did not interfere with the usual flow of people, and that it was easy to connect to the electricity supply to enable all the devices to function.

Furthermore, checks were carried out to ensure that the location of the totem did not interfere with the field of vision of the security cameras related to railway operations. To do this, the totem was recreated in a BIM model of the station, and the different perspectives from the security cameras to the control areas of those cameras were analysed (Figure XX7).

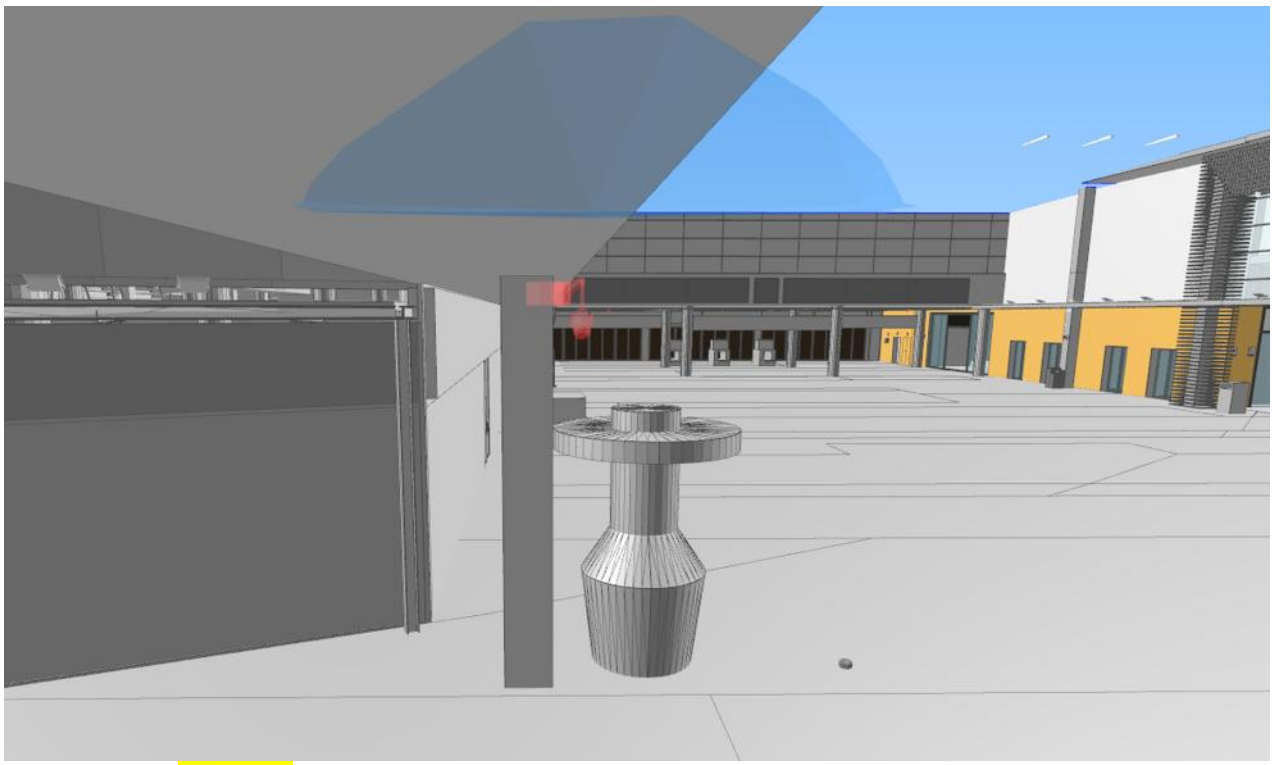


Figure XX7: BIM model of the station to ensure proper placement of the T-Ais totem.

- 2 mobile phones (iOS and Android), that host the apk offering the same information and services as the totem.
- SIM cards for mobile phones and the totem 5G router. As this is a TRL 6 demonstrator with controlled users (not open to the general public), access to the software is only permitted on a private Ineco network. Therefore, SIM cards from this company have been necessary for the totem and mobile phones can connect to the servers hosting the main software. Both the totem and the mobiles function as a client that consults the main software hosted on Ineco's servers.

The NaviLens guidance system (**Guiding Intelligent Tool),** relies on pod tactile pathways installed on the ground, as well as in physical codes (similar to QR codes), placed on the floor or vertical walls, so the Set up and installation of **hardware** required for it was:

- The pod tactile pathways were already installed throughout the María Zambrano Station in Málaga, by a subcontracted company between February and March. (Figure XX8).
- Physical codes (similar to QR codes large in size and featuring a colour combination), was installed between April and June. (Figure XX9).

Figure XX8: Podotactile pathways installed in María Zambrano Station (Málaga).




Figure XX9: NaviLens physical codes installed in María Zambrano Station (Málaga).

Logistical Coordination and Safety:

- All activities were carried out under the supervision of ADIF, Renfe and Vialia staff, who will be present on-site during installation and removal, with ADIF staff being responsible of ensuring full compliance with infrastructure safety protocols.
- ADIF personnel provided guidance on risk management, validated installation zones and ensured that operations do not interfere with passenger flow or train service.

Permissions and Approvals:

- The necessary approvals for access to the station, work on platforms and power connections were requested through the standard ADIF infrastructure intervention procedures.
- The subcontractor was responsible for meeting any additional requirements regarding equipment certifications or temporary installation guidelines.

No permanent modifications to the infrastructure were planned and the installation will be fully reversible after the removal of the elements.

### 7.1.3 Collect and process demonstration data

There are five different types of objectives, and depending on the objective, certain data is required. The following is a list of the data collected for each objective:

- Target: Get information
  Test data:

- Departure time and track of the next train to Madrid (or other destination).
- Time and track of arrival of the next train from Granada (or other origin).
- Underground frequency at those times.

Data related to trains was obtained from Elcano, and data related to the Málaga Metro was obtained from its data system.

- Target: Obtain information on a ticket by scanning its QR code
  Test data:
  - A controlled ticket from which a response will be forced.

Data related to position trains was obtained from Elcano, when no actual ticket was available in the test and Validation Event for a train due to depart within the next few minutes, an old ticket was used and the response from the *Accessible Tool* system was forced.

- Target: Follow accessible routes through the station accompanied by the assistance robot.
  Test data:
  - The user's current location (any of the location of interest within the station (cafeterias, toilets, platforms, exits, ticket sales points, customer service, etc.)
  - Location of interest within the station (the place the user needs or wants to go).

- Target: Follow accessible routes through the station using the mobile guidance system (NaviLens).
  Test data:
  - The user's current location.
  - Location of interest within the station.

- Target: 5. To offer users accessible routes in the station by displaying them on a map both on the totem T-Ais and on the Motional mobile app.
  Test data:
  - The user's current location.
  - Location of interest within the station.

Prepared datasets were mapped to test inputs per session and per disability profile to ensure repeatability across interfaces (Totem vs. mobile).

### 7.1.4 Validation of demonstration data

In this demonstrator, the main data required has been:

- Points or locations of interest within the station.
  To this end, these points (station entrance gates, platform access points, customer service points, cafés, toilets, etc.), were defined and incorporated into the various systems integrated within the *Accessible Tool*, so that all systems shared the exact location of each point of interest. (Figure XX10).
- Information contained in the QR code on a train ticket.

The problem here was that Adif's Elcano System only provides train information from approximately one hour before the train departs, and since it was impossible to obtain a real ticket for each QR code reading test, an old ticket (from another day) was used for the tests and validation, and the response from the *Accessible Tool* system was forced to provide a train departure time consistent with the time at which the test was carried out (the time at which the system detects that it has read a QR code from the ticket), and similarly, the *Accessible Tool* system assigns a pre-set train platform for that old ticket.

- The data on train timetables, departure and arrival platforms, etc., provided by Elcano, was processed in real time.
- Once the relevant API had been developed, numerous tests were carried out both in the laboratory and on-site at María Zambrano station to verify the consistency and reliability of the data obtained.

| destinations_id | destination_name | end_route_codes_id | angle | guide_text |
|---|---|---|---|---|
| 1 | Salida estación a c/Medivil | V2 | 300 | |
| 2 | Control equipaje para acceso a vías | V3 | 300 | |
| 3 | Salida estación a c/Explanada de la Estación | V6 | 300 | |
| 4 | Venta de billetes | V9 | 300 | |
| 5 | Atención al cliente | V10 | 300 | |
| 6 | Mostrador de atención Acerca | V11 | 300 | |
| 7 | Centro de viajeros Renfe | V12 | 300 | |
| 8 | Máquina de venta de tickets Norte | V14 | 300 | |
| 9 | Mostrador de venta de billetes Cercanías | V15 | 300 | |
| 10 | Ascensor Vía 10 | V16 | 300 | |
| 11 | Salida a centro comercial | V19 | 300 | |
| 12 | Acceso a Cercanías | V20 | 300 | |
| 13 | Máquina de venta de tickets Sur | V21 | 300 | |
| 14 | Ascensor Vía 11 | V22 | 300 | |
| 15 | Salida estación a c/ Héroe de Sostoa | V24 | 300 | |
| 16 | Salida estación a c/ Explanada de la Estación esquina c/ Héroe de Sostoa | V26 | 300 | |
| 17 | Acceso Vía 1 | V28 | 300 | |
| 18 | Acceso Vía 2 | V29 | 300 | |
| 19 | Acceso Vía 3 | V30 | 300 | |
| 20 | Acceso Vía 4 | V31 | 300 | |
| 21 | Acceso Vía 5 | V32 | 300 | |
| 22 | Acceso Vía 6 | V33 | 300 | |
| 23 | Acceso Vía 7 | V34 | 300 | |
| 24 | Aseos | V35 | 300 | |
| 25 | Cafetería | V40 | 300 | |
| 26 | Máquina su turno Espacio Renfe | V41 | 300 | |
| 27 | Máquina de autoventa Espacio Renfe | V42 | 300 | |
| 28 | Mostrador de venta de billetes | V43 | 300 | |
| 28 | Tótem | V44 | 300 | |

Figure XX10: Points of interest identified in María Zambrano Station (Málaga) for the project.

## 7.1.5 Integration tests

Integration testing was performed to confirm that all components worked coherently as a system, with particular focus on service-to-service (B2B) exchanges and interface consistency. Activities included:

- End-to-end tests between the Motional backend and both front-ends (T-Ais Totem and Motional mobile).
- Validation of ticket scanning workflows.
- Verification of the integrations with AccessRobot (robot request and meeting-point handling) and NaviLens (handover to guidance tool)
- On-site connectivity checks supported by the deployed Wi-Fi infrastructure.

Tests were performed prior to on-site tests, followed by technical tests at Málaga María

Zambrano to validate behaviour in the relevant environment.

Integration tests between Accessible Tool and AccessRobot were conducted in May 2025, specifically, on May 9, Ineco technicians visited AccessRobot's offices to verify that the integration between the two systems was working properly.

The integration between NaviLens and Accessible Tool took place in June 2025.

From 23 to 25 June, at María Zambrano station in Málaga, preliminary tests were conducted with the users/volunteers who will be participating in the Validation Event in July. Since these individuals have various disabilities, for good coordination, it was deemed appropriate to conduct these tests to determine their reaction times, behaviour, needs, the time the Validation Event will take, etc.

These tests helped to identify a few minor errors in the integration between the systems.
On 8 July, further integration tests were carried out at the station itself, without volunteers, involving only technicians to validate the changes to the integrations.
On 14 July, further integration tests were carried out using the Assistance Robot, and everything was left ready for validation.

### 7.1.6 Develop training materials

Training materials were developed for all relevant participant groups to ensure safe, consistent and effective execution.

A workshop was held on 24 April 2025 to explain the project's objectives, provide a brief overview of the project and its various interfaces (Totem and mobile), and outline the tests to be carried out. The profile of the volunteers required for the validation process was also presented, along with the number of volunteers needed.

The materials included: a PowerPoint presentation for the workshop explaining:

- The workshop's objective.
- What the project offers.
- Who it is aimed at.
- How to interact with the system *Accessible Tool*.
- Planned testing and validation sessions
- The types of tests to be carried out (including a description and objectives for each test), as well as the steps or actions expected of volunteers during the testing process.

Particular attention was paid to the fact that, as the main objective of the project is to empower people with various disabilities, the volunteers should not be 'trained', so that it would be possible to genuinely assess whether the system *Accessible Tool* is sufficiently accessible and understandable to the volunteers the first time they encounter it.

The training was delivered through a face-to-face workshop lasting approximately 60 minutes, supplemented by ad hoc information and review sessions prior to each session.




Figure XX11: Example of the documentation used during the Workshop.

## 7.1.7 Perform installations (if necessary)

As explained in section 7.1.2 of this deliverable, the installation process included:

- Assembly and placement of the T-Ais Totem at Málaga María Zambrano.
- BIM model of the station, in order to ensure that the location of the totem did not interfere with the field of vision of the security cameras related to railway operations.
- Provisioning of test mobile devices and INECO intranet SIM cards.
- Deployment of Wi-Fi repeaters supporting the Assistance Robot.
- Installation of NaviLens physical signalling.

Installation activities were supervised by ADIF/Vialia staff to ensure compliance with station operational constraints and safety procedures, and to minimise impact on passenger flows.

## 7.1.8 Validation tests

Broadly speaking, the aim of this demonstrator is to provide information on train departure and arrival times and platform locations, as well as to offer accessible routes within the station to people with various disabilities, with a view to enhancing their independence and ease of travel.

For this reason, the tests were designed as a series of challenges for the following volunteers:

- People with visual disability
- Hearing impairment
- PRM (wheelchair users)
- Cognitive impairment

- Motor disability (people without fingers and without the ability to press small buttons).

The pre-validation user testing sessions were organised into four sessions prior to the validation event, on 23, 24 and 25 June 2025 (coinciding with some integration tests). Specifically:

- 23 June, morning: tests with people with cognitive disabilities.
- 24 June, morning: testing with people with visual disability.
- 24 June, afternoon: testing with people with hearing impairments.
- 25 June, morning: testing with people with PRM + motor disability.

It was necessary to have at least 2 users/volunteers of a given disability in each work session, one will test with the totem T-Ais and the other with the Motional mobile app, although in some sessions we had more than two volunteers, which allowed us to make the tests more comprehensive and receive better feedback.

In order to meet the objectives, the tests were designed to present the following challenges or *Use Cases*:

1. The user can obtain information through the totem T-Ais or through the mobile phone regardless of the disability he/she suffers from.
2. Users can find out which track their train is parked on by scanning their ticket on the totem T-Ais or with their mobile phone.
3. Users can make accessible routes through the station with the accompaniment of an assistance robot.
4. Users can make accessible routes through the station using a mobile guidance system (NaviLens).
5. Users can find their way around the station by obtaining accessible routes by displaying them on a map both on the totem T-Ais and on the Motional mobile app.

During the Validation tests, the exact same tests planned for the Validation Event were carried out.

The test procedure consists of reproducing each use case in a test case. For each type of disability, the effectiveness of the T-Ais totem and the Motional application is tested to achieve each of the challenges indicated above.

Figure XX12 shows the number of tests to be carried out, based on the combination of the type of disability and the objective to be met, depending on whether the test is carried out using a mobile phone or the Totem.

| | DISCAPACIDAD | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual | | Auditiva | | PMR | | Cognitiva | | Motriz (sin dedos) | | |
| OBJETIVO | Tótem | Móvil | Tótem | Móvil | Tótem | Móvil | Tótem | Móvil | Tótem | Móvil | |
| 1. Obtener información | TC VT01 | TC VM01 | TC AT01 | TC AM01 | TC PT01 | TC PM01 | TC CT01 | TC CM01 | TC MT01 | TC MM01 | 10 |
| 2. Obtener datos billete | TC VT02 | TC VM02 | TC AT02 | TC AM02 | TC PT02 | TC PM02 | TC CT02 | TC CM02 | TC MT02 | TC MM02 | 10 |
| 3. Recorrido a andenes con Robot asistencial | TC VT03 | TC VM03 | TC AT03 | | | TC PM03 | TC CT03 | | | TC MM03 | 6 |
| 4. Recorrido a andenes con Navilens | TC VT04 | TC VM04 | | TC AM04 | TC PT04 | | | TC CM04 | TC MT04 | | 6 |
| 5. Recorrido a andenes con Plano | | | | TC AM05 | TC PT05 | | | | TC MT05 | | 3 |
| 6. Recorrido a servicio con Robot asistencial | TC VT06 | TC VM06 | | TC AM06 | TC PT06 | | | TC CM06 | TC MT06 | | 6 |
| 7. Recorrido a servicio con Navilens | TC VT07 | TC VM07 | TC AT07 | | | TC PM07 | TC CT07 | | | TC MM07 | 6 |
| 8. Recorrido a servicio con Plano | | | TC AT08 | | | TC PM08 | | | | TC MM08 | 3 |
| | 6 | 6 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 50 |

Codificación de los Test:

TC = Test Case
V = Visual (discapacidad)
A = Auditiva (discapacidad)
P = PMR (discapacidad)
C = Cognitiva (discapacidad)
M = Motriz (discapacidad)
T = Tótem (interfaz)
M = Móvil (interfaz)

Figure XX12: Test Case to be carried out.

The structure of each Test Case is as follows:

- Short Description:
  Depends on the objective, the medium used (totem or mobile), and the type of disability of the user taking the test.
- Objective: One of the 5 defined objectives.
- Pre-condition(s):
  - Type of disability of the user.
  - Interface to be used (totem or mobile app).
  - Train ticket to scan its QR code (preferably a real ticket of a train departing close to the time of the test).
  - AccessRobot application, NaviLens application and Motional application installed on the test mobile.
- Input Data Description
  - Train ticket
  - Target to be met (the tester is told what information to get from the Motional system, or a location in the station to go to using the assistive robot, NaviLens, or the Motional app map.)
- Expected Result: The tester obtains the required information and/or reaches the target station location.
- Sequence:

The sequence of steps to be carried out by the tester will depend on each test case, depending on the objective, the type of disability of the tester, and the interface to be used (totem or mobile), but in general it will be as follows (e.g., for totem):

1. The user approaches the totem pole by following the tactile pathways until he/she reaches it.
2. The user recognises the elements and shape of the totem (displays, buttons, Braille reliefs, etc.).
3. The user knows the content of each screen thanks to the touchscreen, screen narrator, loudspeaker, headphone, etc.
4. The user moves through the screens and selects options using the qwerty keyboard, touch screen or accessible buttons.
5. After navigation, the user hears or sees the information requested for the test case (information on timetables, parking lanes after scanning the ticket, etc.).
6. Depending on the test case, the user will navigate through the different screens of the system to select a location in the station to go to, he/she will request an assistive robot or guided with NaviLens and walk to the location with this help autonomously.
7. End of the test case.

When the test case is performed with the Motional mobile application, in step 6 the user will also indicate a meeting point at the station to start the tour with the assistive robot.

The testers belong to official associations (Agrupación de Desarrollo Málaga Accesible, APROINLA and ONCE), and were accompanied at all times by staff from their association, and by project staff who will evaluate the performance of the tests.

Two sign language interpreters were hired for the trials involving people with hearing impairments.

Station staff will also be involved in the demonstration Validation test to facilitate access to the different areas of the station.

The tests were carried out during normal station opening hours, so while the tests were being carried out there were passengers in transit as on any other day.

### 7.1.9 Communication and Dissemination before demonstration execution

Adif, Ineco, and Renfe are carrying out planned communication and dissemination actions aimed at the impact of the accessibility demonstrators planned in the SG3 work packages, whose tests are being carried out at specific points on the General Interest Railway Network.
Prior to demonstration, the communication strategy involved relevant stakeholders, general public was addressed later on the project.
This communication included:

- Disseminating information about the project and Use Cases across the companies involved: ADIF, Renfe and Ineco. Internal articles and video materials were produced.
- Shared information and materials with relevant associations and PMR organizations.

- Workshop including stakeholders and future end-users to explain the project and stablish how demonstrations will take place.
- Agreement with end-users and stakeholders on the graphic material and feedback that was going to be collected and how it was going to be used.
- Sign contracts for transfer of image rights as preparation for demonstration and dissemination.

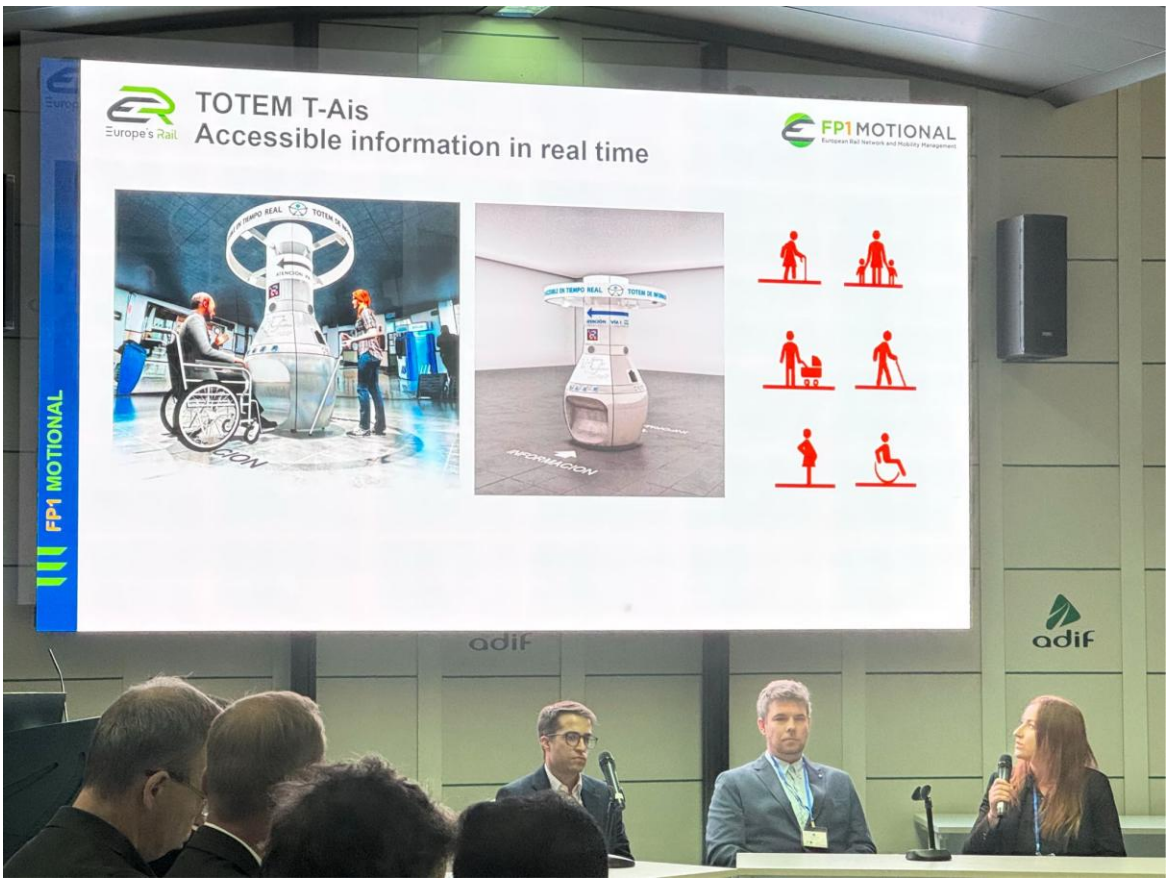
**Communication and Dissemination before Demonstration Execution**

In preparation for the demonstration phase, several targeted communication and dissemination activities were carried out to promote the accessible SW and totem solution and engage relevant stakeholders, both internally and within the project consortium.

**Internal and Project-Level Dissemination**

Prior to the execution of the demonstration, the developments related to the design, safety assessment and implementation of the accessible SW and totem solution were actively shared within the project consortium during key project events.

- In particular, this work was presented during the Mid-Term Event held in Madrid on 30 October 2024, where the solution was showcased to a broad audience of project partners and stakeholders, highlighting its objectives, constraints and expected impact on platform–train interface safety and accessibility. You can see part of the presentation in the next photo:




Additionally, the topic was further discussed during the plenary meeting held in Munich on 29 October 2025, where each partner presented their respective contributions. This ensured alignment across partners and facilitated knowledge exchange on technical, operational and safety aspects associated with the deployment of the accessible SW and totem solution.

Internally, the work was also disseminated across relevant expert departments within the organisations involved—particularly infrastructure, safety and operations teams—ensuring that key stakeholders were aware of the developments and could provide feedback prior to the demonstration phase.

Also, a meeting in May 2024 was held in Metro of Malaga's Quarters not only to communicate, as also to understand better end-users needs:



In addition, several meetings were held with end users with different disabilities in order to communicate the solution and refine the technical approach throughout the project.

### 7.1.10 Implementation of measures to gather results and KPI measurements

The KPIs/PIs used to measure quality during Validation Event do not involve coding or other implementation activities.

Qualitative KPIs have been defined, which are derived by project staff as well as users' feedback.

For each of the five use cases, expected outcomes have been identified, and the qualitative metric or KPI has generally been defined as:
The tester/user has achieved the expected result:

- Easily
- With difficulty
- Has not achieved it

### 7.1.11 Questionnaire and interviews guides for stakeholders/end-users

For each test, the user is asked the following questions (some may not apply, depending on the use case being evaluated):

- Was it easy to activate the screen reader?
- Was it easy to understand the information on each screen?
- Was it easy to navigate the screens and select options?
- Was it easy to achieve the task without assistance?
- Would you be able to achieve the task on another occasion now that you are familiar with the system?
- Did you use the QWERTY keyboard?
- Did you use the touchscreen?
- Did you use the accessible buttons?
- Did you use the headphone jack?
- Do you find the kiosk/app useful, or is it unnecessary?
- Would you use this kiosk or app if it were available at other stations or airports?
- What improvements would you suggest making the information accessible?

The possible answers are Yes, No or Not applicable (N/A).

Figure XX13 shows the questionnaire used.

**MOTIONAL DEMONSTRATOR EVALUATION FORM**

| Date: | TC nº | | | TC nº | | | TC nº | | | TC nº | | | TC nº | | | TC nº | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | | | | | | | | | | | | | | | | |
| Was it easy to understand the information on each screen? | | | | | | | | | | | | | | | | | | |
| Was it easy to navigate through the screens and select options? | | | | | | | | | | | | | | | | | | |
| Was it easy to achieve the task without help? | | | | | | | | | | | | | | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | | | | | | | | | | | | | | | | | | |
| Did you use the QWERTY keyboard? | | | | | | | | | | | | | | | | | | |
| Did you use the touchscreen? | | | | | | | | | | | | | | | | | | |
| Did you use the accessible buttons? | | | | | | | | | | | | | | | | | | |
| Did you use the headphone socket? | | | | | | | | | | | | | | | | | | |
| Do you find the totem/app useful, or is it unnecessary? | | | | | | | | | | | | | | | | | | |
| Would you use this totem or app if it were available at other stations or airports? | | | | | | | | | | | | | | | | | | |
| What improvements would you suggest to make the information more accessible? | | | | | | | | | | | | | | | | | | |

Figure XX13: Questionnaire used for end-users.

## 7.2 Demo execution phase

### 7.2.1 Software distribution to end users

End-users accessed the Accessible Tool System via the T-Ais totem and the Motional mobile app.

As the aim was to reach TRL 6 (real-world environment with controlled users), the Motional mobile app was not made available on any app store and was installed only on two phones purchased for the demonstrator: one running Android and the other running iOS. These two mobile phones also had the NaviLens app installed, which was required when the user selected guidance using that tool.

These two mobile phones were provided to end-users just as they were about to start their test in the Validation Event, and together with the T-Ais Totem, this was how they accessed the software.

From the Accessible Tool (mobile or totem), they had access to all features, ranging from the ability to scan a QR code to find out on which track the train associated with a ticket was parked, to requesting assistance from a robot or guidance using the guidance tool (NaviLens).

### 7.2.2 End users/outsiders training

The main purpose of this Demonstrator is to enable people with disabilities to move around independently in the railway environment. To this end, it is essential that both, the software (Accessible Tool), and the hardware (T-Ais totem), are accessible (comply with accessibility standards and recommendations), and the best way to test whether the mobile app and the content of the T-Ais totem are accessible is not to provide instructions or training to users/volunteers, so as to check whether they are able to complete the challenges set for them without assistance, independently.

Consequently, no specific training was provided to the volunteers, nor were they given any prior information; they were simply presented with the challenge (to obtain specific information, to go to a specific location in the station by following the assistance robot, or by using NaviLens, etc.), and in this way it was possible to assess whether the project's tools were genuinely providing them with true autonomy.

However, a Preparatory session was held on 24 April 2025, which was attended by staff from the official associations that had provided volunteers, as well as staff from the station (Adif and Renfe) and the shopping centre involved (Vialia). This session did not focus on the volunteers, but rather on coordinating the event in a complex setting such as Málaga's María Zambrano station, which handles 30,000 passengers a day, as well as explaining to the organisations providing the volunteers the nature of the project and the kind of challenges the volunteers would face.

At this meeting, representatives from associations for people with disabilities, made it clear that it was absolutely essential to hire sign language interpreters for the tests involving people with hearing impairments.

This session is explained in previous section 7.1.6 of this document.

### 7.2.3 Data collection for real-time demonstrations

In this demonstrator, the main data required has been:

- Points or locations of interest within the station.
  These points (station entrance gates, platform access points, customer service points, cafés, toilets, etc.), were entered into the system (Accessible Tool) by the users themselves.
  In challenges where users asked for a robot to take them from one point in the station to another, the user would enter their current location (so that the robot could come and collect them in real time) and the destination to which they wanted the robot to take them.
  Similarly, when users used NaviLens to move from one place to another, they indicated (on the T-Ais kiosk or in the mobile app) where they wanted to go (specify a location in real time).

- Information contained in the QR code on a train ticket.
  The system (Accessible Tool), displays the train's departure platform in real time based on the information contained in the ticket's QR code. This is made possible by the exchange of information via an API between Accessible Tool and Adif's Elcano system (the rail traffic information system).
  The problem here was that Adif's Elcano System only provides train information from approximately one hour before the train departs, and since it was impossible to obtain a real ticket for each test, an old ticket (from another day) was used for the Validation Event, and the response from the *Accessible Tool* system was forced to provide a train departure time consistent with the time at which the test was carried out (the time at which the system detects that it has read a QR code from the ticket), and similarly, the *Accessible Tool* system assigns a pre-set train platform for that old ticket.

- The data on train timetables, departure and arrival platforms, etc., provided by Elcano, was processed in real time via API.

- The data on Metro frequency were collected from Metro Málaga systems in real time.

In addition, during demonstration, the data that has been collected is the graphic material (photos and videos) that will be used for internal analysis and public dissemination and the end-users and staff feedback.

### 7.2.4 Validation Event

The aim of the demonstrator is for train passengers, specifically users with different types of

disabilities, using the T-Ais Totem and the Motional mobile application developed in the project, being able to autonomously perform five different challenges in a real-life situation at a railway station.

The target disability profiles included in the demonstrator were:

- Visual impairment
- Hearing impairment
- PRM (wheelchair users).
- Cognitive impairment
- Motor disability (people without fingers and without the ability to press small buttons).

The challenges/objectives were:

1. Obtain information (about train schedules, delays, cancellations, etc., and about Underground frequency).
2. Find out which track his train is parked on by scanning their ticket.
3. Follow the accessible route to a station location accompanied by an assistance robot.
4. Follow the accessible route to a station location using a mobile guidance system (NaviLens).
5. Find out the accessible route to a specific point in the station using the map provided by *Accessible Tool*.

Challenges 3, 4 and 5 were duplicated as there was a desire to distinguish between routes to the platforms, and routes to other facilities available at the station (toilets, café, ticket office, etc.), consequently, a total of eight objectives or challenges were identified.

Each challenge must be completed via the T-Ais Totem and the Motional mobile app, so for each type of disability at least two volunteers took part, one volunteer using the T-Ais Totem, and the other using the Motional mobile app. Two sign language interpreters were hired for the tests involving people with hearing impairments.

Therefore, all the use cases to be validated (challenges) are defined as a combination of the objectives to be achieved by people with each type of disability, using both the totem and the mobile app. A test case (TC) was defined for each use case. A total of 50 test cases were planned and carried out. (Figure XX12).

The structure of each Test Case is described in the section 7.1.8. Each of the 50 test cases has been defined and is attached as APPENDIX 1. TEST CASES ACCESSIBLE TOOL.

The Validation Event consisted of controlled user sessions conducted in the real station environment (target TRL 6), at Málaga María Zambrano railway station. The demonstration took place on 15, 16 and 17 July 2025.

Each day comprised one or two sessions (morning and afternoon). Each session focused on a single disability profile, with at least two volunteers participating: at least one using the T-Ais Totem and one using the Motional mobile application.

The general timeline for the event was:

| Day | 15 July | | 16 July | | 17 July | |
|---|---|---|---|---|---|---|
| Session | Morning | Afternoon | Morning | Afternoon | Morning | Afternoon |
| Disability/ Volunteer 1 | Visual/ Totem | Hearing/ Totem | PMR/ Totem | Motor/ Totem | Cognitive/ Totem | Free |
| Disability/ Volunteer 2 | Visual/ Mobile | Hearing/ Mobile | PMR/ Mobile | Motor/ Mobile | Cognitive/ Mobile | Free |

On 16 July (marked in red), there was an issue on the part of Agrupación de Desarrollo Málaga Accesible association, and the tests could not be carried out. However, the tests carried out on 25 June for people with PMR and mobility disabilities remain fully valid, and for this reason, they have been included as validation results.

Tests were performed during normal station opening hours, with station staff supporting safe access and ensuring operations.

### 7.2.5 Data collection for outcome and Performance indicator (PI) measurements

Each Test Case consists of two parts. The first part is the guide to running the test; it describes the Use Case to be performed, sets out the objective to be achieved, the necessary preconditions, the input data, the expected results, and the sequence of actions the user must follow without receiving any instructions, (See the first page of each Test Case in Appendix 2).

The second part, referred to as Test Execution ("Ejecución del test" in Spanish), specifies the location where the test was carried out, the timestamp, the name of the tester and their company, the characteristics of the user/volunteer performing the test, and the result. (See the second page of each Test Case in Appendix 1).

This second part constitutes the outcome that enables performance to be assessed.

The results obtained are attached in Appendix 1.

### 7.2.6 End-user interviews

The form used to conduct the user interviews is shown in Figure XX13 in section 7.1.11.

Feedback received from end-users participating on the demonstration:

**MOTIONAL DEMONSTRATOR EVALUATION FORM. VISUAL-TOTEM**

| **Date:** 15/07/2025 | **TC nº** VT01 | | | **TC nº** VT02 | | | **TC nº** VT03 | | | **TC nº** VT04 | | | **TC nº** VT06 | | | **TC nº** VT07 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | 2 | | | 1 | 1 | | 2 | | | 2 | | | 2 | | | 2 | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Was it easy to navigate through the screens and select options? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Was it easy to achieve the task without help? | 2 | | | 1 | 1 | | 2 | | | 2 | | | 2 | | | 2 | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | 1 | 1 | | 2 | | | 2 | | | 2 | | | 2 | | |
| Did you use the QWERTY keyboard? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | |
| Did you use the touchscreen? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | |
| Did you use the accessible buttons? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Did you use the headphone socket? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | 1 | 1 | | 2 | | | 1 | 1 | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | 1 | 1 | | 2 | | | 1 | 1 | |
| What improvements would you suggest to make the information more accessible? | * | | | * | | | * | | | * | | | * | | | * | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**

VT01*:

- Accessible buttons would be easier to identify if they were raised.
- It is sometimes difficult to reach the 'Home' button.
- To help locate the totem, it should have an audible signal similar to that of traffic lights, activated by pressing a remote control.
- The loudspeaker should be centred rather than positioned at the sides so that the sound reaches the user more effectively.
- When the screen reader is activated, there are confusing messages regarding the use of the touchscreen and the accessible buttons.

VT02*:

- The location of the QR code reader on the totem should be indicated in Braille.
- The user is used to carrying their ticket on their mobile phone or as a paper ticket, so they did not know where the QR code was on the format provided during the test (A4 sheet) and were unable to scan it (they are blind and cannot see the code).
- Scanning the QR code on the ticket is not straightforward, depending on the distance at which the ticket is held.

VT03* y VT06*:

- The loudspeaker should be centred rather than positioned at the sides so that the sound reaches the user more clearly.
- It would be better if the robot could also move whilst holding it with just one hand.

VT04* y VT07*:

- Having to scan Navilens codes with a mobile phone is a problem for blind people travelling with luggage, as they carry their suitcase in one hand and their white cane or guide dog in the other, and it is not easy to scan the codes with a mobile phone when both hands are full. It would be ideal to integrate the app into smart glasses so that they could read the Navilens codes; this would solve the problem.
- Nor do they consider it safe to carry a mobile phone so exposed in their hand, as it could easily be stolen.

Figure XX14: Interviews with visually impaired users. Interface: Totem.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. VISUAL-MOBILE**

| **Date:** 15/07/2025 | **TC nº** VM01 | | | **TC nº** VM02 | | | **TC nº** VM03 | | | **TC nº** VM04 | | | **TC nº** VM06 | | | **TC nº** VM07 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Was it easy to navigate through the screens and select options? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Was it easy to achieve the task without help? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Did you use the QWERTY keyboard? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 |
| Did you use the touchscreen? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 |
| Did you use the accessible buttons? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 |
| Did you use the headphone socket? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | |
| What improvements would you suggest to make the information more accessible? | * | | | * | | | * | | | * | | | * | | | * | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**

VM04* y VM07*:

- Very useful if you're not carrying any luggage, for everyday travel on the local commuter rail network or day trips. However, having to scan the Navilens codes with a mobile phone is a problem for blind people travelling with luggage, as they carry their suitcase in one hand and their white cane or guide dog in the other; it is not easy to scan the codes with a mobile phone when both hands are full. It would be ideal to integrate the app into smart glasses so that they could scan the Navilens codes, which would solve the problem.

Figure XX15: Interviews with visually impaired users. Interface: Mobile phone.

**Comments/Improvements:**

AT01*:

- Deaf people often cannot read, so it is essential to include videos with a sign language interpreter on every screen so that they can understand the content.
- Using colours to distinguish Metro lines (although this is not suitable for people who are blind or colour-blind, it is not good practice in terms of accessibility).
- Difficulty in understanding the difference between High-Speed and Medium-Distance services. Include appropriate pictograms.
- The 'Navigate the station' button is not easily understood; include a 'Services' pictogram or similar.
- The 'Check ticket details' button is not understood; 'Read ticket' would be better.
- Under 'Accessible route to the platforms', replace the wheelchair pictogram with the disability symbol.
- Users find the 'Departures' and 'Arrivals' options confusing; a pictogram should be included.
- The word 'Interval' is not in their vocabulary; 'Waiting time' would be better.

AT02*:

- They do not usually travel by train and are unfamiliar with railway terminology; nor do they use QR codes.
- The sentence explaining how to position the ticket on the QR reader is very long and they do not understand it. They suggest including the distance in the illustration.
- There are three QR codes on the ticket; they do not know which one to scan.
- The information displayed after scanning the QR code contains too much text; they find it difficult to locate the information they are looking for.
- Include pictograms for 'Origin' and 'Destination', as they do not understand the text well.
- The text 'Not available' – used when certain information is not yet available – is not easily understood. It is suggested that an hourglass, a question mark or similar symbol be included.
- Add pictograms to the home screen to better convey what is contained within.

AT03*:

- Include a pictogram showing a person with a disability and a robot.
- There is generally too much text, which makes it difficult to understand, and there are several words or phrases that are not easy for people with hearing impairments to understand; the following changes are proposed:
    - They do not fully understand "Solicitar"; "Pedir" would be better.
    - Replace "Agarraré" with "Me cogeré"
    - Replace "Comenzar acompañamiento" with "Empezar" and add a pictogram
    - Replace "Iniciar" with "Empezar"



    - "Localizar" should have a pictogram of a flag or a flag with a light.
    - The robot is not adapted for people with hearing impairments; it should display everything it says on its screen and ideally include videos with sign language interpreters.
    - The text that appears on the robot's screen is very complex.

AT07*:

- The mobile phone guidance system, after selecting the destination on the totem, is found to be very useful for unfamiliar locations.
- Very positive feedback.

AT08*:

- The text on the map is very long and complex, and there are several words or phrases that are not easy for people with hearing impairments to understand; they suggest the following changes:
    - Where it says 'Metro connection', it would be better to say simply 'Metro'.
    - The labelling for 'Toilets' and 'Vialia Toilets' is confusing; replace with a toilet symbol and use a pictogram to indicate if any are pay-to-use.
    - Include a pictogram of the information totem to help users find their way around the map.
    - Include a money pictogram or a drawing of a cash machine to represent it.
    - The map is too complex; there are too many lines, and the colour green is associated with grass or a garden. Include landmarks (bars, Mercadona, etc.).
    - The staircase symbol is not understood.
    - Display the street name on the outside of the doors.
    - Incorporate the colour orange for Adif Acerca.

Figure XX16: Interviews with users with hearing impairments. Interface: Totem.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. LISTENING-MOBILE**

| **Date:** 15/07/2025 | **TC nº** AM01 | | | **TC nº** AM02 | | | **TC nº** AM04 | | | **TC nº** AM05 | | | **TC nº** AM06 | | | **TC nº** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | |
| Was it easy to understand the information on each screen? | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | | | |
| Was it easy to navigate through the screens and select options? | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | | | |
| Was it easy to achieve the task without help? | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | | | |
| Did you use the QWERTY keyboard? | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | |
| Did you use the touchscreen? | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | |
| Did you use the accessible buttons? | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | |
| Did you use the headphone socket? | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | |
| Do you find the totem/app useful, or is it unnecessary? | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | | | |
| Would you use this totem or app if it were available at other stations or airports? | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | | | |
| What improvements would you suggest making the information more accessible? | * | | | * | | | * | | | * | | | * | | | | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**

AM01*:

- Deaf people often cannot read, so it is essential to include videos with a sign language interpreter on every screen so that they can understand the content.
- This volunteer can read and is quite adept at using her mobile phone and the app.

AM05*:

- This volunteer is very good at reading maps and finds her way around very easily when viewing the route marked by the app on the map.

Figure XX17: Interviews with users with hearing impairments. Interface: Mobile phone.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. COGNITIVA-TOTEM**

| **Date:** 17/07/2025 | **TC nº** CT01 | | | **TC nº** CT02 | | | **TC nº** CT03 | | | **TC nº** CT07 | | | **TC nº** | | | **TC nº** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | 2 | | | 2 | | | 2 | | | 2 | | | | | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Was it easy to navigate through the screens and select options? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Was it easy to achieve the task without help? | 2 | | | 1 | 1 | | 1 | 1 | | 2 | | | | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Did you use the QWERTY keyboard? | | 2 | | | 2 | | | 2 | | | 2 | | | | | | | |
| Did you use the touchscreen? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Did you use the accessible buttons? | | 2 | | | 2 | | | 2 | | | 2 | | | | | | | |
| Did you use the headphone socket? | | 2 | | | 2 | | | 2 | | | 2 | | | | | | | |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| What improvements would you suggest to make the information more accessible? | * | | | * | | | * | | | * | | | | | | | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**

CT02*:

- There are too many QR codes on the A4 paper ticket; as one user was unfamiliar with this type of ticket, they did not know which one to scan and kept trying different ones until they found the information.

CT03*:

- When requesting the robot via the totem and a message appears saying “Please wait until it arrives”, one user did not understand the message and was unsure what to do; they had to be told to wait for the robot to arrive.

CT07*:

- When the map appears on the totem screen showing the accessible route, one user does not understand it properly.

Figure XX18: Interviews with users with cognitive impairments. Interface: Totem.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. COGNITIVE-MOBILE**

| **Date:** 17/07/2025 | **TC nº** CM01 | | | **TC nº** CM02 | | | **TC nº** CM04 | | | **TC nº** CM06 | | | **TC nº** | | | **TC nº** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | 2 | | | 2 | | | 2 | | | 2 | | | | | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Was it easy to navigate through the screens and select options? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Was it easy to achieve the task without help? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Did you use the QWERTY keyboard? | | | 2 | | | 2 | | | 2 | | | 2 | | | | | | |
| Did you use the touchscreen? | | | 2 | | | 2 | | | 2 | | | 2 | | | | | | |
| Did you use the accessible buttons? | | | 2 | | | 2 | | | 2 | | | 2 | | | | | | |
| Did you use the headphone socket? | | | 2 | | | 2 | | | 2 | | | 2 | | | | | | |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | 2 | | | | | | | | |
| What improvements would you suggest to make the information more accessible? | * | | | * | | | * | | | * | | | | | | | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**
Volunteers (Marina and Mª José), who have a mild disability and are comfortable using their mobile phones and the app in general
CM02*:

- They suggest that, after checking departure times and the platform number where the train will arrive, a 'How to get there' button should be added so that users can request the robot or Navilens directly from there.

Figure XX19: Interviews with users with cognitive impairments. Interface: Mobile phone.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. PMR-TOTEM**

| **Date:** 25/06/2025 | **TC nº** PT01 | | | **TC nº** PT02 | | | **TC nº** PT04 | | | **TC nº** PT05 | | | **TC nº** PT06 | | | **TC nº** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Was it easy to navigate through the screens and select options? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Was it easy to achieve the task without help? | 2 | | | 1 | 1 | | 2 | | | 2 | | | 2 | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Did you use the QWERTY keyboard? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | |
| Did you use the touchscreen? | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 | | | | |
| Did you use the accessible buttons? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Did you use the headphone socket? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| What improvements would you suggest to make the information more accessible? | * | | | * | | | | | | * | | | | | | | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**

PT01*:
- The totem's design is not optimised; the keyboard cannot be seen from a wheelchair and the touchscreen is positioned too high; the accessible buttons are used.
- When the screen reader is activated, the system becomes sluggish; switching between screens is slow, as is the response to each keystroke.

PT02*:
- The position of the QR code scanner is not convenient for people in wheelchairs with limited mobility, as they may not be able to see it because it is slightly too high; consequently, even though they know where it is because the totem's screen indicates its location, they find it difficult to scan the code.

PT05*:
- They can easily access the map showing the route, but find it difficult to interpret it (the aim was simply to display the map with the route; interpreting maps depends on the individual and is not straightforward in complex environments).

PT06*:
- Lifting a suitcase onto the robot can be difficult or even impossible for a person in a wheelchair, depending on the degree of disability.

Figure XX20: Interviews with PMR users. Interface: Totem.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. PMR-MOBILE**

| **Date:** 25/06/2025 | **TC nº** PM01 | | | **TC nº** PM02 | | | **TC nº** PM03 | | | **TC nº** PM07 | | | **TC nº** PM08 | | | **TC nº** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Was it easy to navigate through the screens and select options? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Was it easy to achieve the task without help? | 2 | | | 1 | 1 | | 2 | | | 2 | | | 2 | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Did you use the QWERTY keyboard? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Did you use the touchscreen? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Did you use the accessible buttons? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Did you use the headphone socket? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| What improvements would you suggest to make the information more accessible? | | | | * | | | | | | | | | * | | | | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

FP1 MOTIONAL
Europe's Rail

**Comments/Improvements:**

PM02*:

- One of the users was not familiar with scanning QR codes on a mobile phone and so found it a little more difficult the first time.

PM08*:

- They easily obtained the map showing the route, but found it difficult to interpret (the aim was simply to display the map with the route; interpreting maps depends on the individual and is not straightforward in complex environments).

Figure XX17: Interviews with PMR users. Interface: Mobile phone.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. DRIVE-TOTEM**

| **Date:** 25/06/2025 | **TC nº** MT01 | | | **TC nº** MT02 | | | **TC nº** MT04 | | | **TC nº** MT05 | | | **TC nº** MT06 | | | **TC nº** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Was it easy to navigate through the screens and select options? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | |
| Was it easy to achieve the task without help? | | 2 | | | 2 | | | 2 | | | 2 | | 2 | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Did you use the QWERTY keyboard? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | |
| Did you use the touchscreen? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | |
| Did you use the accessible buttons? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Did you use the headphone socket? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | | 2 | | 2 | | | | | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | | 2 | | 2 | | | | | |
| What improvements would you suggest to make the information more accessible? | * | | | * | | | * | | | * | | | * | | | | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**

MT01*:

- Both volunteers have a severe motor disability affecting their hands and arms, so they choose to use the accessible buttons; however, as they also have a significant cognitive disability, they find it difficult to understand the purpose of each of the three buttons, and do not find it easy to select options or navigate from one screen to another. This applies generally to the various challenges we set them.

MT02*:

- Although the volunteers state that they could achieve the objective on another occasion once they are familiar with the system (as reflected in the survey), in view of their severe motor impairment and the resulting difficulty they have in positioning the ticket correctly in the QR code reader, the evaluator (tester) believes they would not be able to do so.

MT04*:

- Due to their mobility impairment, they find it difficult to hold their mobile phone securely, to avoid pressing any buttons accidentally, and, in general, to complete the challenge as it involves scanning Navilens codes with their mobile phone. However, both say that they found it very easy to reach the location, bearing in mind that they did not know where it was; they therefore found the project's mobile guidance system very useful and straightforward to use (an improved version of Navilens, as Accessible Tool sends the destination from the totem to the Navilens app, and the app indicates for each code whether to go straight ahead, turn left or turn right, and they found this very useful and straightforward).

MT05*:

- As these volunteers, in addition to a mobility impairment, also have a significant cognitive impairment, although they managed (with difficulty) to reach the point where the totem displays the map with the accessible route, it is of no use to them because they are unable to interpret it or use it to find their way. For this reason, they do not find it useful and would not use this feature at another station.

MT06*:

- Apart from the difficulty these volunteers have in understanding how the totem's three buttons work, after spending some time using the totem during the previous tests, they have become more independent in requesting the robot, and they have found the robot-assisted guidance system very useful, as well as quite straightforward to follow in order to reach their chosen destination.

Figure XX21: Interviews with motor disability. Interface: Totem.

**MOTIONAL DEMONSTRATOR EVALUATION FORM. DRIVE-MOBILE**

| **Date:** 25/06/2025 | **TC nº** MM01 | | | **TC nº** MM02 | | | **TC nº** MM03 | | | **TC nº** MM07 | | | **TC nº** MM08 | | | **TC nº** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questions** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** | **Yes** | **No** | **N/A** |
| Was it easy to activate the screen reader? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Was it easy to understand the information on each screen? | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | | |
| Was it easy to navigate through the screens and select options? | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | | |
| Was it easy to achieve the task without help? | | 2 | | | 2 | | 2 | | | | 2 | | 2 | | | | | |
| Would you be able to achieve the task another time, now that you are familiar with the system? | 2 | | | | 2 | | 2 | | | 2 | | | 2 | | | | | |
| Did you use the QWERTY keyboard? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Did you use the touchscreen? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Did you use the accessible buttons? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Did you use the headphone socket? | | | 2 | | | 2 | | | 2 | | | 2 | | | 2 | | | |
| Do you find the totem/app useful, or is it unnecessary? | 2 | | | 2 | | | 2 | | | 2 | | | | 2 | | | | |
| Would you use this totem or app if it were available at other stations or airports? | 2 | | | 2 | | | 2 | | | 2 | | | | 2 | | | | |
| What improvements would you suggest to make the information more accessible? | * | | | * | | | * | | | * | | | * | | | | | |

1: This answer was given by one volunteer.
2: This answer was given by two volunteers.

**Comments/Improvements:**

MM01*:

- Both volunteers have severe motor impairments in their hands and arms, as well as significant cognitive impairments; they find it difficult to understand what is being asked of them, and their accuracy when tapping options on the mobile phone is poor – they sometimes tap the wrong option – but they manage to achieve the objectives once they have understood the task or challenge. This applies generally to the various challenges we set them.
- Although the volunteers state that they could achieve the objective on another occasion once they are familiar with the system (as reflected in the survey), in view of the severe motor impairment they have and the consequent difficulty they face in selecting options on the mobile phone, the evaluator (tester) believes they would not be able to do so. This applies generally to the various challenges set for these volunteers using the mobile phone.

MM02*:

- Due to the significant motor impairment mentioned above, it is difficult for the volunteers to handle the train ticket and the mobile phone with their hands in order to scan the QR code.

MM03*:

- Despite the difficulties in operating a mobile phone, as the volunteers became more familiar with the project's app, they found it easier and were able to request the robot. From then on, the robot's assistance in guiding them through the station proved very useful and straightforward; they seemed genuinely enthusiastic about the solution.

MM07*:

- As with the robot use case, despite the difficulties involved in operating a mobile phone – and particularly in correctly pointing the phone at the Navilens codes – they were able to carry out the use case and scan the Navilens codes to reach their set destination, and they were very enthusiastic about the guidance system developed as part of the project.

MM08*:

- As these volunteers have a significant cognitive disability in addition to a physical disability, although they managed (with difficulty) to get to the point where the mobile phone displayed the map showing the accessible route, it was of no use to them because they were unable to interpret it or use it to find their way around. For this reason, they do not find it useful and would not use this feature at another station.

Figure XX22: Interviews with motor disability. Interface: Mobile phone.

## 7.2.7 Demonstration event summary

The Validation Event took place on 15, 16 and 17 July 2025; however, on 16 July there was a problem with the Agrupación de Desarrollo Málaga Accesible organisation, and it was not

possible to carry out the tests on people with physical disabilities and people with reduced mobility (PRM). Instead, the tests carried out on 25 June 2025 with these two groups were used, which were exactly the same as those planned for 16 July.

In total, the Accesible Tool system was tested with around 15 people from three different associations, with a minimum of two people for each type of disability, although some tests were carried out with up to five people with the same disability, even though this was not reflected in the final interviews because questionnaires were only completed for two people per disability.

The plan was to carry out at least 50 tests, but as most of the volunteers took the tests both on the kiosk and on the mobile phone, a total of 90 evaluated tests were ultimately carried out.

Furthermore, as the validation event and the tests carried out the previous month took place in a real-world setting (María Zambrano station in Málaga), several genuine train passengers who were not involved in the project—and who had some form of disability—noticed that we were conducting tests with people with disabilities, they asked if they could try out the system, and, under the supervision of the project staff, they were allowed to do so and also provided us with some interesting feedback.

The testing plan for the Validation Event comprised 50 challenges for different types of users, and for each challenge, the aim was for them to complete it entirely independently, without receiving any help or guidance from the project staff. The results were as follows:

| | DISABILITY | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visual | | Auditory | | PMR | | Cognitive | | Motor | | |
| OBJECTIVE | Totem | Mobile | Totem | Mobile | Totem | Mobile | Totem | Mobile | Totem | Mobile | |
| 1. Get train information | 2✓ | 2✓ | 1✓ | 1✓ | 2✓ | 2✓ | 2✓ | 2✓ | 2≈ | 2≈ | 14✓+4≈ |
| 2. Get ticket details | 1✓+1X | 2✓ | 1≈ | 1✓ | 1✓+1≈ | 1✓+1≈ | 2✓ | 2✓ | 2X | 2X | 10✓+3≈+5X |
| 3. Reaching platforms with an assistive robot | 2✓ | 2✓ | 1✓ | | | 2✓ | 2✓ | | | 2✓ | 11✓ |
| 4. Reaching platforms with Navilens | 2✓ | 2✓ | | 1✓ | 2✓ | | | 2✓ | 2≈ | | 9✓+2≈ |
| 5. Reaching platforms with a map | | | | 1✓ | 2✓ | | | | 2≈ | | 3✓+2≈ |
| 6. Reaching services with an assistive robot | 2✓ | 2✓ | | 1✓ | 2✓ | | | 2✓ | 2✓ | | 11✓ |
| 7. Reaching services with Navilens | 2✓ | 2✓ | 1✓ | | | 2✓ | 2✓ | | | 2≈ | 9✓+2≈ |
| 8. Reaching services with a map | | | 1≈ | | | 2✓ | | | | 2≈ | 2✓+3≈ |
| | 11✓+1X | 12✓ | 3✓+2≈ | 5✓ | 9✓+1≈ | 9✓+1≈ | 8✓ | 8✓ | 2✓+6≈+2X | 2✓+6≈+2X | 90 |

Tests Results: Test passed **(85)** = ✓ and ≈
✓ = Test passed easily **(69)**
≈ = Test passed with difficulty **(16)**
X = Test no passed **(5)**

Figure XX23: Summary of test results.

As can be seen, out of 90 tests, the objective was achieved in 85 of them; of these, 16 were achieved with some difficulty (≈ symbol), whilst in the remaining 69 tests (✓ symbol), the objective was achieved with relative ease.

The objective was not achieved in just 5 tests (**X** symbol).

## 7.3 Demo evaluation phase

### 7.3.1 Dissemination Event

The demonstration results have been disseminated through a combination of targeted events and multimedia materials, with a strong focus on maximising impact, stakeholder engagement, and visibility at both operational and institutional levels.

- A key dissemination milestone was the event "Seamless and Inclusive Mobility (Event 2)", held on 7 May in Madrid. The event brought together a broad and diverse group of stakeholders from different countries, including transport operators, infrastructure managers and innovation experts. More than 80 participants attended in person and 35 joined remotely, with additional unregistered attendees, reflecting a high level of interest and engagement.
    - https://www.linkedin.com/posts/metro-de-m%C3%A1laga_fp1motional-euabrrail-railinnovation-activity-7458529935553593345-8aKi/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/adif_fp1motional-euabrrail-railinnovation-activity-7458215368789196802-0YPW?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/implaser99_encaminamiento-podotaerctil-ugcPost-7459510666014519298-2DMm/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/renfe_fp1motional-euabrrail-railinnovation-activity-7458445783953227776-aUlY/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
- Links to the project on the Ineco website:
    - https://www.ineco.com/ineco/comunicacion/noticias/adif-renfe-e-ineco-instalan-un-innovador-punto-de-ayuda-accesible-para
    - https://www.ineco.com/ineco/comunicacion/noticias/ineco-protagonista-en-la-semana-europea-de-la-movilidad-2025
    - https://www.ineco.com/ineco/comunicacion/noticias/transportes-prueba-un-sistema-de-proyeccion-luminosa-para-mejorar-la
- Further details, supporting materials and dissemination outputs are available through the following links:
    - https://forbes.es/economia/744045/adif-renfe-e-ineco-instalan-un-punto-de-ayuda-para-facilitar-la-movilidad-de-personas-con-discapacidad/
    - https://www.linkedin.com/posts/NaviLens_rail-travel-is-becoming-more-inclusive-in-ugcPost-7354150546913554433-

gVEQ?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE

- https://www.linkedin.com/feed/update/urn:li:activity:7352611982576865281/
- https://www.linkedin.com/feed/update/urn:li:activity:7349346782046269441/
- https://www.linkedin.com/feed/update/urn:li:activity:7342151835278802944/
- https://www.elplural.com/economia/empresas/renfe-aumenta-apuesta-garantizar-accesibilidad-aquellos-viajeros-padezcan-alguna-discapacidad_366516102

### 7.3.2 TRL validation

The TRL achieved matches the expected TRL, TRL 6.

As explained in detail in this document, the Validation Event, and even the preliminary tests, were carried out in a real-world environment (María Zambrano station in Málaga), with controlled users (volunteers provided by various associations for people with disabilities).

There is ample evidence, such as videos and photographs, and the event was even covered by national television channels, radio stations and local newspapers.

Furthermore, feedback received from end users is provided in section 7.2.6 and in APPENDIX 1. TEST CASES ACCESSIBLE TOOL.

### 7.3.3 Analyse feedback from stakeholders

The response to Accessible Tool from people with disabilities, as well as from the staff of the organisations to which they belong, has been excellent.
The solution comprising a totem + mobile app integrated with an assistive robot and a mobile guidance system such as NaviLens, has been a resounding success, and they have expressed a desire for it to be rolled out across all stations, airports, shopping centres, etc.

Analysing the data shown in Figure XX23, we draw the following conclusions:

**Analysis by type of disability:**

- It has been highly accessible for people with visual, hearing*, PRM and cognitive** disabilities, as they were able to complete the tasks independently without needing assistance in 67 out of 72 challenges. They achieved the objective, albeit with some difficulty, in 4 challenges, and there was only one challenge they were unable to complete independently.
  (*) The results for people with hearing impairments have been positive; however, as we were told during the testing and validation sessions, they are misleading. The deaf volunteers who carried out the tests were able to read, but they have told us that this is not common among deaf people; therefore, to ensure that Accessible Tool is accessible

to deaf people, it is essential that every screen displayed on the kiosk or in the mobile app includes a link to a video featuring a sign language interpreter who explains the content and options on that screen.
(**) The volunteers who took the tests for cognitive disability had a low degree of disability. The results would likely have been worse for people with a more severe disability.

- People with severe physical disabilities, who also had intellectual disabilities, achieved the objectives in 16 of the 20 challenges set, although they managed to do so with ease in only 4 challenges, and found it quite difficult to achieve in 12 challenges. Conversely, they were unable to achieve the objectives in 4 challenges.
  Nevertheless, they are perhaps the group that has benefited most, as their highly limiting disabilities mean they are very dependent on others, and Accessible Tool has proved to be a very effective solution for them.
  The solution is considered to have been very effective for this group despite the fact that they encountered such difficulty, because it must be borne in mind that they were completely unfamiliar with the solution; the aim was to test it without providing them with training in order to assess to what extent it was 'user-friendly' and 'accessible'. However, as they carried out tests, their skills with both the kiosk and the mobile app improved, suggesting that if the system were widely implemented at other transport hubs, shopping centres, and major public and private infrastructure sites, they would quickly become familiar with it and these individuals would gain a great deal of independence through this solution.

  To conclude the analysis by type of disability, Accessible Tool has been very well received, but it has a significant shortcoming: in order to make it accessible to deaf people**, it is necessary to include the content of each screen in the system** (both on the Totem T-Ais and in the mobile app), **along with videos featuring a sign language interpreter who explains the content and options on that screen**.

**Analysis by interface type:**

- Totem T-Ais: Overall, the response to the totem has been very good, with 42 out of 45 tasks successfully completed; of these 42, 33 were completed easily and 9 with some difficulty. Three of the 45 tasks were not completed.
  Its main advantages are:
  - It has a very large screen, making it very easy to read.
  - It offers many ways to interact with it, so that people with all kinds of disabilities can access the information and other services offered by Accessible Tool, notably the accessible buttons (very large buttons), which allow people with fine motor skills difficulties—who find it much harder to use a mobile phone—to interact with the device. Another key feature is the functionality whereby the screen

content is read aloud when the screen reader is activated, allowing blind people to hear the content through the speakers or headphones, as well as those who wear hearing aids, as it features a magnetic induction loop.

- It is easy to spot due to its size and eye-catching design. One way to improve accessibility for blind people would be to incorporate a remote-controlled audible signal system (similar to those currently being installed at traffic lights).
- It is very easy to reach any location within the station independently, either accompanied by the robot that comes to the totem to collect the user on request, or via NaviLens and the tactile paving routes that start from the totem itself.

The following areas for improvement have been identified regarding the kiosk:

- The position of the QR code scanner needs to be improved; it is not convenient for people in wheelchairs with limited mobility, as they may not be able to see it because it is positioned slightly too high, making it difficult for them to scan the code. It would be better to position it more directly in front of the user.
- Incorporate Braille signage to indicate the location of the QR code reader.
- Optimise the design of the kiosk. The keyboard is not clearly visible from a wheelchair, and the touchscreen is positioned too high.
- Remove the QWERTY keyboard, as no user has used it.

- Mobile phone: This has also been very well received, with 43 out of 45 challenges successfully completed; of these 43, 36 were completed easily and 7 with some difficulty. Two of the 45 challenges were not completed.

  Its main advantages are:

  - Users are very familiar with using mobile phones, which makes it easier for them to interact with the Motional mobile app, which provides access to the project's information and services. For example, blind people naturally activate the text-to-speech function in the app, or easily scan the QR code, as these are standard mobile phone functions they use frequently. These actions on the totem have to be learnt.
  - People with reduced mobility do not face the problem of the height of some elements of the totem.
  - The mobile app gives travellers greater independence because they do not need to go to a physical location such as the totem; they have all the information and services on their mobile, right in their hand.

  The following drawbacks of mobile phones have been identified:

- It is not a suitable solution for people with physical disabilities, those who are missing fingers or cannot handle small objects, or those who lack the dexterity to tap a button on a mobile screen.
- The screen is too small for people with low vision.
- People with cognitive or hearing impairments, who require pictograms to understand the content, prefer the kiosk because the screen is much larger and can display more and larger pictograms.

In conclusion, based on the analysis of Totem T-Ais versus mobile, depending on the type of disability, one device is better suited to the user than the other; therefore, it is ideal to have both, as this allows for greater independence.

**Analysis by type of objective:**

- Obtaining train information: User feedback has been very positive, with 18 out of 18 tasks successfully completed, 14 of them with ease and 4 with some difficulty. Accessible Tool proved to be quite accessible in providing the information; only people with significant motor and cognitive disabilities had difficulty obtaining the information.
- Obtaining ticket information: This was by far the objective that presented the greatest difficulty for users; out of 18 tests, the objective was achieved on 13 occasions, of which 10 were completed with ease and 3 with difficulty. The task was not completed in 5 of the 18 tests. It should be noted once again that no prior training was provided to the users; therefore, the concept of searching for "something" on the Totem T-Ais to find out which platform their train was on was not at all straightforward at first, as they did not know what to look for. Once they were familiar with the system and knew they could scan the ticket, everything became easier.
- Getting around the station: The Accessible Tool system has proved highly effective in enabling users with disabilities to move around the station independently, whether by following the robot (all challenges completed easily, 22 out of 22) or using NaviLens (22 out of 22 completed, of which 18 were completed easily and 4 with difficulty). NaviLens has also impressed users with its ease of use. Only people whose disability prevents them from holding their mobile phone securely have had problems with NaviLens when scanning the codes on the floor, but despite this, these people have found it extremely useful.

  As for using the accessible route shown on the map via the totem or mobile phone, it is not useful for blind people because they cannot see it, and most users find it difficult to find their way around using a map in large buildings; it gives them an idea of where to start the route, but if the route is very long, it is not easy to memorise all the directions on the map.

### 7.3.4 Evaluation of outcomes and Performance indicators (PI)

No KPIs or PIs had been set for this demonstrator; however, based on the tests carried out at the Validation Event, the following ratios can be reported:

**Total tests: 90**

| | |
|---|---|
| Tests passed easily (a): | 69 tests ➔ 77% |
| Tests passed with difficulty (b): | 16 tests ➔ 18% |
| Test passed (a+b): | 85 tests ➔ 94% |
| Tests failed: | 5 tests ➔ 6% |

**Total tests with people with visual impairments: 24**

| | |
|---|---|
| Tests passed easily (a): | 23 tests ➔ 96% |
| Tests passed with difficulty (b): | 0 tests ➔ 0% |
| Test passed (a+b): | 23 tests ➔ 96% |
| Tests failed: | 1 test ➔ 4% |

**Total tests with people with hearing impairments: 10**

| | |
|---|---|
| Tests passed easily (a): | 8 tests ➔ 80% |
| Tests passed with difficulty (b): | 2 tests ➔ 20% |
| Test passed (a+b): | 10 tests ➔ 100% |
| Tests failed: | 0 tests ➔ 0% |

**Total tests with people with cognitive impairments: 16**

| | |
|---|---|
| Tests passed easily (a): | 16 tests ➔ 100% |
| Tests passed with difficulty (b): | 0 tests ➔ 0% |
| Test passed (a+b): | 16 tests ➔ 100% |
| Tests failed: | 0 tests ➔ 0% |

**Total tests with people with PMR: 20**

| | |
|---|---|
| Tests passed easily (a): | 18 tests ➔ 90% |
| Tests passed with difficulty (b): | 2 tests ➔ 10% |
| Test passed (a+b): | 20 tests ➔ 100% |
| Tests failed: | 0 tests ➔ 0% |

**Total tests with people with motor impairments: 20**

| | |
|---|---|
| Tests passed easily (a): | 4 tests ➔ 20% |
| Tests passed with difficulty (b): | 12 tests ➔ 60% |
| Test passed (a+b): | 16 tests ➔ 80% |
| Tests failed: | 4 tests ➔ 20% |

### 7.3.5 Impact assessment

As mentioned earlier, the demonstration was very well received. It is important to bear in mind that people with disabilities face accessibility issues on a daily basis, and a railway station is a very challenging environment for them due to its size, the difficulty in finding one's way around,

the number of passengers with whom they share the space, and the amount of information they need to know to make the journey. All these factors prevent them from being independent in that environment. For this reason, any attempt to improve their independence is welcomed by the community.

But beyond the fact that they welcome any initiative that improves their independence, we really saw how enthusiastic they were about the system's various features, the ease of obtaining information, or finding out which platform their train was on by scanning their ticket, and above all, the options offered by the robot and NaviLens to navigate to any point in the station with complete independence—even for those volunteers who were unfamiliar with the station.

The solution developed in this demonstrator would have a major impact if it were implemented in all stations, airports, shopping centres, public buildings where administrative procedures need to be carried out, etc.

In this way, people with disabilities would know that, wherever they went, they could get about independently, even if it was their first time there, and would be able to access the relevant information at that location.

In an ideal world where this were the case, people with disabilities would face fewer barriers and would gain a great deal in terms of independence.

# 8. Task 23.2 (3)– Demonstration in Malaga – Gobos

## 8.1 Demo implementation phase

| | | | |
|---|---|---|---|
| UC-FP1-WP19-15 | TE22 | Gobos useful information lights for the traveller with or without disabilities | Gobos is a concept of solution that indicates on the floor useful indicative information |

### 8.1.1 Recruitment of end-users

End-users involved in the demonstration were selected based on their direct interaction with railway services and accessibility needs. The recruitment focused on:

- Passengers with reduced mobility (PRM)
- Regular station users
- Station staff (RENFE and ADIF)

Participants were invited through existing collaboration channels, including accessibility associations and internal coordination with station personnel. The objective was to ensure a representative group of users capable of providing relevant feedback on usability, visibility, and overall effectiveness of the solution.

### 8.1.2 Deployment of demonstration environment

**Software**

The demonstration did not rely on a fully automated software system but rather on a manual simulation of the activation logic, representing the future integration with operational data systems.

A coordination process was established where:

- One team member monitored incoming train composition
- Two team members activated the corresponding projection manually

This approach ensured controlled validation conditions while replicating the expected system behaviour.

**Hardware**

The hardware setup included:

- Light projection devices (gobos) installed on platforms 10 and 11
- Power supply and temporary wiring
- Mounting structures aligned with safety requirements



The equipment was installed, calibrated and tested to ensure:

- Proper alignment with train boarding areas
- Adequate visibility under station lighting conditions
- Safe operation within passenger environments

All hardware was verified before the demonstration to ensure full functionality.

All the hardware was uninstalled between august - September 2025.

### 8.1.3 Collect and process demonstration data

The following data was collected during the demonstration:

- User feedback (qualitative observations and interviews)
- Visual documentation (photos and videos)
- Operational observations (staff interaction, passenger behaviour)
- Environmental conditions (peak vs off-peak periods)

In the next figure you can see a peak period validation:



This data was used to evaluate:

- Usability of the solution
- Visibility and clarity of projections
- Operational feasibility

### 8.1.4 Validation of demonstration data

Data validation was ensured through:

- Cross-checking user feedback across different participant groups
- Comparing observations across different time slots (peak/off-peak)
- Verification of consistency between expected and observed behaviour

The data collection process was also tested during initial setup phases to ensure reliability.

### 8.1.5 Integration tests

Integration testing focused on ensuring that all components worked together in a coordinated manner.

Although the system was not fully automated, in order to validate the overall concept and future integration potential, the interaction between the following elements was tested under real operational conditions:

- Train information

- Manual activation logic
- Projection system

### 8.1.6 Develop training materials

A light training approach was implemented to ensure all participants understood the demonstration:

- On-site briefing sessions
- Explanation of system functionality and objectives
- Instructions for interaction and feedback collection

This ensured a consistent understanding among users and staff.

### 8.1.7 Perform installations (if necessary)

The installation was carried out by a specialised subcontractor and included:

- Setup of projection systems
- Alignment and calibration
- Safety validation
- Temporary integration with station infrastructure

All installations were supervised by ADIF to ensure compliance with safety standards.

### 8.1.8 Validation tests

Validation tests were performed during the demonstration event and included:

- Real-time testing under operational conditions (peak and peak-off periods)
- Observation of user interaction
- Assessment across different time slots

These tests ensured that the system met minimum usability and operational requirements.

## 8.1.9 Communication and Dissemination before demonstration execution

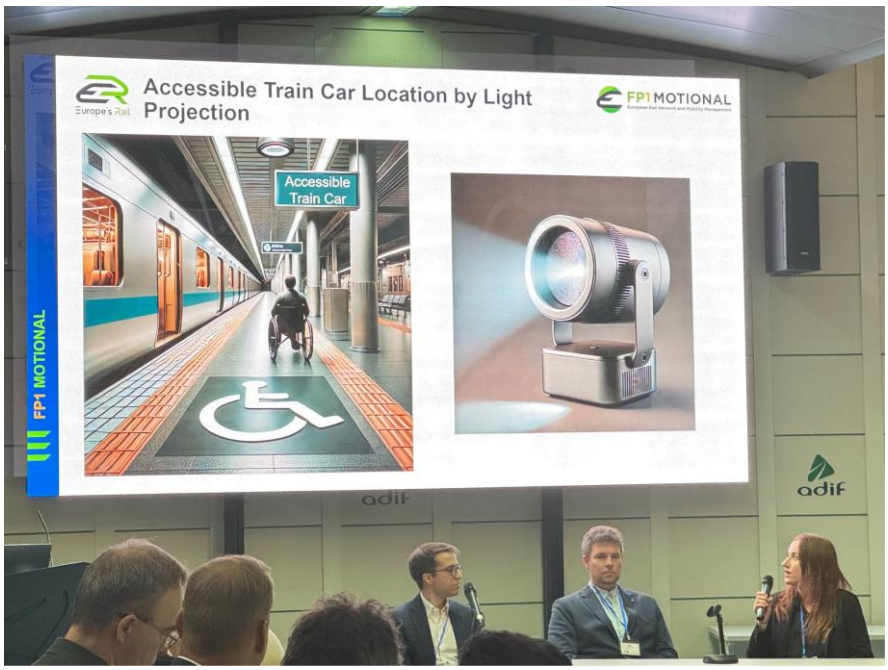
**Communication and Dissemination before Demonstration Execution**

In preparation for the demonstration phase, several targeted communication and dissemination activities were carried out to promote the gobos solution and engage relevant stakeholders, both internally and within the project consortium.

**Internal and Project-Level Dissemination**

Prior to the execution of the demonstration, the developments related to the design, safety assessment and implementation of the Gobos solution were actively shared within the project consortium during key project events.

- In particular, this work was presented during the Mid-Term Event held in Madrid on 30 October 2024, where the solution was showcased to a broad audience of project partners and stakeholders, highlighting its objectives, constraints and expected impact on platform–train interface safety and accessibility. Part of the presentation can be seen in the next photo:




Additionally, the topic was further discussed during the plenary meeting held in Munich on 29 October 2025, where each partner presented their respective contributions. This ensured alignment across partners and facilitated knowledge exchange on technical, operational and safety aspects associated with the deployment of the Gobossolution.

Internally, the work was also disseminated across relevant expert departments within the organisations involved—particularly infrastructure, safety and operations teams—ensuring that key stakeholders were aware of the developments and could provide feedback prior to the demonstration phase.

Also, a meeting in May 2024 was held in Metro of Malaga's Quarters not only to communicate, but also to understand better end-users needs:



In addition, several meetings were held with end users with different disabilities in order to communicate the solution and refine the technical approach throughout the project.

### 8.1.10 Implementation of measures to gather results and KPI measurements

To ensure a proper KPI evaluation, the following measures were implemented:

- Structured observation of user behaviour
- Collection of qualitative feedback
- Definition of evaluation criteria (visibility, usability, usefulness)

No complex instrumentation was required, as the focus was on qualitative validation.

### 8.1.11 Questionnaire and interviews guides for stakeholders/end-users

Questionnaires and interview guides were developed and administered to both end users and station staff during the validation event.

For end users, structured questionnaires were used to collect information on user profile (e.g., type of disability, travel habits), perceived accessibility challenges, and specific feedback on the Gobos solution, including visibility, positioning, usability and overall satisfaction. Open-ended questions were also included to capture suggestions and qualitative insights.

For station staff, questionnaires focused on operational aspects, including perceived usefulness of the solution, visibility under real passenger flow conditions, adequacy of the projection, and potential improvements from an operational perspective.

Both questionnaires combined closed and open questions to ensure a comprehensive understanding of user experience, allowing the collection of both qualitative feedback and basic quantitative ratings (e.g., scoring from 1 to 5). This approach supported a structured yet flexible assessment of the solution under real operational conditions.

## 8.2 Demo execution phase

### 8.2.1 Software distribution to end users

No software distribution to end users was required for the validation event, as the Gobos solution does not rely on any software component. The demonstration was carried out through the physical deployment of the system in the station environment, with no need for user interaction with digital tools.

### 8.2.2 End users/outsiders training

Several preparatory sessions were conducted throughout the project to familiarise stakeholders and potential users with the Gobos solution. These sessions included presentations, discussions and feedback exchanges held during different project meetings and milestones.

This continuous engagement ensured that participants were well informed about the objectives, functionality and expected behaviour of the solution prior to the validation phase.

As a result, by the time of the demonstration carried out in May 2025, all involved users had a clear understanding of the system and its intended use, making a dedicated kick-off session immediately prior to the validation event unnecessary.

### 8.2.3 Data collection for real-time demonstrations

Data collection during the demonstration was carried out in real-time under actual operating conditions at the station, with regular passenger flows.

The approach was based on direct observation of passenger behaviour during boarding and alighting, combined with the collection of feedback from users through on-site questionnaires and informal interactions.

This methodology allowed capturing immediate user reactions, perceived usability and overall experience with the Gobos solution in a real environment, ensuring that the collected data accurately reflects real-world conditions.

### 8.2.4 Validation Event

The validation event was prepared through a series of engagements with external end users, including persons with different types of disabilities, carried out throughout the project. These interactions allowed the team to present the Gobos solution, gather early feedback, and progressively refine the technical and operational approach prior to the demonstration phase.

For the validation event itself, the system was deployed in a real station environment (Málaga María Zambrano), where the demonstration was conducted under normal operating conditions with active passenger flows. External end users participated on-site, interacting directly with the solution during real boarding and circulation scenarios.

The preparation therefore focused not on controlled testing protocols, but on ensuring that the solution was mature enough to be assessed in an authentic environment. This enabled validation based on real user behaviour, supported by direct observation and structured feedback collection (questionnaires and interviews), ensuring a robust and realistic assessment of usability, visibility and overall effectiveness.

### 8.2.5 Data collection for outcome and Performance indicator (PI) measurements

Data collection for outcome and Performance Indicator (PI) measurements was carried out during the demonstration under real operating conditions.

The collected data focused primarily on qualitative and observational inputs, including:

- Direct observation of passenger behaviour and interaction with the Gobos system during boarding and platform circulation

- Feedback gathered from end users through structured questionnaires and interviews, covering usability, visibility, perceived safety and overall experience
- Input from station staff regarding operational aspects and system performance under varying passenger flow conditions
- Visual documentation (photos and videos) to support the analysis of system visibility and interaction in different scenarios

While no automated or sensor-based data collection systems were deployed, the combination of structured feedback and real-time observation provided sufficient evidence to assess the performance of the solution and support the evaluation of its effectiveness and user acceptance in Phase 4.

### 8.2.6 End-user interviews

End-user interviews were conducted on-site during the validation event, involving both passengers (including persons with reduced mobility) and station staff.

For passengers, interviews were structured through questionnaires combining closed and open-ended questions. These focused on user experience aspects such as visibility, usability, clarity of the projected signals, perceived safety, and overall satisfaction with the Gobos solution. Additional qualitative insights were collected through open feedback and suggestions.

The feedback highlighted that the solution is positively perceived in concept, but its effectiveness depends strongly on visibility conditions. Key observations included the need for larger or repeated projections, complementary signalling (e.g., on walls or ceilings), and prior information to users. Challenges such as crowding and platform furniture affecting visibility were also identified.

For station staff, interviews addressed operational aspects, including system visibility under varying passenger flow conditions, adequacy of the projection, and perceived usefulness of the solution in supporting passenger management. Staff feedback also emphasised the importance of adapting projection size and location depending on station characteristics.

This approach ensured the collection of both qualitative and semi-quantitative feedback, enabling a comprehensive assessment of user perception and operational suitability under real conditions.

### 8.2.7 Demonstration event summary

The validation event confirmed that the Gobos solution is a feasible and adaptable approach to support passenger guidance in station environments under real operating conditions.

The results showed positive acceptance of the concept by both end users and station staff, highlighting its potential to improve awareness of boarding areas and passenger distribution along the platform. The solution was particularly valued as a non-intrusive and flexible system.

However, the effectiveness of the system was found to be highly dependent on visibility conditions. Key limitations identified include reduced visibility in crowded scenarios, insufficient projection size, and interference from station elements such as furniture. Feedback consistently pointed to the need for larger, repeated projections and complementary signalling (e.g., on walls or ceilings), as well as prior user information.

Overall, the demonstration provided valuable insights into both the strengths and limitations of the solution, confirming its potential while identifying clear areas for optimisation and adaptation to different station contexts.

## 8.3 Demo evaluation phase

### 8.3.1 Dissemination Event

The demonstration results have been disseminated through a combination of targeted events and multimedia materials, with a strong focus on maximising impact, stakeholder engagement, and visibility at both operational and institutional levels.

- A key dissemination milestone was the event "Seamless and Inclusive Mobility (Event 2)", held on 7 May in Madrid. The event brought together a broad and diverse group of stakeholders from different countries, including transport operators, infrastructure managers, and innovation experts. More than 80 participants attended in person and 35 joined remotely, with additional attendees participating without prior registration, reflecting a strong level of interest and engagement. During the event, a demo pitch was delivered to present the key outcomes of the demonstrator within a wider programme that included multiple project results and use cases. This ensured that the WP23 outcomes were positioned within a broader innovation context, increasing their visibility and reinforcing their relevance. The session enabled direct interaction with stakeholders, fostering awareness of the developed solutions, encouraging exchange of views, and supporting discussions on future uptake and scalability. Links of the dissemination event 2:
    - https://www.linkedin.com/posts/metro-de-m%C3%A1laga_fp1motional-euabrrail-railinnovation-activity-7458529935553593345-8aKi/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/adif_fp1motional-euabrrail-railinnovation-activity-7458215368789196802-0YPW?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/implaser99_encaminamiento-podotaerctil-ugcPost-7459510666014519298-2DMm/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/renfe_fp1motional-euabrrail-railinnovation-activity-7458445783953227776-

aUlY/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE

- In parallel, a video recording of the validation activities conducted with end-users has been produced. This material showcases the demonstrator operating in real-life conditions and highlights user interaction, usability, and operational benefits. The planned dissemination of this video through the official communication channels of ADIF, RENFE and INECO, was done to significantly expand the reach of the results, engaging both technical audiences and decision-makers beyond the immediate project environment.
    - https://www.linkedin.com/feed/update/urn:li:activity:7338096680153632768/

- A dedicated press release has been prepared at ministerial level, which is expected to significantly expand the reach of the results, engaging both technical audiences and decision-makers beyond the immediate project environment.
    - https://www.transportes.gob.es/ministerio/comunicacion/sala-prensa/vie-23052025-1344

- Furthermore, additional dissemination is foreseen during the project's final event, where the results will be presented to a wider European audience. This will further strengthen the impact of the demonstrator, supporting knowledge transfer, facilitating replication potential, and promoting the uptake of the solutions across the rail sector.

- Further details, supporting materials and dissemination outputs are available through the following links:
    - https://forbes.es/economia/719123/transportes-prueba-un-proyecto-piloto-de-accesibilidad-ferroviaria-para-personas-con-movilidad-reducida/
    - https://forbes.es/economia/744045/adif-renfe-e-ineco-instalan-un-punto-de-ayuda-para-facilitar-la-movilidad-de-personas-con-discapacidad/
    - https://www.linkedin.com/posts/NaviLens_rail-travel-is-becoming-more-inclusive-in-ugcPost-7354150546913554433-gVEQ?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/feed/update/urn:li:activity:7352611982576865281/
    - https://www.linkedin.com/feed/update/urn:li:activity:7349346782046269441/

### 8.3.2 TRL validation

The target TRL for the project was TRL 5 (technology validated in a relevant environment). However, the Gobos solution reached a higher level of maturity (TRL 6–7), as it was demonstrated in a real operational environment with actual passenger flows.

### 8.3.3 Analyse feedback from stakeholders

The collected feedback indicates that the Gobos solution is positively valued as a concept and considered useful for improving passenger guidance and platform organisation.

However, several limitations were identified:

- Reduced visibility in crowded conditions
- Insufficient projection size
- Interference from station elements (e.g., furniture, passenger density)

Stakeholders consistently highlighted the need for:

- Larger or repeated projections
- Complementary signalling (e.g., wall or ceiling projections)
- Prior information to users
- Adaptation to specific station layouts

Station staff also emphasised the importance of tailoring the system to operational conditions and passenger flow patterns.

### 8.3.4 Evaluation of outcomes and Performance indicators (PI)

Although no specific quantitative KPIs were defined for this solution, the evaluation was based on qualitative performance indicators, including:

- User acceptance and perception
- Usability and clarity of the system
- Visibility under different operational conditions
- Operational feasibility

The results indicate that the solution meets its objectives in terms of feasibility and initial usability validation, while identifying clear areas for optimisation.

### 8.3.5 Impact assessment

The Gobos solution has the potential to improve passenger guidance, awareness and distribution along platforms, contributing to safer and more efficient boarding processes.

Its main impact lies in providing a flexible, non-intrusive and easily deployable visual guidance system. However, its effectiveness is influenced by environmental conditions, particularly visibility and crowd density.

Overall, the demonstration represents an important step towards improving accessibility and passenger information in rail environments. The insights gained will support further development and optimisation, enabling broader applicability and increased impact in future implementations.

# 9. Task 23.2 (4) – Demonstration in Asturias (Villalegre) - Gap Filler

## 9.1 Demo implementation phase

| | | | |
|---|---|---|---|
| UC-FP1-WP19-14 | TE22 | Gap filler for the gap between platform and rail stock | Piece to close the gap between platform and train |

### 9.1.1 Recruitment of end-users

The recruitment of end-users for the demonstration was based on the involvement of real passengers and operational staff within the selected station environment, ensuring that the validation was carried out under realistic conditions.

End-users were not recruited through a formal campaign, but rather naturally involved as part of regular station operations during the demonstration period. This approach allowed capturing authentic behaviour and interaction with the gap filler solution, without introducing artificial conditions or biases.

The primary end-users consisted of:

- Passengers using the station and travellers with luggage
- General passengers boarding and alighting trains during the demonstration period

In addition, indirect end-users included operational staff involved in station management and train operations. These stakeholders played a key role in observing the performance of the solution and assessing its integration into daily operations.

This approach ensured that the demonstration reflected real-world usage scenarios, enabling a reliable assessment of usability, accessibility improvements, and operational impact.

### 9.1.2 Deployment of demonstration environment

The demonstration was carried out at Villalegre station (Asturias), a curved commuter rail station with mixed traffic, including high-speed rolling stock, characterized by varying static and dynamic gauges.




Based on a detailed gauge and risk assessment performed, the installation of a 4 cm gap filler element was deemed safe and feasible. Subsequently, a temporary installation over a 15-metre section (Avilés direction) was proposed and validated by **safety committee**, confirming that it does not infringe clearance limits and ensures safe operation. Given the initial positive results and stakeholder interest, it was agreed to extend the demonstration period beyond the originally planned three weeks, postponing dismantling until early summer (tentatively mid of July 2026), to be confirmed in a subsequent meeting.

Due to the reservations shown by the operator's station responsible team at the safety committee on invading theoretical limit gauge envelope (the most restrictive profile which combines all the rolling stock types that pass through the station), full gap coverage was not achievable; however, the solution represents a safe and valuable first implementation to reduce the platform–train gap and gather operational insights. The safety committee has proposed conducting new studies and tests aimed at enabling full and interoperable implementation at any station, especially those where two different track gauges coexist.

Anyway, the demonstration provided a set of measurable and observable outcomes to assess the effectiveness and feasibility of the gap filler solution:



- **Effectiveness (gap reduction):**
  The installation of the gap filler resulted in a measurable reduction of the horizontal distance between platform and train, improving accessibility and reducing the risk of accidents. However, at this stage, the solution does not fully address accessibility requirements for persons with reduced mobility (PRM), as achieving gap reductions below critical thresholds (e.g., beyond 4 cm) would require more extensive safety validations and approvals. Such configurations would exceed the applicable clearance limits and were therefore considered outside the scope of this project phase.

- **Accessibility improvement:**
  The solution facilitated safer and more comfortable boarding and alighting, particularly for passengers with reduced mobility, elderly users, and passengers with luggage.

- **Operational feasibility:**
  The installation processes was successfully carried out without major disruptions to station operations, confirming the practical applicability of the solution in a real environment.

- **Potential impact on dwell time:**
  Although not measured quantitatively in this phase, smoother boarding conditions suggest a potential reduction in boarding times, contributing to improved operational efficiency.

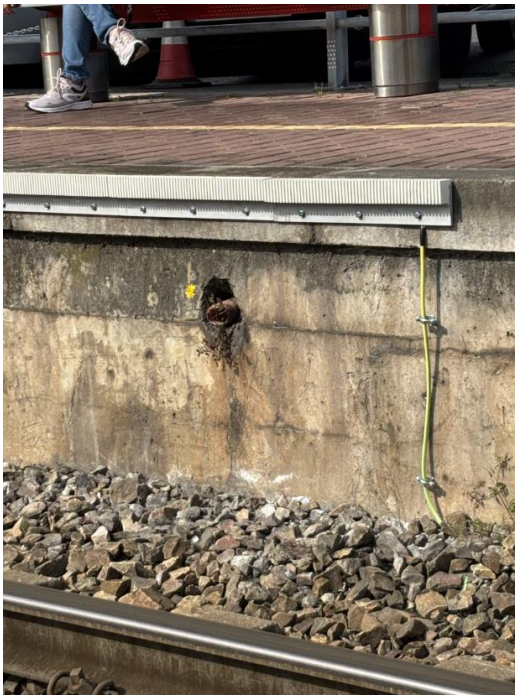
### 9.1.3 Collect and process demonstration data

During the demonstration phase, both quantitative and qualitative data were collected to assess the performance and usability of the gap filler solution under real operational conditions.

Quantitative data focused on the measurement of the horizontal gap between the platform and rolling stock, recorded at different points along the platform and across multiple train types. These measurements were systematically collected by technical staff using standardised procedures to ensure consistency and comparability.



In parallel, qualitative data was gathered through direct observation of passenger behaviour and interaction with the gap filler, as well as feedback from operational staff involved in the demonstration.

All collected data was processed and organised to enable comparison between pre-installation and post-installation conditions, supporting a structured evaluation of the solution's impact.

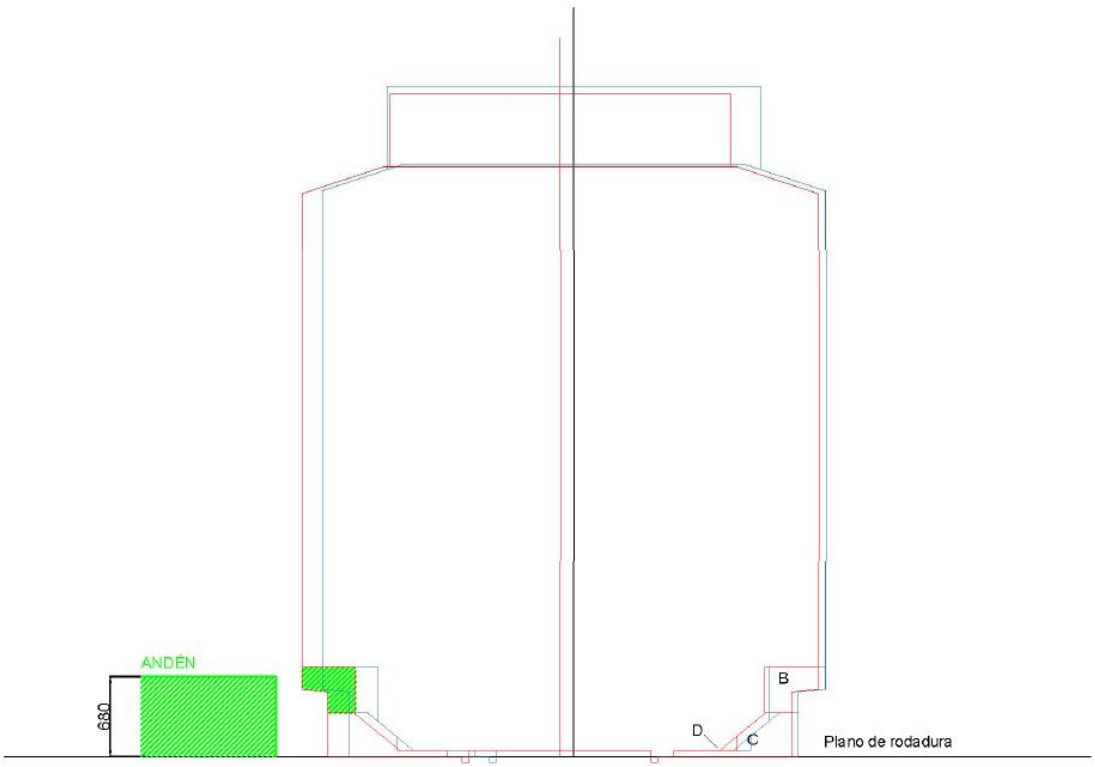
### 9.1.4 Validation of demonstration data

A validation event was carried out at a selected station in Asturias, where the gap filler was installed and tested under real operating conditions over an extended period.

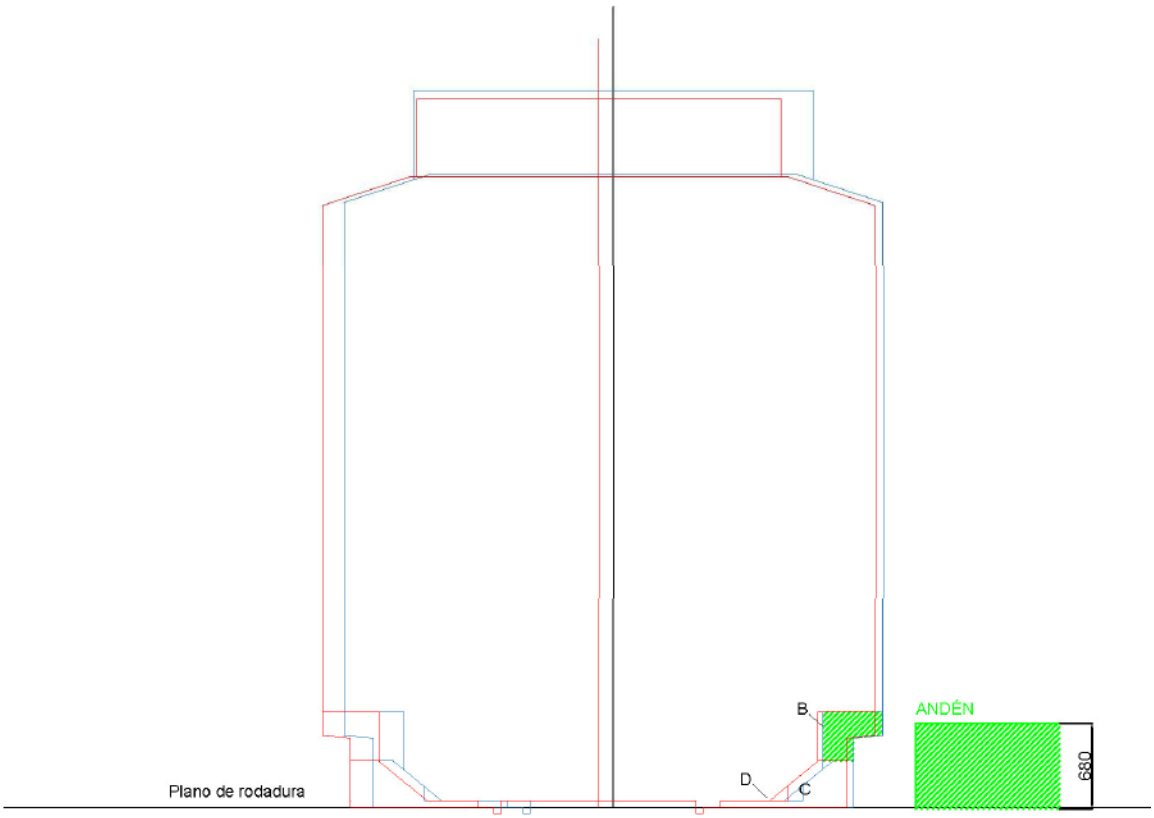
I*nitially, the installation of the gap filler was planned at El Puig station (near of Valencia). However, this was not feasible due to very restrictive clearance constraints. These constraints are defined by the combined theoretical gauge envelope of all passing rolling stock, as the track accommodates a third rail system and dual gauge operation (UIC and Iberian), involving multiple types of trains.*

*As a result, the gap filler design had to comply with the most restrictive theoretical static gauge, which significantly limited the available space. Consequently, the size of the piece would have been extremely small, reducing its effectiveness and making the solution impractical for implementation at this site.*

*The next scheme illustrates the superposition of the static gauge envelopes for both Iberian and UIC gauges. These envelopes are overlapped to define the most restrictive combined limits.*




**SUPERPOSICIÓN DE CONTORNOS** Vía 1 (lado montaña)




**SUPERPOSICIÓN DE CONTORNOS** Vía 2 (lado mar)

During the validation phase, multiple measurements of the gap reduction were performed at different points along the platform and for different train units. These measurements confirmed the ability of the solution to reduce the platform-train gap in a consistent manner.

Additionally, the validation allowed for:

- Direct observation of passenger interactions with the solution
- Identification of operational constraints and installation requirements
- Collection of feedback from technical staff and station personnel

The validation event demonstrated the technical feasibility and robustness of the solution, as well as its potential for replication in other stations with similar conditions.

### 9.1.5 Integration tests

Although the gap filler is a predominantly physical solution, integration aspects were considered to ensure compatibility with existing infrastructure and operational processes.

Integration tests focused on:

- Compatibility with different rolling stock types operating at the station
- Alignment with platform geometry and infrastructure constraints
- Interaction with normal passenger flows and boarding processes

The tests confirmed that the gap filler can be integrated into existing station environments without requiring significant infrastructure modifications or causing interference with normal operations.

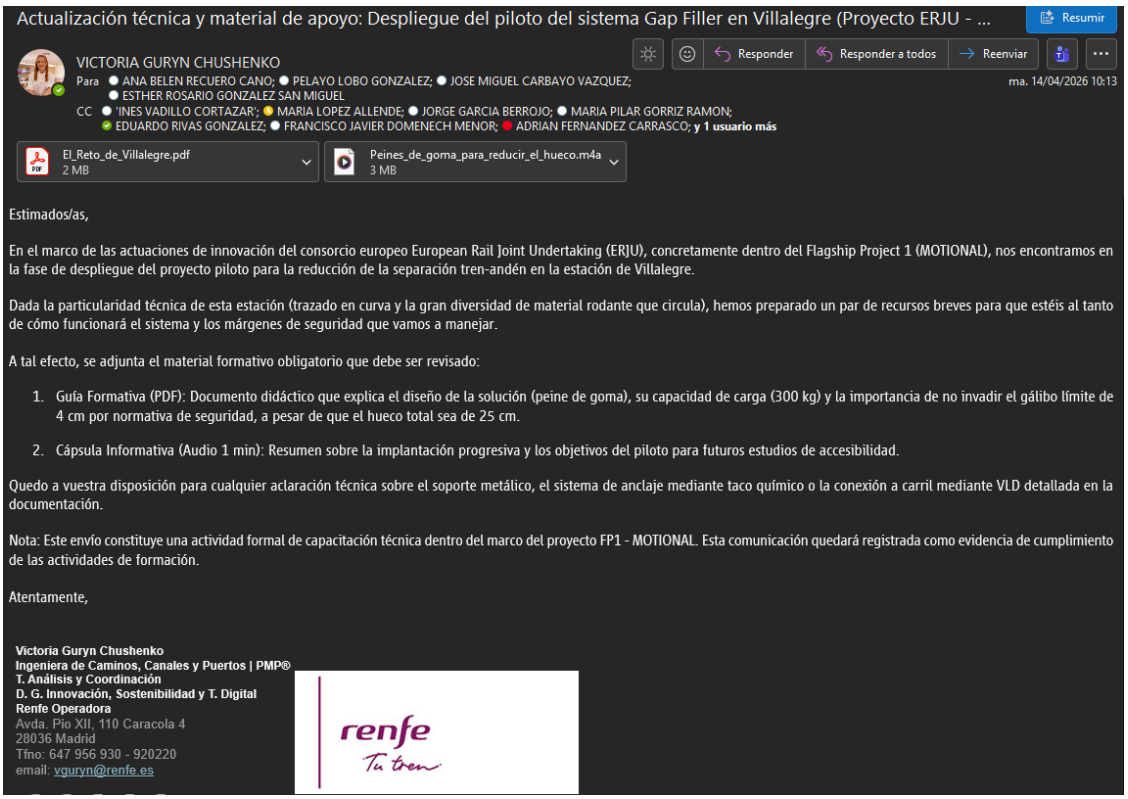
### 9.1.6 Develop training materials

Basic training materials were prepared to support the **correct understanding of the solution and execution of the demonstration activities**. These materials were designed for operational staff and technical personnel involved in the installation and validation processes.

The training content included:

- Description of the gap filler solution and its objectives
- Information about its installation and removal
- An audio explanation about the solution and its particularities

The materials were delivered through short briefings, on-site explanations and by email, prior to the validation activities.


Actualización técnica y material de apoyo: Despliegue del piloto del sistema Gap Filler en Villalegre (Proyecto ERJU - ...

Resumir

VICTORIA GURYN CHUSHENKO

Responder | Responder a todos | Reenviar

Para ANA BELEN RECUERO CANO; PELAYO LOBO GONZALEZ; JOSE MIGUEL CARBAYO VAZQUEZ; ESTHER ROSARIO GONZALEZ SAN MIGUEL

ma. 14/04/2026 10:13

CC 'INES VADILLO CORTAZAR'; MARIA LOPEZ ALLENDE; JORGE GARCIA BERROJO; MARIA PILAR GORRIZ RAMON; EDUARDO RIVAS GONZALEZ; FRANCISCO JAVIER DOMENECH MENOR; ADRIAN FERNANDEZ CARRASCO; **y 1 usuario más**

El_Reto_de_Villalegre.pdf 2 MB

Peines_de_goma_para_reducir_el_hueco.m4a 3 MB

Estimados/as,

En el marco de las actuaciones de innovación del consorcio europeo European Rail Joint Undertaking (ERJU), concretamente dentro del Flagship Project 1 (MOTIONAL), nos encontramos en la fase de despliegue del proyecto piloto para la reducción de la separación tren-andén en la estación de Villalegre.

Dada la particularidad técnica de esta estación (trazado en curva y la gran diversidad de material rodante que circula), hemos preparado un par de recursos breves para que estéis al tanto de cómo funcionará el sistema y los márgenes de seguridad que vamos a manejar.

A tal efecto, se adjunta el material formativo obligatorio que debe ser revisado:

1. Guía Formativa (PDF): Documento didáctico que explica el diseño de la solución (peine de goma), su capacidad de carga (300 kg) y la importancia de no invadir el gálibo límite de 4 cm por normativa de seguridad, a pesar de que el hueco total sea de 25 cm.
2. Cápsula Informativa (Audio 1 min): Resumen sobre la implantación progresiva y los objetivos del piloto para futuros estudios de accesibilidad.

Quedo a vuestra disposición para cualquier aclaración técnica sobre el soporte metálico, el sistema de anclaje mediante taco químico o la conexión a carril mediante VLD detallada en la documentación.

Nota: Este envío constituye una actividad formal de capacitación técnica dentro del marco del proyecto FP1 - MOTIONAL. Esta comunicación quedará registrada como evidencia de cumplimiento de las actividades de formación.

Atentamente,

**Victoria Guryn Chushenko**
**Ingeniera de Caminos, Canales y Puertos | PMP®**
**T. Análisis y Coordinación**
**D. G. Innovación, Sostenibilidad y T. Digital**
**Renfe Operadora**
Avda. Pío XII, 110 Caracola 4
28036 Madrid
Tfno: 647 956 930 - 920220
email: vguryn@renfe.es

renfe Tu tren

## 9.1.7 Perform installations

The installation of the gap filler was carried out on-site at the selected station in Asturias (Villalegre), following predefined technical specifications and safety requirements.

The process included:

- Preparation of the installation area
- Placement and fixing of the gap filler element along the platform edge
- Verification of alignment with the train door positions
- Safety checks prior to operational use

The installation was performed by specialised personnel under the supervision of ADIF and RENFE, ensuring compliance with all relevant safety and operational standards.





The solution was designed as a temporary and reversible installation, with no permanent modifications to the infrastructure.

### 9.1.8 Validation tests

Validation tests were conducted under real operating conditions to ensure the quality and reliability of the solution before and during the Validation Event.

These tests included:

- Repeated measurements of the gap reduction across multiple train arrivals
- Visual inspection of the stability and positioning of the gap filler
- Observation of passenger interaction during boarding and alighting

- Verification that no safety incidents or operational disruptions occurred

The validation tests confirmed that the solution performs consistently and meets the expected safety and accessibility objectives.

### 9.1.9 Communication and Dissemination before demonstration execution

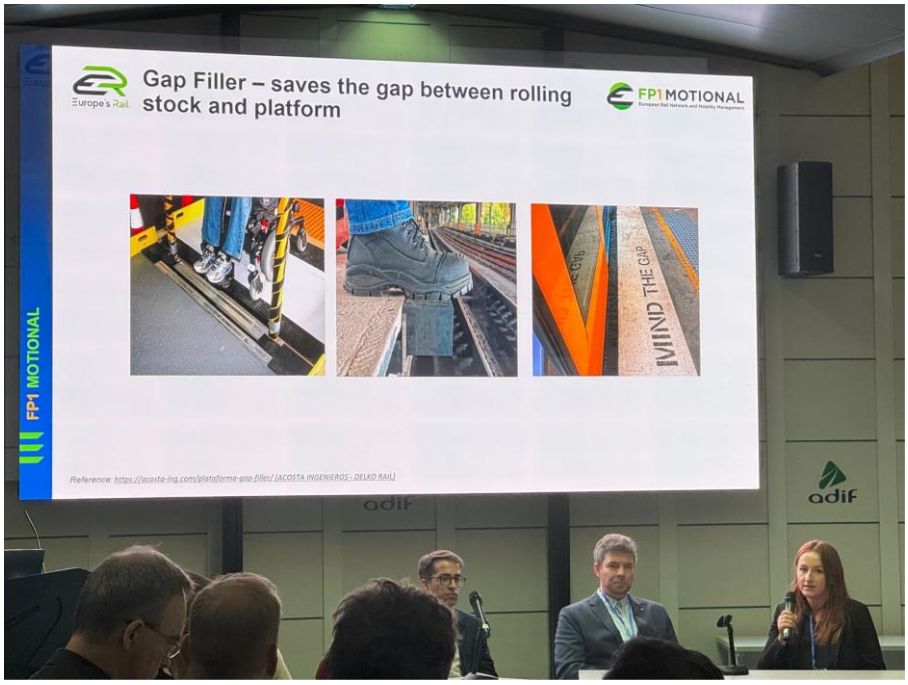
**Communication and Dissemination before Demonstration Execution**

In preparation for the demonstration phase, several targeted communication and dissemination activities were carried out to promote the gap filler solution and engage relevant stakeholders, both internally and within the project consortium.

**Internal and Project-Level Dissemination**

Prior to the execution of the demonstration, the developments related to the design, safety assessment and implementation of the gap filler solution were actively shared within the project consortium during key project events.

In particular, this work was presented during the Mid-Term Event held in Madrid on 30 October 2024, where the solution was showcased to a broad audience of project partners and stakeholders, highlighting its objectives, constraints and expected impact on platform–train interface safety and accessibility. You can see part of the presentation in the next photo:




Additionally, the topic was further discussed during the plenary meeting held in Munich on 29

October 2025, where each partner presented their respective contributions. This ensured alignment across partners and facilitated knowledge exchange on technical, operational and safety aspects associated with the deployment of the gap filler solution.

Internally, the work was also disseminated across relevant expert departments within the organisations involved—particularly infrastructure, safety and operations teams—ensuring that key stakeholders were aware of the developments and could provide feedback prior to the demonstration phase.

Also, a meeting in May 2024 was held in Metro of Malaga's Quarters not only to communicate, but also to understand better end-users needs:



In addition, several meetings were held with end users with different disabilities in order to communicate the solution and refine the technical approach throughout the project.

### 9.1.10 Implementation of measures to gather results and KPI measurements

To support KPI measurement, specific procedures were implemented during the demonstration to ensure consistent data collection.

These measures included:

- Measurement protocols for recording gap distances
- Defined observation points along the platform

- Repetition of measurements under different operational conditions
- Logging of observations related to passenger behaviour and operational performance

In addition, alternative design configurations were assessed, including a wider gap filler element. However, this option was ultimately not implemented, as it would have required more extensive safety analyses and validation processes beyond the scope of the project.

Although no automated data collection systems were required, the structured methodology ensured reliable and reproducible results, enabling a robust assessment of the demonstration outcomes.

### 9.1.11 Questionnaire and interviews guides for stakeholders/end-users

Given the nature of the demonstration, qualitative feedback was initially collected through informal observation and direct interaction with operational staff, ensuring minimal disruption to passenger flows and station operations.

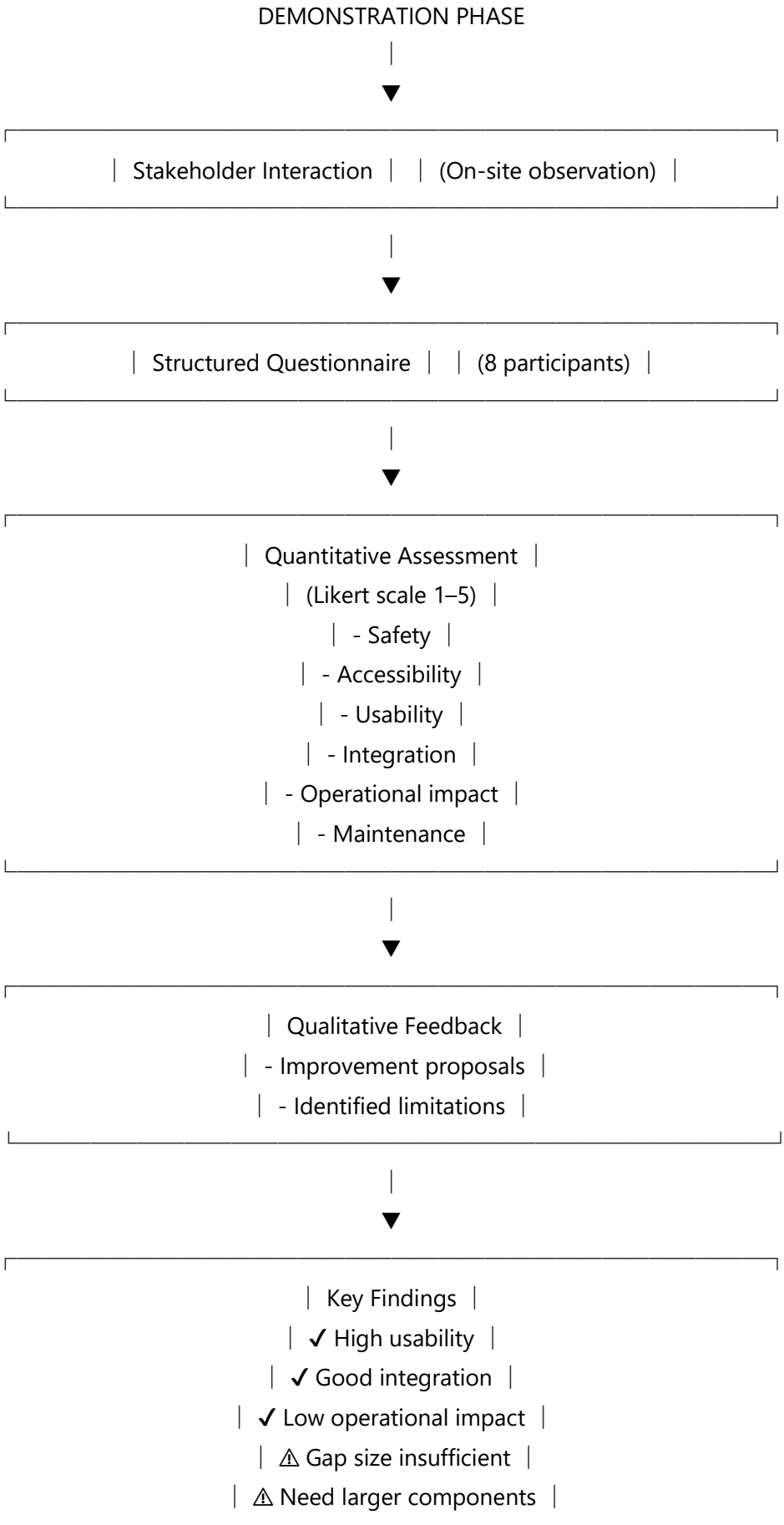
A total of 8 participants with different profiles (including infrastructure managers, operational staff, maintenance personnel and end-users) provided feedback. The questionnaire was designed to assess key aspects of the solution using a 5-point Likert scale, covering:

- Perceived improvement in safety during boarding and alighting
- Enhancement of accessibility for passengers with reduced mobility, luggage, or strollers
- Clarity and usability of the system
- Integration into daily station operations
- Impact on operational performance (e.g., absence of delays or interferences)
- Maintainability of the solution
- Replicability in other stations

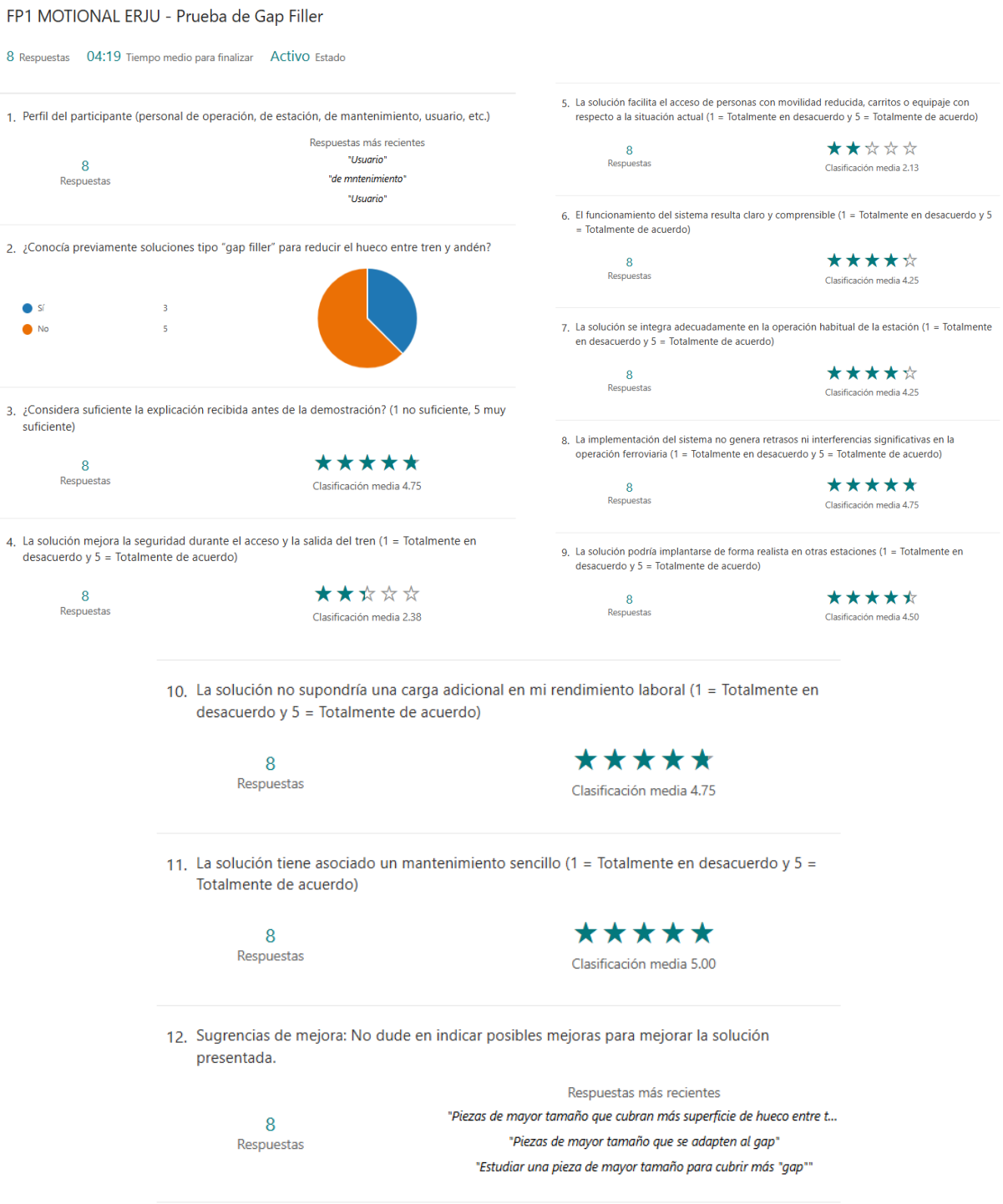
Overall, the results indicate a **generally positive perception** of the solution, particularly in terms of usability, operational integration and maintainability, which received consistently high scores across participants.

However, feedback also highlighted a **key limitation related to the size of the gap filler**, with several respondents indicating that the solution does not sufficiently reduce the gap. A recurring suggestion for improvement is the development of **larger components capable of covering a wider gap area**, thereby enhancing accessibility and effectiveness.

This mixed-method approach allowed capturing both measurable indicators and qualitative insights, providing a well-rounded evaluation of the solution's performance under real operational conditions.


DEMONSTRATION PHASE
Stakeholder Interaction
(On-site observation)
Structured Questionnaire
(8 participants)
Quantitative Assessment
(Likert scale 1–5)
- Safety
- Accessibility
- Usability
- Integration
- Operational impact
- Maintenance
Qualitative Feedback
- Improvement proposals
- Identified limitations
Key Findings
✓ High usability
✓ Good integration
✓ Low operational impact
⚠ Gap size insufficient
⚠ Need larger components

These results provide a strong basis for further iterations and scaling, while clearly identifying key design improvements required to enhance system effectiveness.



FP1 MOTIONAL ERJU - Prueba de Gap Filler

8 Respuestas 04:19 Tiempo medio para finalizar Activo Estado

1. Perfil del participante (personal de operación, de estación, de mantenimiento, usuario, etc.)

8 Respuestas

Respuestas más recientes
"Usuario"
"de mntenimiento"
"Usuario"

2. ¿Conocía previamente soluciones tipo "gap filler" para reducir el hueco entre tren y andén?

Sí 3
No 5

3. ¿Considera suficiente la explicación recibida antes de la demostración? (1 no suficiente, 5 muy suficiente)

8 Respuestas

Clasificación media 4.75

4. La solución mejora la seguridad durante el acceso y la salida del tren (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 2.38

5. La solución facilita el acceso de personas con movilidad reducida, carritos o equipaje con respecto a la situación actual (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 2.13

6. El funcionamiento del sistema resulta claro y comprensible (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 4.25

7. La solución se integra adecuadamente en la operación habitual de la estación (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 4.25

8. La implementación del sistema no genera retrasos ni interferencias significativas en la operación ferroviaria (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 4.75

9. La solución podría implantarse de forma realista en otras estaciones (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 4.50

10. La solución no supondría una carga adicional en mi rendimiento laboral (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 4.75

11. La solución tiene asociado un mantenimiento sencillo (1 = Totalmente en desacuerdo y 5 = Totalmente de acuerdo)

8 Respuestas

Clasificación media 5.00

12. Sugrencias de mejora: No dude en indicar posibles mejoras para mejorar la solución presentada.

8 Respuestas

Respuestas más recientes
"Piezas de mayor tamaño que cubran más superficie de hueco entre t...
"Piezas de mayor tamaño que se adapten al gap"
"Estudiar una pieza de mayor tamaño para cubrir más "gap""

## 9.2 Demo execution phase

### 9.2.1 Software distribution to end users

Not applicable, as the solution is a physical system and does not require any software for end users.

### 9.2.2 End users/outsiders training

No formal preparatory session or demonstration kick-off meeting was conducted. The validation approach was designed to observe natural passenger behaviour in a real operational environment, without prior instruction or awareness of the solution. This ensured that user interaction with the gap filler reflected authentic conditions, as passengers would encounter the system in everyday use.

Regarding the project team and involved staff, no specific training session was required, as they were already familiar with the solution. These participants also took part in the validation process, contributing to the observation and assessment activities.

### 9.2.3 Data collection for real-time demonstrations

Data collection for the demonstration was carried out through direct on-site observation and manual measurements.

Real-time data included photographic documentation of the installation and its interaction with passengers, as well as manual measurements of the platform–train gap using a ruler at predefined locations.



These activities were complemented by the recording of qualitative observations related to passenger behaviour and operational conditions during the demonstration, ensuring a consistent and traceable dataset for subsequent analysis.

### 9.2.4 Validation Event

The event preparation with expert users was minimal, as the validation approach focused on real operational conditions. The gap filler element was installed on-site, after which the team remained at the station to observe passenger behaviour during normal boarding and alighting processes.

No specific interaction protocols or guided validation activities were required. Instead, both expert participants and project team members monitored how passengers naturally engaged with the solution, ensuring that the assessment reflected realistic usage conditions. This approach allowed for a direct evaluation of the solution's performance and user interaction in an authentic environment.

Due to the specific constraints of the station (curved platform), the variety of rolling stock in operation, and the applicable safety and clearance limitations, the gap could not be fully covered. As a result, the solution did not achieve the threshold required to ensure fully accessible boarding conditions for wheelchair users. Consequently, validation with persons with reduced mobility using wheelchairs was not conducted in this phase for safety reasons.

### 9.2.5 Data collection for outcome and Performance indicator (PI) measurements

Data collection during the demonstration was structured to support the evaluation of outcomes and Performance Indicators (PIs), combining quantitative and qualitative inputs.

- Quantitative data included repeated measurements of the platform–train gap at predefined locations, before and after installation, across different train types. This enabled assessment of the main PI related to gap reduction effectiveness.
- Qualitative data was obtained through on-site observation of passenger behaviour and feedback from operational staff, complemented by a short, structured questionnaire. This supported the evaluation of perceived safety, accessibility, usability, operational integration, and maintainability.

Additionally, photographic evidence and field notes were recorded to ensure traceability. All data were collected using consistent procedures, allowing comparison of pre- and post-installation

conditions and providing a reliable basis for performance evaluation.

### 9.2.6 End-user interviews

Interviews during the validation event were conducted through structured questionnaires administered online to some end-users in the station.

These surveys aimed to capture user perceptions regarding the usability, comfort and perceived safety of the gap filler solution, as well as their overall experience during boarding and alighting.

The collected responses provided qualitative insights to complement the observational data, supporting the assessment of user acceptance and perceived effectiveness of the solution under real operating conditions.

### 9.2.7 Demonstration event summary

The validation event confirmed that the gap filler solution is safe, feasible and effective in reducing the platform–train gap under real operating conditions. Positive user interaction and acceptance were observed, and deployment caused no disruption to service.

However, due to infrastructure, rolling stock and safety constraints, the gap could not be fully eliminated, preventing compliance with accessibility requirements for wheelchair users. Overall, the demonstration provided valuable insights and a solid basis for further development and optimisation.

## 9.3 Demo evaluation phase

### 9.3.1 Dissemination Event

The demonstration results have been disseminated through a combination of targeted events and multimedia materials, with a strong focus on maximising impact, stakeholder engagement, and visibility at both operational and institutional levels.

- A key dissemination milestone was the event “Seamless and Inclusive Mobility (Event 2)”, held on 7 May in Madrid. The event brought together a broad and diverse group of stakeholders from different countries, including transport operators, infrastructure managers and innovation experts. More than 80 participants attended in person and 35 joined remotely, with additional unregistered attendees, reflecting a high level of interest and engagement. A physical prototype of the gap filler

was also presented during the event, allowing attendees to directly observe and interact with the solution.



- During the event, a demo pitch was delivered to present the key outcomes of the demonstrator within a wider programme that included multiple project results and use cases. This ensured that the WP23 outcomes were positioned within a broader innovation context, increasing their visibility and reinforcing their relevance. The session enabled direct interaction with stakeholders, fostering awareness of the developed solutions, encouraging exchange of views, and supporting discussions on future uptake and scalability.

    - https://www.linkedin.com/posts/metro-de-m%C3%A1laga_fp1motional-euabrrail-railinnovation-activity-7458529935553593345-8aKi/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/adif_fp1motional-euabrrail-railinnovation-activity-7458215368789196802-0YPW?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/implaser99_encaminamiento-podotaerctil-ugcPost-7459510666014519298-2DMm/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE
    - https://www.linkedin.com/posts/renfe_fp1motional-euabrrail-railinnovation-activity-7458445783953227776-aUlY/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAA0PFY8B21SsdDZgcC-Ad30-It-wyFOjJeE

- Furthermore, additional dissemination is foreseen during the project's final event, where the results will be presented to a wider European audience. This will further strengthen the impact of the demonstrator, supporting knowledge transfer, facilitating replication potential, and promoting the uptake of the solutions across the rail sector.

### 9.3.2 TRL validation

The target TRL for the project was TRL 5 (technology validated in a relevant environment).

However, the achieved maturity of the gap filler solution can be considered closer to TRL 6–7, as it was demonstrated in a real operational environment (Villalegre station) under actual service conditions with live railway traffic.

The solution was deployed in an open station environment with continuous passenger flows, allowing unrestricted and repeated use by the general public over an extended period (1–2 months), thereby ensuring safe interaction beyond controlled or project-specific users.

### 9.3.3 Analyse feedback from stakeholders

Feedback from stakeholders was collected through structured questionnaires completed during the demonstration, complemented by direct on-site interaction.

A total of **8 participants** contributed to the evaluation, representing different stakeholder profiles (infrastructure managers, operational staff, maintenance personnel and end users), ensuring a broad perspective.

Quantitative results (average scores – scale 1 to 5):

- **Clarity and usability of the system:** ~4.3
- **Integration into station operations:** ~4.5
- **Operational impact (lack of delays/interference):** ~4.6
- **Maintainability of the solution:** ~4.6
- **Replicability in other stations:** ~4.8
- **Improvement in accessibility:** ~2.6
- **Perceived safety improvement:** ~2.4

Key findings:

- ✅ **High usability and clarity**, with most users easily understanding the system
- ✅ **Strong integration into operations**, with minimal perceived disruption
- ✅ **Positive perception of maintenance and scalability potential**
- ⚠️ **Lower scores in accessibility and safety**, indicating limited effectiveness in gap reduction

Qualitative feedback (main insights):

- The most recurrent comment is the **need for a larger gap filler**, as the current solution does not sufficiently reduce the gap
- Several stakeholders highlighted that the current prototype is **a good initial approach**, but requires further development
- Suggestions focus on:
    - Increasing the **width of the solution**
    - Improving its **effectiveness in bridging the train–platform gap**

Overall assessment:

- The concept shows **high acceptance and operational feasibility**
- There is a **clear direction for improvement**, mainly related to the physical dimensions of the system
- The solution demonstrates **strong potential for scalability**, provided that the identified limitations are addressed
- The complete set of questionnaire responses and detailed feedback is included in the annexes.

### 9.3.4 Evaluation of outcomes and Performance indicators (PI)

The assessment is therefore based on a combination of qualitative and quantitative measures derived from the demonstration activities:

**Applied performance indicators:**

- **User perception indicators** (based on questionnaire results):
    - Improvement in accessibility (~2.6 / 5)
    - Perceived safety enhancement (~2.4 / 5)
    - Usability and clarity of the system (~4.3 / 5)
    - Integration into station operations (~4.5 / 5)
    - Operational impact (absence of delays/interference) (~4.6 / 5)
    - Maintainability (~4.6 / 5)
    - Replicability potential (~4.8 / 5)

- **Stakeholder feedback indicators:**
    - Level of acceptance of the solution
    - Identification of limitations and improvement needs
    - Willingness to support further development or deployment

- **Technical and operational indicators:**

- Successful execution of the demonstration under real conditions
- Absence of significant operational disruptions during testing
- Compatibility with existing station processes

**Evaluation of results:**

- The demonstration confirms that the solution **meets key operational objectives**, particularly in terms of usability, integration and feasibility.
- The **high scores in operational and usability aspects** indicate strong readiness for integration into real environments.
- Lower scores in accessibility and safety highlight **design limitations**, mainly related to the reduced size of the implemented gap filler.
- Qualitative feedback consistently points to the need for **larger components to enhance effectiveness**, providing a clear direction for future iterations.

**Overall conclusion:**

Despite the absence of predefined formal KPIs, the combination of proxy indicators provides a **robust and reliable assessment framework**. The results demonstrate that the solution is operationally viable and well accepted, while also clearly identifying areas requiring further development to fully meet accessibility and safety objectives.

### 9.3.5 Impact assessment

The demonstrated solution has a positive but limited impact on the intended user group. In this specific case, due to the complexity of the station (curved platform, mixed rolling stock and associated safety and gauge constraints), the solution could not fully bridge the platform–train gap to meet accessibility requirements for persons with reduced mobility (PRM), particularly wheelchair users.

However, within these constraints, the solution achieved a measurable reduction of the gap, improving safety and comfort for passengers. Therefore, it should be considered a relevant first step in addressing the issue in complex environments. The experience gained provides a basis for future developments aimed at enabling greater gap coverage while maintaining compliance with safety and operational requirements.

# 10. Task 23.3 – Demonstration in Amsterdam

The Amsterdam demonstration, led by **Hitachi Rail (RCS France)** under WP23 Task 23.3, was carried out in close collaboration with **GVB Amsterdam** at **Amsterdam Central Station**, one of the largest multimodal transport hubs in the Netherlands. The demonstration was conducted in a representative operational environment, allowing the developed solution to be validated under realistic passenger operating conditions.

The demonstrator focused on the validation of an innovative **Hands-Free Seamless Travelling** solution designed to simplify passenger access to public transport while improving accessibility, convenience, and operational efficiency. The solution combines **Ultra-Wideband (UWB)** localization technology, wearable devices, account-based ticketing principles and intelligent back-office services to enable automatic passenger validation without requiring any manual interaction with conventional ticket validation equipment.

The demonstration addressed the validation of representative use cases covering the complete passenger journey through the station, including hands-free entry, hands-free exit, intermodal transfer support and automated assistance for passengers requiring additional support. These scenarios demonstrate how digital technologies can reduce physical and cognitive barriers while facilitating seamless movement across multimodal transport infrastructures.

The demonstrator primarily contributes to the validation of **Technical Enabler 21 (Hands-Free Experience for Travelers)** while also supporting the objectives of **Technical Enabler 20**, by improving accessibility and facilitating assistance for passengers with reduced mobility and other travellers requiring inclusive mobility services.
The main objectives of the demonstration were to:

- Validate the technical feasibility and operational reliability of hands-free passenger validation using UWB technology;
- Demonstrate the integration of wearable devices, localization infrastructure and account-based ticketing services within an operational transport environment;
- Evaluate the interaction between station infrastructure, passenger devices and back-office systems during a complete passenger journey;
- Assess the usability and acceptance of the proposed solution by transport operators and representative end-users;
- Collect technical and operational evidence supporting the future deployment of hands-free mobility services in multimodal transport networks.

The remainder of this chapter presents the implementation, execution, and evaluation of the Amsterdam demonstration, following the common demonstration methodology adopted throughout WP23. The demonstration is structured into three complementary phases:

- The **Demonstration Implementation Phase**, describing the preparation activities carried out prior to the Validation Event;
- The **Demonstration Execution Phase**, detailing the operational demonstration and data collection activities;

- The **Demonstration Evaluation Phase**, presenting the assessment of the achieved results, stakeholder feedback, Technology Readiness Level (TRL) validation and overall impact of the demonstrated solution.

Use cases

| Use case ID | TEs | Name | Description |
|---|---|---|---|
| UC-FP1-WP19-22 | TE20<br>TE21 | Hands Free.<br>UWB Walk-in | Passengers will be able to check-in and access the closed area of the mobility hub using their UWB wearable tag, without any physical validation gesture (e.g., tapping a contactless card or device at a gate or validator). |
| UC-FP1-WP19-23 | TE20<br>TE21 | Hands Free.<br>UWB Walk-out | This use case is the continuation of UC-FP1-WP19-22 (walk-out, following the walk-in).<br>Passengers will check-out and exit the closed area using the same UWB wearable tag, again without requiring any validation gesture. |
| UC-FP1-WP19-24 | TE20<br>TE21 | Hands Free.<br>UWB Intermodal transfer | Use of UWB technology to support seamless transfers between different mobility modes.<br>After exiting the train platform via an automated gate, passengers receive contextual guidance for the next travel leg. |
| UC-FP1-WP19-25 | TE20<br>TE21 | Hands Free.<br>UWB in station assistance | Focused on enhancing accessibility for passengers with reduced mobility (PRM), this use case features automatic detection of passenger arrival via UWB, triggering notifications to station staff to provide appropriate support. |

## 10.1 Demo implementation phase

The implementation phase successfully delivered a **TRL 7 demonstrator** of the **Hands-Free Seamless Travelling** solution, validating the technical readiness and operational feasibility of seamless passenger validation within a real public transport environment. This phase focused on deploying, integrating, and validating all demonstrator components required to execute the planned validation scenarios before involving end-users and stakeholders.

The implemented demonstrator combined the software, communication and localisation components required to support the hands-free travelling experience. This included the deployment of the account-based ticketing services, the installation and configuration of the **Ultra-Wideband (UWB)** infrastructure, and the connection with GVB's existing validation infrastructure.

In parallel, representative demonstration scenarios were prepared, end-users and stakeholders were recruited, integration and validation tests were performed, and the necessary communication, training and evaluation material was developed. These activities ensured that both the technical environment and the operational organisation were fully prepared prior to the Validation Event.

The following sections describe the main implementation activities carried out during this phase, including the preparation of the demonstration environment, participant recruitment, validation of the integrated solution, and the implementation of the mechanisms required to support the execution and evaluation of the demonstration.

### 10.1.1 Recruitment of end-users

The recruitment of end-users and validation participants was jointly coordinated by **Hitachi Rail (RCS France)** and **GVB** to ensure that the Validation Event involved representative users of the Amsterdam public transport network as well as operational stakeholders able to assess the demonstrated solution from both user and operator perspectives.

The recruitment strategy aimed to involve participants who were representative of the target population expected to benefit from hands-free travelling services. Particular attention was given to including travellers with different mobility profiles, such as regular commuters, occasional passengers and users travelling with luggage or experiencing temporary or mobility constraints. This approach ensured that the demonstrated solution could be evaluated under realistic usage conditions while addressing the inclusiveness objectives of the project.

In parallel, representatives from GVB and technical experts from Hitachi Rail participated in the Validation Event to observe the behaviour of the integrated solution, assess its operational performance, and provide expert feedback on its suitability for deployment within an operational transport environment.

The combination of representative end-users and transport professionals enabled the demonstrator to be evaluated from complementary perspectives, including usability, accessibility, passenger acceptance, operational integration, and technical reliability.

### 10.1.2 Deployment of demonstration environment

To support the execution of the Amsterdam Validation Event, a dedicated demonstration environment was deployed and integrated within the operational infrastructure of **GVB Amsterdam Central Station**. The objective of this environment was to reproduce realistic passenger journeys while ensuring seamless interaction between the newly developed Hands-Free components and the existing ticketing infrastructure.

The demonstrator was implemented within a representative operational environment, allowing the solution to be validated under real operating conditions while preserving the integrity of the production ticketing system. Existing GVB infrastructure, including the Ticketing back-office and access gates, was reused, and interconnected with the demonstrator components specifically developed within the project.

**Software deployment and configuration:**
The deployment included the installation, configuration and integration of all software components required to execute the demonstration scenarios.
The main software components were:

- **Hands-Free Control System (HFCS):** the central application responsible for managing wearable registration and hands-free validation workflows (processes access events and validates entitlements). The platform coordinated communications between the localisation system, the ticketing back-office, and the station infrastructure.
- **Real-Time Location Service (RTLS):** responsible for processing localisation events generated by the Ultra-Wideband infrastructure and determining passenger positions within the demonstration area. The RTLS supplied the localisation information required to trigger automatic validation events during station entry, station exit and passenger assistance scenarios.
- **GVB Ticketing Back-Office:** the existing fare system back-office provides fare rules and test product validation. It was connected to the demonstrator to verify travel rights and support the automatic validation process while ensuring compatibility with the operator's existing ticketing architecture.

All software components were interconnected through secure communication interfaces and configured to exchange localisation events, validation requests and ticketing information in real time throughout the demonstration.

**Hardware deployment and infrastructure setup:**
The demonstration required the deployment of several dedicated hardware components within Amsterdam Central Station while leveraging the existing station infrastructure provided by GVB.
The installed hardware included:

- **Ultra-Wideband (UWB) anchors:** strategically installed throughout the demonstration area (paid and unpaid zones) to provide high-precision localisation of passengers carrying wearable devices.
- **UWB wearable tags:** distributed to demonstration participants and used as the traveller identification media during the hands-free validation scenarios.
- **RTLS and HFCS servers:** installed within GVB facilities to host the localisation and hands-free services required during the demonstration.
- **Existing access gates:** already operational within the station and integrated with the demonstrator to support automatic hands-free validation.

Prior to the Validation Event, all newly installed equipment was tested for correct operation, communication performance and interoperability with the existing GVB infrastructure.

**System integration and operational validation:**
A comprehensive integration and verification campaign was carried out before the Validation Event to ensure that all software and hardware components operated as a single integrated system.
The validation activities confirmed:

- Correct communication between the UWB infrastructure, localisation platform and Hands-Free Control System;
- Successful interaction between the demonstrator and the GVB Ticketing back-office;
- Reliable detection of passenger movements throughout the demonstration area;
- Correct triggering of validation events at station access and exit points;
- Stable network connectivity and data exchange between all demonstrator components;
- Successful execution of the complete end-to-end demonstration scenarios.

Following the successful completion of these integration tests, the demonstration environment was declared fully operational and ready for the Validation Event, providing a stable and representative platform for evaluating the Hands-Free Seamless Travelling solution under realistic operational conditions.

### 10.1.3 Collect and process demonstration data

To prepare the Amsterdam demonstrator and ensure the correct execution of the Validation Event, several categories of operational and configuration data were collected, verified, and processed prior to deployment. These datasets were required to configure the Hands-Free validation system, calibrate the localisation infrastructure, and reproduce realistic passenger journeys within the operational environment provided by GVB.

The following data were collected and configured:

- **Fare and Ticketing Data:** Operational fare structures, ticketing products and validation rules supplied by GVB were used to configure the Ticketing back-office and ensure that the demonstrated validation scenarios reflected the operator's existing fare policy. These data enabled the verification of passengers' travel rights during the automatic hands-free validation process.
- **Station Layout and Access Control Data:** Detailed station maps describing entrances, exits, paid and unpaid areas, and passenger circulation paths were collected to define the operational context of the demonstration. These data were used to configure the automatic validation logic associated with station entry, exit and intermodal transfer scenarios.
- **UWB Infrastructure Configuration Data:** The precise positions of all UWB anchors deployed within the demonstration area were collected and configured in the Real-Time Location Server (RTLS). This information enabled accurate localisation of passengers carrying wearable tags and ensured reliable triggering of the hands-free validation events.
- **Detection Zone Configuration:** Detection areas, localisation thresholds and entry/exit zones were defined and calibrated to ensure consistent passenger detection throughout the demonstration. These parameters allowed the system to distinguish between different operational situations, including station access and station exit.
- **Wearable Registration Data:** Each UWB wearable tag distributed to participants was registered and associated with a demonstration user profile within the Hands-Free Control System (HFCS). This configuration enabled automatic identification of participants during the validation scenarios while maintaining full consistency between localisation events and ticketing information.
- **System Configuration Data:** Configuration parameters governing communication between the RTLS, HFCS, gates and the GVB Ticketing back-office were collected and verified to ensure reliable real-time information exchange throughout the demonstration.

Before the Validation Event, all collected datasets were validated to verify their consistency, completeness, and compatibility with the deployed software components. Configuration tests and end-to-end verification activities confirmed the correct interaction between localisation, ticketing, and validation services, ensuring that the demonstration environment accurately represented the operational conditions required to validate the Hands-Free Seamless Travelling solution.

### 10.1.4 Validation of demonstration data

Before the Validation Event, all datasets and configuration parameters used by the Amsterdam demonstrator were systematically verified to ensure that the Hands-Free validation service operated reliably under representative operational conditions. The objective of this validation phase was not to certify the operational datasets provided by GVB, but to confirm that the configured environment was complete, coherent, and suitable for demonstrating the targeted use cases.

The validation process covered both the reference data used to configure the demonstrator and the operational parameters governing the interaction between the localisation infrastructure, the ticketing back-office and the station equipment. Particular attention was given to the consistency

between station topology, UWB localisation zones and the automatic validation logic implemented by the Hands-Free Control System (HFCS).
The validation activities included:

- Verification of the consistency between station maps and configured detection zones;
- Confirmation of the correct positioning and calibration of all deployed UWB anchors;
- Verification of the registration and association of wearable UWB tags with the corresponding demonstration user profiles;
- Validation of fare products and travel entitlement configurations within the GVB Ticketing back-office;
- Verification of the communication interfaces between the Real-Time Localisation System (RTLS), the HFCS, the gates and the ticketing back-office;
- Confirmation of the correct exchange of localisation events, validation requests and access authorisation messages across all integrated systems.

As the demonstrator relied on real-time localisation information, dedicated end-to-end tests were also performed prior to the Validation Event to verify the complete data collection and processing chain. These tests confirmed that localisation events generated by the UWB infrastructure were correctly captured by the RTLS, processed by the HFCS, and translated into automatic check-in, check-out, and station access validation events within the ticketing system.

The successful completion of these verification activities confirmed that the demonstration environment was fully operational and that all data processing workflows behaved consistently under representative operating conditions, providing a reliable basis for the TRL 7 validation of the Hands-Free Seamless Travelling demonstrator.

### 10.1.5 Integration tests

Prior to the Validation Event, a comprehensive integration test campaign was carried out to verify that all components of the Hands-Free Seamless Travelling demonstrator operated as a fully integrated system. The objective was to ensure the correct interaction between the newly deployed UWB-based localisation infrastructure, the existing GVB ticketing environment, and the software components developed by GTSD before involving end-users in the validation activities.

Particular attention was paid to the end-to-end integration of the different subsystems responsible for localisation, ticketing validation, access control and passenger assistance. Since the demonstrator combines existing operational infrastructure with newly developed services, the integration tests focused on verifying that information was exchanged reliably and in real time between all participating components.
The integration testing activities addressed the following objectives:

- Verification of the communication between the UWB anchors and the Real-Time Location Server (RTLS);
- Validation of the interface between the RTLS and the Hands-Free Control System (HFCS);
- Verification of the interaction between the HFCS and the GVB Ticketing back-office;
- Validation of the communication between the HFCS and the fare gates responsible for granting passenger access;
- Verification of the passenger assistance workflow, including the generation and delivery of notifications to station staff;

- Confirmation of the consistency and integrity of localisation events, validation requests and access authorisation messages throughout the complete processing chain.

Several integration and verification campaigns were conducted during the preparation phase, combining hardware integration tests, software integration tests, communication interface verification and functional qualification tests. These activities were performed using representative operational data and pre-configured UWB wearable tags within the Amsterdam Central station environment.

The main integration tests covered the four demonstration use cases implemented during the Validation Event, as summarised in the following table:

| Use Case | Integrated Components | Test Type | Purpose of the Integration Test |
|---|---|---|---|
| **UC-FP1-WP19-22 – Hands-Free UWB Walk-in** | UWB Anchors, RTLS, HFCS, GVB Back-office, Gates | Hardware, Software & Interface Integration | Verification of the complete automatic check-in workflow, ensuring that passenger localization correctly triggers ticket validation and gate opening. |
| **UC-FP1-WP19-23 – Hands-Free UWB Walk-out** | UWB Anchors, RTLS, HFCS, GVB Back-office, Gates | Hardware, Software & Interface Integration | Validation of the automatic check-out sequence and confirmation of the correct interaction between localization, ticket validation and exit authorization. |
| **UC-FP1-WP19-24 – Hands-Free Intermodal Transfer** | UWB Anchors, RTLS, HFCS, GVB Back-office | Functional & Interface Integration | Verification that localization events generated after station exit correctly trigger the contextual passenger guidance associated with the intermodal transfer scenario. |
| **UC-FP1-WP19-25 – Hands-Free In-Station Assistance** | UWB Anchors, RTLS, HFCS, GVB Back-office, SMS Notification Service | Functional & Interface Integration | Validation of the automatic assistance workflow, ensuring that the arrival of a registered passenger requiring assistance generates the expected notification to station staff. |

In addition to the individual integration tests, complete end-to-end integration scenarios were executed to verify the overall demonstrator workflow under representative operational conditions. These scenarios validated the following sequence of operations:

1. Detection of the passenger carrying a registered UWB wearable tag;
2. Real-time localisation by the RTLS;
3. Continuous position updates transmitted to the HFCS;
4. Verification of travel entitlement through the GVB Account-Based Ticketing back-office;
5. Access authorisation and gate control;
6. Generation of contextual events, including transfer guidance or assistance notifications where applicable.

The successful completion of these integration tests confirmed that all software components, communication interfaces and hardware elements operated correctly as a unified ecosystem. The demonstrator was therefore considered fully integrated and operationally ready for the Validation Event, providing a representative environment for the TRL 7 validation of the Hands-Free Seamless Travelling solution.

### 10.1.6 Develop training materials

To ensure the successful execution of the Validation Event and enable effective participation from both demonstration participants and operational staff, a dedicated set of training materials was prepared during the implementation phase. The objective was to provide all participants with a common understanding of the Hands-Free Seamless Travelling demonstrator, its operational principles, the validation scenarios, and their respective roles during the demonstration.

The training material was designed to accommodate participants with different technical backgrounds, including GTSD engineers, GVB operational staff and demonstration participants. Particular emphasis was placed on ensuring that end-users could naturally interact with the Hands-Free solution without requiring extensive technical knowledge, while providing meaningful feedback on the demonstrated solution.

**Training Objectives:**
The training materials were developed to enable participants to:

- Understand the objectives and scope of the Hands-Free Seamless Travelling demonstrator;
- Become familiar with the principles of UWB-based hands-free validation and its interaction with the existing GVB ticketing infrastructure;
- Understand the different components involved in the demonstration;
- Learn how to use the pre-configured wearable UWB tags during the demonstration scenarios;
- Understand the sequence of activities associated with each demonstration use case;
- Become familiar with the validation process, the expected observations, and the feedback collection methodology.

**Training Sessions:**
Two dedicated preparation sessions were organized before the Validation Event.

- **Briefing Session:** An initial briefing session was organized during the preparation phase to introduce the demonstration objectives, review the overall validation approach, and clarify the responsibilities of the different participants. The session included:
  - Presentation of the demonstrator architecture and overall system concept;
  - Introduction to the Hands-Free Seamless Travelling use cases;
  - Explanation of participant roles during the Validation Event;
  - Review of the demonstration schedule and operational procedures;
  - Question-and-answer session with GTSD and GVB teams.

- **Pre-Demonstration Session:** A second preparation session was conducted approximately two weeks before the Validation Event to perform the final operational checks and ensure that all participants were fully prepared. The session included:
  - Detailed walkthrough of each demonstration scenario;
  - Verification of the wearable UWB tag registration and allocation;
  - Confirmation of communication between the different system components;
  - Execution of complete dry-run scenarios under operational conditions;
  - Final coordination of participant roles and demonstration logistics.

**Training Materials:**
A concise but comprehensive training package was prepared and shared with the demonstration participants.

- **Presentation Material:** A dedicated presentation was developed covering:
  - Demonstration objectives and expected outcomes;
  - Overview of the Hands-Free Seamless Travelling concept;
  - Architecture of the demonstrator and interaction between its components;
  - Description of the demonstration scenarios;
  - Participant responsibilities;
  - Validation process and feedback collection activities.

- **Operational User Guide:** A practical user guide was prepared to support the execution of the demonstration. Rather than providing detailed software instructions, the guide focused on the operational aspects of the Validation Event and included:
  - Instructions for using the wearable UWB tags;
  - Description of the participant journey during each demonstration scenario;
  - Explanation of the expected system behaviour at each step;
  - Practical guidance for the validation activities and observation points.

**Dry-Run Demonstrations:**
Several rehearsal sessions were carried out using the final demonstration environment before the Validation Event. These dry runs enabled GTSD and GVB teams to verify the complete operational workflow, validate the interaction between participants and the demonstrator, and confirm that all technical and organisational procedures were fully understood before the live demonstration.

**Training Outcomes:**

The training activities ensured that all participants shared a common understanding of the demonstrator objectives, the validation methodology and the operational procedures. By combining briefing sessions, presentation material, practical user guidance and full-scale dry runs, the preparation phase significantly reduced operational risks and contributed to the smooth execution of the Validation Event. It also ensured that the feedback collected during the demonstration reflected the participants' assessment of the demonstrated functionalities rather than difficulties related to the execution of the scenarios.

### 10.1.7 Perform installations (if necessary)

Prior to the Validation Event, the physical and software installation activities required to make the Amsterdam demonstration environment operational were completed in coordination with GVB. The installation was performed within the existing operational infrastructure of Amsterdam Central Station, while ensuring that the deployment remained compatible with the station's existing ticketing and access-control equipment.
The following installations were carried out prior to the Validation Event:

- **Real-Time Location Server (RTLS):** installed on-premises in the station server room and configured to receive and process positioning information generated by the UWB infrastructure.
- **Hands-Free Control System (HFCS):** installed on-premises and configured to process localisation information received from the RTLS and interact with the existing ticketing and gate infrastructure.
- **UWB Anchors:** installed at predefined positions within the demonstration area of the station. Their locations were configured in the RTLS to provide the detection and positioning capabilities required for the hands-free validation scenarios.
- **UWB Wearable Tags:** prepared and registered in the back-office environment for use by the demonstration participants.
- **Communication and network infrastructure:** connectivity between the newly installed components and the existing GVB systems was configured and verified to ensure reliable communication during the demonstration.

The existing **GVB ticketing back-office and automatic validation gates** did not require physical installation, as these components were already deployed and operational at the station. The integration activities therefore focused on connecting the newly installed RTLS and HFCS components with the existing infrastructure required for hands-free validation.

Following installation, technical checks were performed to verify system connectivity, component communication, UWB detection and positioning, and the correct interaction with the automatic gates and back-office services. Installation and testing activities were coordinated with GVB and carried out in accordance with the applicable site access, safety, and operational requirements.

The completion of these activities ensured that the physical and software infrastructure required for the demonstration was installed, configured and ready for the Validation Event in the operational environment of Amsterdam Central Station.

### 10.1.8 Validation tests

Prior to the Validation Event, a dedicated validation campaign was conducted to confirm that the Amsterdam demonstrator was sufficiently stable and reliable for execution in the operational environment. The validation activities focused on the correct behaviour of the implemented UWB-based use cases and on verifying that the expected passenger and system interactions could be consistently reproduced.

The validation tests were performed by **GTSD technical experts**, with support from **GVB operational staff**. The testing team was responsible for executing the predefined scenarios, observing the system behaviour, checking the expected outcomes, and identifying any issues requiring correction before the Validation Event.
The validation campaign covered the following scenarios:

- **UC-FP1-WP19-22 – Hands-Free UWB Walk-in:** verification that a registered UWB wearable enables automatic access through the gate when the passenger enters the defined detection and entry zones, without any physical validation gesture (e.g., tapping a contactless card or device at a gate or validator).
- **UC-FP1-WP19-23 – Hands-Free UWB Walk-out:** verification of automatic check-out and exit the closed area through the gate using the same UWB wearable tag, again without requiring any validation gesture.
- **UC-FP1-WP19-24 – Hands-Free Intermodal Transfer:** verification that the exit event is correctly followed by the provision of transfer information between different mobility modes.
- **UC-FP1-WP19-25 – Hands-Free In-Station Assistance:** verification that the detection of a passenger associated with an assistance profile triggers the expected notification to station staff.

For each scenario, the testers followed the predefined sequence and checked the expected system response. Particular attention was given to the correct detection of the UWB wearable, the transition between positioning zones, the triggering of the corresponding validation or assistance event, and the resulting interaction with the station equipment and user-facing services. These scenarios and their expected results were defined in the demonstration test specifications.

The validation also included checks of representative operational conditions, such as repeated passenger passages and different positioning situations, in order to verify the stability and responsiveness of the solution before the event. The test objectives included confirming accurate UWB positioning and zone detection, correct RTLS and HFCS processing, and the proper behaviour of the system for intermodal transfer and assistance scenarios.

The validation results were reviewed by the testing team against the expected outcomes defined for each scenario. Any discrepancies observed during the preparation phase were analysed and addressed before the Validation Event. The successful completion of the validation tests provided the necessary confidence that the demonstrator was ready for execution in the operational environment of Amsterdam Central Station.

### 10.1.9 Communication and Dissemination before demonstration execution

Prior to the Validation Event, the communication and dissemination activities were carried out to ensure that the stakeholders involved in the demonstration were adequately informed, coordinated, and prepared. The activities followed the communication approach defined during the demonstration preparation phase and focused on supporting the successful execution of the event and ensuring appropriate visibility of the demonstration.

**Stakeholder Engagement and Invitations:**
Targeted communication was provided to the stakeholders involved in the Validation Event, including GTSD, GVB, technical contributors, operational staff, and selected test users. The shared information covered:

- The objectives and scope of the demonstration;
- The demonstration scenarios and expected outcomes;
- The roles and responsibilities of participants;
- The planned Validation Event agenda and schedule;
- Practical information concerning access to the demonstration environment;
- Technical and operational prerequisites for participation.

This ensured that participants had a common understanding of the demonstration activities and their expected contribution.

**Communication of Demonstration Objectives and Key Messages:**
Preparatory communication focused on the main innovation addressed by the Amsterdam demonstration, namely **hands-free and contactless access based on UWB technology**. Particular emphasis was placed on the expected benefits of seamless passenger interaction, accessibility, and improved passenger experience, including for passengers requiring assistance.

The communication also highlighted the demonstration context and the role of the technology in supporting seamless interactions between travellers, station infrastructure, and back-office systems.

**Dissemination and Outreach:**
In parallel with the preparation of the Validation Event, dissemination activities were initiated to support the visibility of the demonstration within the project and the wider mobility and railway communities. These activities included the preparation of communication material for future presentations and dissemination activities, as well as the sharing of information on the demonstration objectives, technological approach, and expected outcomes with relevant project and industry stakeholders.

The dissemination approach also prepared the basis for communicating the demonstration results through dedicated events and other appropriate project communication channels following completion of the validation activities.

**Distribution of Preparatory Information:**
Participants were provided with the information required to prepare for the Validation Event, including the demonstration schedule, scenario descriptions, practical instructions, and supporting training material. The preparatory briefings and pre-demonstration exchanges also provided an opportunity to clarify responsibilities, review the planned execution sequence, and address any remaining questions before the event.

Overall, these communication and dissemination activities ensured that the relevant participants were informed and prepared for the Validation Event, while establishing the basis for the subsequent dissemination of the demonstration results and lessons learned.

### 10.1.10 Implementation of measures to gather results and KPI measurements

To support the evaluation of the Amsterdam demonstration, measures were implemented to collect objective technical evidence and user-oriented feedback during the Validation Event. The measurement approach was designed to verify the correct execution of the demonstrated scenarios and to provide evidence for the assessment of the expected outcomes and relevant performance indicators.

The implemented measures focused on three complementary areas: **system operation, demonstration outcomes, and user experience**.

**System Monitoring and Evidence Collection:**
The demonstration environment was configured to capture the information required to analyse the behaviour of the hands-free solution during the test scenarios. In particular, system logs and back-office data were used to record and verify:

- UWB tag detection and positioning events generated by the RTLS;
- Detection of passenger movements through the configured station zones;
- Validation and access-control events processed by the HFCS;
- Commands exchanged between the HFCS and the station gates;
- Completion of walk-in and walk-out sequences;
- Detection of intermodal transfer events and associated passenger guidance;
- Detection of the assistance scenario and generation of the corresponding staff notification.

These records provided traceable technical evidence of the interactions between the UWB infrastructure, back-office components, and station equipment.

**Outcome and KPI Measurement:**
For each demonstrated scenario, the expected behaviour was defined in advance and the corresponding system observations were collected during execution. The following evidence was used to assess the main outcome areas:

| Outcome / KPI Area | Evidence Collected | Evaluation Objective |
|---|---|---|
| **Hands-Free Access** | RTLS/HFCS logs and gate access events | Verify successful automatic walk-in and walk-out without manual validation |

| | | |
|---|---|---|
| **UWB Detection and Positioning** | UWB/RTLS system logs | Verify reliable detection and tracking within the configured zones |
| **Validation Processing** | HFCS and back-office records | Confirm correct recognition of the travel entitlement and triggering of the appropriate access event |
| **Intermodal Transfer** | Transfer-related system events and demonstration observations | Verify continuity of the passenger journey and provision of the expected transfer indication |
| **Station Assistance** | Detection events and notification records | Verify that the presence of a passenger requiring assistance triggers the expected staff notification |
| **End-to-End Execution** | Test records, system logs and observations | Confirm successful completion of the defined demonstration scenarios |
| **User Experience** | Questionnaires, interviews, and direct observations | Assess ease of use, perceived seamlessness, accessibility, and overall satisfaction |

The collection mechanisms were configured and tested before the Validation Event to ensure that the relevant events could be captured throughout the demonstration without requiring additional intervention from the test users.

**User Feedback Collection:**
In addition to technical measurements, dedicated mechanisms were prepared to capture qualitative feedback from participants. Short questionnaires and structured discussions were used to assess aspects that cannot be derived from system logs alone, including:

- Ease of use of the hands-free interaction;
- Perceived convenience compared with conventional validation;
- Clarity of the passenger interaction and guidance;
- Perceived accessibility and relevance for passengers with specific mobility needs;
- Overall satisfaction with the demonstrated experience;
- Perceived operational relevance of the solution.

The feedback collected during the Validation Event was subsequently consolidated with the technical evidence to support the evaluation presented in the following sections.

Overall, the implemented measurement mechanisms provided a combination of **system-generated evidence, test observations, and user feedback**, allowing the demonstration outcomes to be assessed against the expected behaviour and providing a consistent evidence base for the subsequent KPI and impact evaluation.

### 10.1.11 Questionnaire and interviews guides for stakeholders/end-users

To support the evaluation of the Amsterdam demonstration, a structured feedback collection approach was prepared for use during and after the Validation Event. The objective was to complement the technical evidence collected from the demonstration environment with the

perceptions and experiences of end-users and stakeholders, with particular attention to usability, accessibility, seamlessness, operational relevance, and the potential for future deployment.

The feedback approach combines a **post-demonstration questionnaire** with **structured interviews and discussions**. This combination allows both comparable feedback across participants and more detailed qualitative observations to be collected.

**End-User Questionnaire:**
A short questionnaire was prepared for participants after completing the demonstration scenarios. The questions were designed to remain accessible to participants with different technical backgrounds and to focus on their direct experience rather than on the underlying implementation.
The questionnaire covers the following topics:

- **Participant Profile**
  - What is your role in relation to public transport or mobility?
  - How frequently do you use public transport?
  - Have you previously used contactless or hands-free travel services?
- **Demonstration Experience**
  - How clearly were the objectives and demonstration scenarios explained?
  - How easy was it to understand and follow the demonstrated passenger journey?
  - How would you rate the overall demonstration experience?
- **Hands-Free Travel Experience**
  - How easy was it to enter and exit the controlled area without manually presenting a ticket or device?
  - How natural and intuitive was the hands-free interaction?
  - Did the absence of a physical validation action improve the travel experience?
  - How confident did you feel that the system correctly recognized and validated your travel right?
- **Seamless Intermodal Travel**
  - How useful was the demonstrated support for transferring between transport modes?
  - Was the information provided during the transfer clear and understandable?
  - To what extent could such a solution make multimodal journeys easier?
- **Accessibility and Passenger Assistance**
  - Do you consider the demonstrated approach relevant for passengers with reduced mobility or other specific needs?
  - How useful would automatic passenger detection and staff notification be in an operational station environment?
  - What aspects could be improved to make the service more accessible?
- **Usability and Acceptance**
  - How easy would the solution be to use in everyday travel?
  - Would you feel comfortable using a hands-free validation service regularly?
  - Would you recommend such a service to other passengers?
- **Open Feedback**
  - What was the most useful or valuable aspect of the demonstration?
  - What was the most challenging or least convincing aspect?
  - What improvements would you recommend before wider deployment?

- Do you have any additional comments or suggestions?

**Stakeholder Interview Guide:**
Structured discussions and interviews were prepared to collect complementary feedback from stakeholders involved in or observing the demonstration. The questions were adapted according to the participant's role and focused on the operational and deployment implications of the demonstrated solution.

- **Transport Operators and Infrastructure Stakeholders**
  - **Operational relevance:** How could hands-free validation improve passenger flows and station operations?
  - **Integration:** How compatible do you consider the demonstrated approach with existing station and ticketing infrastructure?
  - **Passenger experience:** What benefits could hands-free interaction provide compared with conventional validation?
  - **Accessibility:** How could the solution contribute to improving services for passengers requiring assistance?
  - **Deployment:** What would be the main technical, operational, or organisational barriers to deploying the solution at a larger scale?
- **Technical and Project Experts**
  - **Technical assessment:** Which aspects of the demonstrated solution provide the greatest added value?
  - **System integration:** How do you assess the interaction between UWB positioning, the hands-free control system, gates, and the existing back-office environment?
  - **Reliability:** Were there any technical aspects that could affect the robustness of the solution in a larger operational environment?
  - **Scalability:** What additional technical developments would be required for deployment across multiple stations or transport networks?
  - **Future development:** Which functionalities or integration aspects should be prioritised in subsequent development phases?
- **End-Users and Passenger Representatives**
  - **Ease of use:** How did the hands-free interaction compare with conventional ticket validation from a passenger perspective?
  - **Accessibility:** Could the demonstrated approach make station access easier for passengers with specific mobility needs?
  - **Trust and confidence:** Did the automated nature of the validation process provide sufficient confidence that the journey rights were correctly recognized?
  - **Adoption:** What would encourage or discourage you from using such a service in everyday travel?

**Use of Collected Feedback:**
The questionnaire responses and interview discussions were intended to provide qualitative and, where applicable, quantitative evidence for the evaluation of the demonstration. The collected feedback supports:

- Assessment of user satisfaction and acceptance;
- Evaluation of the perceived usability and seamlessness of the hands-free experience;
- Assessment of the accessibility and operational relevance of the demonstrated services;
- Identification of technical, operational, and usability improvements;

- Evaluation of the potential for future deployment and scaling.

The feedback collection approach therefore complements the system-generated evidence described in the preceding sections and provides the user and stakeholder perspective required for the subsequent evaluation of the demonstration outcomes and impacts.

## 10.2 Demo execution phase

The Demo Execution Phase comprised the on-site operation of the demonstrator during the Validation Event at Amsterdam Central Station. The activities focused on executing the predefined demonstration scenarios under representative operational conditions, while collecting technical evidence, observations, and feedback from the participating users and stakeholders.

The execution followed the procedures and roles established during the implementation phase. Participants were guided through the relevant scenarios, while the technical team and GVB operational staff monitored the system behaviour and supported the execution where required. Particular attention was given to the correct interaction between the UWB wearable tags, station infrastructure, back-office components, and passenger access mechanisms.
During the execution, the following activities were performed:

- **Participant onboarding and briefing:** Participants were introduced to the demonstration procedure and provided with the necessary instructions before taking part in the scenarios.
- **Execution of demonstration scenarios:** The predefined hands-free travel scenarios were performed, including hands-free walk-in and walk-out, seamless intermodal transfer, and automatic detection supporting station assistance.
- **Technical monitoring:** System events and operational behaviour were monitored during the execution to verify correct detection, positioning, validation processing, access control, and communication between the integrated components.
- **Collection of demonstration evidence:** Relevant system logs, validation events, gate operations, transfer events, and assistance notifications were recorded to provide evidence of the actual system behaviour.
- **User and stakeholder feedback:** Participants were invited to provide feedback on their experience, with particular attention to ease of use, seamlessness, accessibility, clarity of the interaction, and perceived operational value.
- **On-site observations:** Observations from the technical and operational teams were collected to identify any relevant issues, constraints, or opportunities for improvement.

The combination of controlled test execution and operation within the station environment enabled the demonstrator to be assessed not only from a technical perspective but also in terms of its interaction with passengers and existing operational processes. The results and evidence collected during this phase form the basis for the detailed evaluation presented in the subsequent sections of this deliverable.

### 10.2.1 Software distribution to end users

No dedicated software installation was required on the end-user devices for the Validation Event. The demonstrated functionality relied primarily on the UWB wearable tags and the station infrastructure, while the associated processing was handled by the back-office components deployed as part of the demonstration environment.

Participants therefore did not need to install or configure specialised software on their personal devices to perform the planned scenarios. The necessary access and operational instructions were provided during the preparatory activities described in the previous sections.

For the assistance scenario, the relevant notification mechanism was made available to the designated GVB operational staff. Technical users involved in the demonstration were provided with the appropriate access to the monitoring and back-office interfaces required for supervision and verification of the system behaviour.

Before the Validation Event, the required access, connectivity, and user permissions were checked to ensure that the participants and operational staff could use the relevant interfaces when required. This approach limited the technical preparation required from end-users and allowed the Validation Event to focus on the actual passenger experience and operational behaviour of the hands-free solution.

Overall, software distribution to end-users was therefore limited to providing the necessary access and instructions for the interfaces used during the validation, while the core processing and control functions remained within the configured demonstration environment.

### 10.2.2 End users/outsiders training

As described in Section 10.1.6 (Develop Training Materials), the preparation phase included dedicated briefing and pre-demonstration activities to ensure that participants were familiar with the demonstration objectives, their roles, and the expected execution of the Validation Event.

The **Briefing Session** provided participants with an overview of the demonstration, the hands-free travel concept, the main validation scenarios, and the expected sequence of activities. The session also clarified the responsibilities of the different participants, including the technical team, GVB operational staff, and test users.

A **Pre-Demonstration Session** was conducted shortly before the Validation Event to review the final execution arrangements and ensure that participants understood the practical procedures to be followed. The session included a walkthrough of the planned passenger scenarios, clarification of the expected system behaviour, and a review of the roles of the participants during each scenario.

Particular attention was given to ensuring that test users understood how to participate in the hands-free travel scenarios, including the expected behaviour when approaching the relevant station areas and access points. GVB operational staff were also briefed on the procedures associated with the assistance scenario and the handling of the corresponding notifications.

Where appropriate, **dry-run exercises** were performed to familiarise participants with the demonstration sequence and verify that the planned procedures could be followed correctly in the operational environment. Any questions or practical issues identified during these sessions were addressed before the Validation Event.

The training and briefing activities ensured that participants entered the Validation Event with a common understanding of the demonstration procedure, their respective responsibilities, and the expected results. This contributed to a controlled execution of the scenarios and allowed participants to focus on the actual user experience and validation of the demonstrated services.

### 10.2.3 Data collection for real-time demonstrations

The Amsterdam demonstration was conducted in an operational station environment, requiring the collection of system data during the execution of the scenarios to capture the behaviour of the hands-free service in real time. The data collection mechanisms implemented during the preparation phase were therefore activated throughout the Validation Event.

The main source of real-time evidence was the interaction between the **UWB infrastructure, RTLS, HFCS, and station access equipment**. During each scenario, the system generated and processed events corresponding to passenger detection, positioning, validation, access control, transfer support, and assistance notification.
The following information was collected during the demonstration:

- **UWB detection and positioning events**, recording the detection and movement of the wearable tags within the configured station zones;
- **RTLS processing information**, providing evidence of the continuous positioning and zone detection performed during passenger movements;
- **HFCS validation events**, including the processing of travel rights and the triggering of access-control actions;
- **Gate interaction events**, allowing the correspondence between system validation and the actual opening of the relevant access point to be verified;
- **Transfer-related events**, supporting the verification of the transition between the access-control sequence and the provision of transfer guidance;
- **Assistance-related events**, including the detection of the relevant passenger profile and generation of the notification to station staff.

The collected data were associated with the corresponding demonstration scenarios to enable comparison between the **expected sequence of events and the actual system behaviour**. This provided evidence for determining whether each scenario was completed successfully and whether the different components responded in the expected sequence.

Real-time monitoring was also used by the technical team during the Validation Event to identify potential anomalies and, where necessary, support the participants during execution. The collection of these operational records complemented the observations and user feedback gathered during the event.

The resulting datasets and system records were retained as evidence for the subsequent evaluation of demonstration outcomes and performance indicators described in the evaluation phase.

### 10.2.4 Validation Event

The Validation Event represented the central activity of the Demo Execution Phase and provided the main opportunity to validate the hands-free solution under representative operational conditions at **Amsterdam Central Station**, in cooperation with GVB. The event was designed as a live, hands-on demonstration involving the technical team, GVB operational staff, and selected end-users. The planned approach was to combine technical validation with direct observation of the passenger experience and operational interaction. The demonstration plan targeted **TRL 7**.

The Validation Event followed the preparatory activities described in the previous sections. Before the user sessions, the technical team and GVB staff performed the necessary on-site checks and briefings to confirm the readiness of the demonstration environment. Participants were then introduced to the demonstration procedure and guided through the relevant passenger scenarios. The validation was structured around the following sequence:

1. **Introduction and briefing:** presentation of the demonstration objectives, validation approach, roles, and expected outcomes.
2. **On-site readiness checks:** confirmation that the UWB infrastructure, wearable tags, back-office components, and access-control equipment were operational.
3. **Hands-on passenger demonstrations:** execution of the predefined UWB-based scenarios by selected participants.
4. **Technical monitoring:** observation of UWB detection, positioning, validation processing, and interaction with the station access infrastructure.
5. **Collection of technical evidence:** recording of system events and observations generated during the different scenarios.
6. **User and stakeholder feedback:** collection of participants' observations regarding ease of use, seamlessness, accessibility, and overall experience.

The core of the Validation Event consisted of the execution of the four UWB-based scenarios defined for the Amsterdam demonstration.

**UC-FP1-WP19-22 – Hands Free: UWB Walk-in:**
The first scenario demonstrated hands-free entry into the controlled area. A participant equipped with a registered UWB wearable entered the detection zone. The UWB anchors detected the wearable and transmitted the positioning information to the RTLS. The RTLS continuously calculated the position and updated the HFCS, which verified the travel entitlement and monitored the passenger's movement towards the entry zone. When the passenger reached the appropriate zone, the HFCS triggered the access-control mechanism and the gate granted passage.
This scenario directly demonstrated the core hands-free principle: the passenger could access the controlled area without presenting or tapping a physical ticket or device. The underlying test sequence and expected automatic access were defined in the demonstration plan.

**UC-FP1-WP19-23 – Hands Free: UWB Walk-out:**
The second scenario continued the passenger journey and demonstrated hands-free exit from the controlled area. The same UWB-based detection and positioning mechanism was used on the exit side. The RTLS tracked the wearable and provided the relevant information to the HFCS, which verified the passenger's entitlement to exit and triggered the gate when the passenger entered the defined exit zone.
The scenario therefore validated the continuity of the hands-free interaction beyond entry and demonstrated the corresponding exit process without requiring a manual validation gesture.

**UC-FP1-WP19-24 – Hands Free: UWB Intermodal Transfer:**
The third scenario addressed the intermodal dimension of the demonstration. Following the hands-free exit sequence, the passenger proceeded towards the next stage of the journey. The scenario demonstrated how the hands-free interaction could be combined with contextual information supporting a transfer between transport modes.

This use case was particularly relevant to the operational context of Amsterdam Central Station, which serves both rail and metro services and was selected specifically because of its intermodal characteristics.

**UC-FP1-WP19-25 – Hands Free: UWB In-Station Assistance:**
The fourth scenario addressed the use of UWB technology to support passengers requiring assistance. A UWB wearable associated with the relevant passenger profile was detected when entering the configured detection area. The RTLS communicated the detected position to the HFCS, which identified the relevant profile and initiated the notification mechanism for station staff.

This scenario extended the hands-free concept beyond ticket validation and illustrated how the same positioning infrastructure can support passenger assistance within the station environment.

Throughout the Validation Event, the technical team monitored the interaction between the UWB anchors, wearable tags, RTLS, HFCS, and access-control infrastructure. The demonstration approach was designed to provide evidence of reliable detection, correct validation processing, appropriate triggering of access events, and the overall responsiveness of the integrated solution. The project presentation identified validation success rate, system reliability, latency, system logs, and passenger-flow-related measurements as relevant evidence for assessing the demonstration outcomes.

In parallel with the technical validation, participants were invited to provide feedback on the passenger experience. Particular attention was given to the perceived simplicity of the hands-free interaction, the absence of a physical validation gesture, the continuity of the passenger journey, and the relevance of the approach for accessibility and assistance services.

The Validation Event therefore provided evidence from three complementary perspectives: **technical operation of the UWB-based solution, integration with the existing station environment, and user experience**. This combination was essential for assessing the feasibility of deploying hands-free services in a real operational mobility hub rather than evaluating the technology solely under laboratory conditions.

A professional video was also produced during and following the Amsterdam validation activities, providing visual evidence of the demonstration environment and the hands-free passenger experience. The video can be referenced as complementary demonstration evidence: Task 23.3 – Amsterdam Validation Event video.

Overall, the Validation Event provided the principal practical evidence for assessing the Amsterdam demonstrator against its objectives. It demonstrated the operation of UWB-based hands-free access and its extension to intermodal transfer and in-station assistance, while allowing technical and user-oriented observations to be collected under representative operational conditions.

### 10.2.5 Data collection for outcome and Performance indicator (PI) measurements

During the Validation Event, a structured set of technical, operational, and user-related data was collected to provide the evidence required for the evaluation activities in Phase 4. The collection focused on capturing the actual results generated during the execution of the demonstration scenarios, rather than repeating the measurement mechanisms and procedures described in Section 10.1.10.
The collected data covered the following main categories.

**Technical and Operational Data:**
Evidence generated during the execution of the hands-free scenarios was collected from the demonstration environment, including:

- UWB detection and positioning events generated by the UWB anchors and wearable tags;
- RTLS position and tracking information associated with passenger movements through the configured zones;
- HFCS validation events, including the identification and processing of passenger travel rights;
- Access-control events generated by the gates, including successful and unsuccessful access attempts;
- Records of walk-in and walk-out validation transactions;
- Data related to intermodal transfer detection and associated passenger information;
- Records of notifications generated for the in-station assistance scenario;
- System logs and timestamps supporting the analysis of validation success, response time, reliability, and potential processing issues.

These records provide the factual evidence required to reconstruct the execution of the different scenarios and assess whether the expected system behaviour was achieved.

**Outcome-Oriented Data:**
The collected data were also organized according to the main expected outcomes of the Amsterdam demonstration.

- **Outcome 1 – Successful frictionless validation:**
  Data related to successful and unsuccessful UWB validation events were collected to verify whether passengers could enter and exit the controlled areas without performing a physical validation action.
- **Outcome 2 – Seamless system operation and integration:**
  Detection events, positioning information, HFCS processing records, and gate-control events were collected to assess the continuity of the processing chain from passenger detection to access authorization.
- **Outcome 3 – Support for intermodal and inclusive mobility:**
  Records associated with transfer scenarios and in-station assistance were collected to verify the correct triggering of the corresponding services following passenger detection and validation.
- **Outcome 4 – User experience:**

Feedback collected from participating end-users and stakeholders was retained to complement the technical evidence with their perception of ease of use, seamlessness, accessibility, and overall experience.

**Performance Indicator (PI) Evidence:**
The collected datasets provide the basis for assessing the relevant Performance Indicators and demonstrating the effectiveness of the solution during the Validation Event. In particular, the evidence supports the assessment of:

- **Validation success rate**, based on the proportion of expected validation transactions successfully completed;
- **Validation reliability**, based on the occurrence of errors, incorrect or multiple validation events, and successful execution of the defined scenarios;
- **System responsiveness and latency**, based on timestamps recorded throughout the detection, positioning, validation, and access-control sequence;
- **Passenger-flow performance**, including the number and successful processing of passages during the demonstration;
- **Correct execution of transfer and assistance events**, based on the corresponding system records;
- **User acceptance and perceived usability**, based on the feedback provided by participating end-users and stakeholders.

This analysis will enable comparison between the expected and observed results, calculation or assessment of the relevant PIs, identification of deviations or limitations, and formulation of conclusions regarding the performance and maturity of the hands-free solution. The approach is consistent with the demonstration plan, which identifies validation success rates, reliability, latency, system logs, and passage rates as relevant measurements for assessing the demonstration outcomes.

Overall, the data collected during the Validation Event constitute the evidence base for the subsequent evaluation of the Amsterdam demonstration, allowing the technical performance, operational behaviour, and user-oriented outcomes of the solution to be assessed in the relevant operational environment.

### 10.2.6 End-user interviews

During the Validation Event, qualitative feedback was collected directly from participants through short, structured interviews and informal discussions following the execution of the demonstration scenarios. The objective was to capture immediate user perceptions of the hands-free experience and obtain feedback from participants with direct knowledge of the operational environment.
Particular attention was given to the following aspects:

- Overall understanding and ease of use of the hands-free interaction;
- Perceived convenience of entering and exiting the controlled area without a physical validation action;

- Perception of the continuity and seamlessness of the passenger journey;
- Relevance of the solution for passengers requiring additional assistance;
- Perceived suitability of the technology for an operational public-transport environment;
- Observations regarding the integration of the solution with existing station operations;
- Potential improvements and considerations for future deployment.

The interviews included **end-users with technical and operational expertise**, providing complementary perspectives on the demonstrated solution and its potential use in an operational station environment. Their feedback was particularly relevant for assessing not only the passenger-facing experience but also the practical implications of integrating the technology into existing operational processes.

The interviews were intentionally kept concise and focused on the participants' direct experience of the demonstration. This approach complemented the technical evidence collected during the Validation Event by providing qualitative insights.

Two interviews were recorded as part of the professional video produced during and following the Amsterdam Validation Event. The video provides complementary qualitative evidence of the demonstration and includes the participants' direct observations of the hands-free solution and its operational relevance. Amsterdam Validation Event – Demonstration Video

The interview feedback is used to assess the usability, operational relevance, and overall acceptance of the demonstrated solution.

### 10.2.7 Demonstration event summary

The Validation Event in Amsterdam successfully provided an operational setting to assess the hands-free solution and its interaction with the existing station environment. The event brought together the technical team, GVB operational representatives, and selected end-users to validate the solution through practical, scenario-based demonstrations.

**Key Results:**
The demonstration provided evidence of:

- Successful detection and positioning of UWB wearables within the configured station zones;
- Correct interaction between the UWB infrastructure, RTLS, HFCS and station access-control equipment;
- Hands-free access and exit without requiring a physical validation gesture;
- Continuity of the hands-free mechanism for the intermodal transfer scenario;
- Automatic triggering of the assistance workflow based on passenger detection and profile information;
- Operation of the solution within a relevant operational station environment;

- Collection of technical evidence and user feedback to support the subsequent evaluation phase.

The Validation Event also confirmed the practical feasibility of extending the hands-free concept beyond access validation. The same underlying UWB positioning, and identification capabilities can support additional passenger-oriented services, such as transfer assistance and targeted support within the station.

**User and Operational Feedback:**
The validation activities enabled direct observations from GVB personnel and participating users regarding the usability and operational relevance of the solution. The hands-free interaction was assessed from both the passenger and operational perspectives, with particular attention to the simplicity of the interaction, the reduction of physical actions required from passengers, and the potential benefits for users requiring additional assistance.

Participants with technical and operational expertise provided short interviews following the demonstration. Their feedback complements the technical evidence collected during the event and provides an operational perspective on the potential integration of the solution into a public-transport environment. The interviews are included in the professional video produced during and following the Amsterdam validation activities. Amsterdam Validation Event – Demonstration Video

**Overall Conclusion:**
Overall, the Amsterdam Validation Event successfully demonstrated the core capabilities of the UWB-based hands-free solution in a relevant operational environment. The results provide a solid evidence base for assessing the targeted **TRL 7** and for evaluating the potential of the technology to support more seamless, inclusive, and passenger-centric mobility services.

The combination of technical evidence, operational observations, and direct participant feedback provides the basis for the detailed outcome, PI, TRL, and impact assessment presented in the subsequent evaluation phase.

## 10.3 Demo evaluation phase

The Demo Evaluation Phase consolidates and assesses the evidence collected during the Amsterdam Validation Event. Its purpose is to determine the extent to which the demonstrated solution achieved the expected technical and operational outcomes, while capturing user and stakeholder feedback and identifying the conditions for further development and deployment.
The evaluation is structured around five complementary activities:

- **Dissemination of demonstration results:** consolidation and communication of the demonstration activities and key results through appropriate dissemination material, including the recorded demonstration video and stakeholder-oriented communication activities.
- **TRL validation:** assessment of the Technology Readiness Level achieved by the demonstrator based on the evidence collected during the implementation and Validation Event phases, using the TRL definitions established by the project.
- **Stakeholder and end-user feedback analysis:** analysis of the observations, interviews, questionnaire responses, and discussions collected during the validation activities to assess usability, acceptance, accessibility, and operational relevance.
- **Outcome and Performance Indicator evaluation:** comparison of the expected and observed results for the demonstrated use cases, using system logs, validation records, performance measurements, and user feedback to assess the achievement of the defined outcomes and PIs.
- **Impact assessment:** analysis of the potential contribution of the demonstrated solution to passengers, transport operators, station stakeholders, and the wider European rail and multimodal mobility ecosystem, including opportunities and requirements for future deployment.

The evaluation does not consider the demonstration as an isolated technical test. Instead, the different sources of evidence are considered together to provide a balanced assessment of the solution's **technical performance, operational feasibility, user acceptance, maturity, and potential impact**. The following subsections present the results of these evaluation activities.

### 10.3.1 Dissemination Event

The results of the Amsterdam demonstration were disseminated as part of the FP1 MOTIONAL dissemination event **"Event 2 – Seamless, Inclusive Mobility & Predictive Services"**, held in Madrid on 7 May 2026.

The event provided an opportunity to present the objectives, implementation approach, validation activities, and main results of the WP23 demonstrations to project partners and relevant stakeholders from the European railway and mobility community. The Amsterdam demonstration was presented as one of the contributions addressing inclusive and seamless passenger mobility within the overall WS1.3 results.




**Figure 26. Hitachi Rail (RCS France) representative at the Dissemination Event**

**Presentation Content:**
The dissemination material related to the Amsterdam demonstration covered:

- The motivation and objectives of the hands-free solution;
- The operational context of the Amsterdam demonstration and the involvement of GVB;
- The main UWB-based use cases demonstrated during the Validation Event;
- The architecture and interaction between the UWB infrastructure, wearable tags, RTLS, HFCS and station access-control equipment;
- The approach followed for the preparation and execution of the Validation Event;
- Key technical and operational observations resulting from the demonstration;
- User and stakeholder feedback collected during the validation activities;
- The main conclusions and potential future deployment perspectives.

The presentation positioned the Amsterdam demonstration within the broader WP23 objective of improving inclusive and seamless passenger mobility and highlighted the potential of hands-free technologies to reduce the need for physical interaction with ticketing and access-control equipment.

**Dissemination Materials:**
The dissemination activities were supported by a set of presentation and communication materials prepared during the project. These included:

- Presentation slides summarising the demonstration objectives, use cases, technical approach and results;
- Illustrations of the demonstration environment and system architecture;
- Material describing the Validation Event and the demonstrated passenger scenarios;

- Key observations and results from the validation activities;
- The professional **demonstration video** produced during and following the Amsterdam Validation Event, including footage of the hands-free solution in the GVB operational environment and short interviews with end-users. Amsterdam Validation Event – Demonstration Video

The video provides complementary visual evidence of the demonstration and was particularly useful for communicating the practical passenger experience and the operational context to stakeholders who did not attend the Validation Event.

**Stakeholder Interaction:**
The coordinated WS1.3 dissemination format also enabled exchanges between the demonstration teams and stakeholders interested in inclusive mobility, passenger experience, station services and future deployment of innovative railway technologies. Questions and discussions provided an opportunity to clarify the demonstrated capabilities, validation approach, operational experience and potential applicability beyond the demonstration environment.

**Dissemination Outcome:**
The dissemination activities contributed to transferring the knowledge and results generated through the WP23 demonstrations to a wider Europe's Rail audience. Presenting the Amsterdam results together with the other WS1.3 demonstrations provided a broader view of the complementary solutions developed to improve passenger experience, accessibility and seamless mobility.

Overall, the dissemination event and supporting materials increased the visibility of the demonstrated hands-free capabilities and provided stakeholders with concrete evidence of their implementation and validation in a relevant operational environment. The activities also established a basis for further discussion on the applicability, scalability and potential future deployment of hands-free passenger services within European public-transport and railway environments.

### 10.3.2 TRL validation

The Validation Event provided evidence supporting the achievement of **Technology Readiness Level 7 (TRL7)** for the Amsterdam hands-free demonstrator. The assessment is based on the successful demonstration of an integrated UWB-based solution in a **relevant operational environment**, using existing station infrastructure and representative operational configurations, and validated with users having direct technical and operational knowledge of the environment.
The target TRL7 is supported by the following elements.

**Demonstration in a Relevant Operational Environment:**
The demonstrator was deployed and validated at **Amsterdam Central Station**, in cooperation with GVB. The demonstration was conducted using the existing station access-control infrastructure and operational gates, complemented by the newly deployed UWB anchors, wearable tags, RTLS and HFCS components.

This configuration enabled the solution to be assessed in the physical and operational context for which it is intended, rather than solely in a laboratory or simulated environment. The demonstration therefore provided evidence of the ability of the developed technology to operate within an existing mobility hub and to interact with infrastructure already used for passenger access.

**Operationally Representative Data and Configuration:**
The validation relied on station and operational information provided by GVB, including the relevant fare structures, station layout and access-control configuration. The demonstration environment was configured with the positioning of the UWB anchors and the detection, entry and exit zones corresponding to the physical demonstration area.

The UWB wearable tags used during the validation were registered and configured within the back-office environment, while the RTLS and HFCS processed the positioning and validation events generated during the passenger scenarios.

The data and configuration used for the demonstration were therefore representative of the operational context and enabled the execution of realistic hands-free access, exit, transfer and assistance scenarios. The demonstration did not constitute a production deployment or a long-term operational trial; rather, it validated the integrated prototype in the relevant operational environment.

**Integrated System Demonstration:**
The Validation Event demonstrated the integrated operation of the main components of the hands-free solution:

- UWB wearable tags used by passengers;
- UWB anchors deployed in the station environment;
- Real-Time Location Server (RTLS) for positioning and detection;
- Hands-Free Control System (HFCS) for processing validation and access events;
- Existing station gates and access-control infrastructure;
- Supporting communication and network infrastructure.

The successful execution of the UWB Walk-in, UWB Walk-out, Intermodal Transfer and In-Station Assistance scenarios provided evidence that the different components could operate together as an integrated system and support the intended passenger workflows.

**Validation with Operational and Technical Users:**
The solution was assessed with the participation of GVB personnel and selected end-users during the Validation Event. In addition to observing the execution of the scenarios, participants provided feedback concerning the usability, seamlessness, and operational relevance of the demonstrated solution.

Participants with technical and operational expertise also provided dedicated feedback following the demonstration. Their observations complemented the technical evidence by addressing the practical applicability of the solution within a public-transport station environment. The interviews were recorded as part of the professional demonstration video. Amsterdam Validation Event – Demonstration Video

**Evidence Supporting TRL7:**
The achievement of TRL7 is supported by the following evidence:

- Deployment of the hands-free solution in a **relevant operational environment at Amsterdam Central Station**;
- Integration of the demonstrator with existing station access-control infrastructure;
- Installation and operation of UWB anchors and wearable tags in the physical demonstration area;
- Integration of RTLS and HFCS components supporting real-time positioning and hands-free validation;
- Use of GVB-provided station, fare and operational configuration data representative of the demonstration environment;
- Successful execution of the four planned UWB-based demonstration scenarios;
- Validation of both passenger-facing functionality and interaction with existing operational infrastructure;
- Collection of system-generated evidence, operational observations and user feedback during the Validation Event;
- Assessment by GVB participants with direct technical and operational knowledge of the station environment.

**TRL Assessment:**
The demonstration goes beyond the validation of individual technical components by showing their integrated operation in the environment for which the solution is intended. In particular, the use of existing station gates and infrastructure, combined with the deployment of the UWB positioning and hands-free processing components, provided evidence of system-level operation under representative operational conditions.

The main aspects remaining beyond the scope of the demonstration concern **large-scale and long-duration operational deployment**, including validation with substantially larger passenger volumes, extended operational monitoring, integration across a wider number of stations and transport operators, and systematic assessment under production-scale conditions. These activities would be appropriate for subsequent pilot deployment and industrialisation phases.

Based on the evidence collected during the Validation Event, including the deployment in a relevant operational environment, successful integration of the main system components, execution of the defined scenarios, and feedback from operational and technical users, the Amsterdam demonstrator **fulfils the criteria targeted for TRL7**. The demonstration therefore provides a solid basis for further pilot-scale validation, optimisation, and potential deployment of hands-free passenger services.

### 10.3.3 Analyse feedback from stakeholders

Stakeholder feedback collected during the Validation Event was analysed using the complementary feedback mechanisms prepared during the implementation phase. These included direct observations during the demonstration, discussions with participants, and short

interviews with end-users. The combination of these inputs provided both a user-oriented and an operational perspective on the demonstrated hands-free solution.

The feedback was particularly relevant because participants included stakeholders with direct knowledge of the public-transport operational environment. Their observations therefore complemented the technical evidence collected from the system and provided insights into the practical value and applicability of the solution.

**Overall Assessment:**
The feedback indicates a positive perception of the hands-free concept and its potential to simplify passenger interaction with station access systems. The demonstrated ability to pass through access points without a conventional physical validation action was perceived as a relevant improvement to the passenger experience, particularly where minimising physical interaction can facilitate access.

The demonstration also illustrated that the UWB technology can support functionalities beyond basic access control, including intermodal transfer support and assistance for passengers requiring additional support. This reinforces the potential of a common hands-free infrastructure to support several passenger-oriented services.

**Main Strengths Identified:**
The main strengths identified from the stakeholder observations and interviews include:

- **Frictionless passenger interaction:** the possibility of accessing and leaving the controlled area without manually presenting or tapping a ticket or device;
- **Ease of use:** the hands-free interaction can reduce the number of physical actions required from passengers during a journey;
- **Operational integration:** the solution was demonstrated in an existing station environment, providing a concrete basis for assessing its interaction with existing access-control infrastructure;
- **Multi-purpose UWB infrastructure:** the same positioning and detection capabilities can support access validation, transfer-related services and passenger assistance;
- **Accessibility potential:** hands-free interaction may be particularly beneficial for passengers for whom conventional ticket validation represents an additional physical or cognitive burden;
- **Intermodal potential:** the demonstrated transfer scenario illustrates how hands-free services can contribute to a more continuous passenger experience across different stages of a multimodal journey.

**Operational and User Perspectives:**
From the passenger perspective, the principal benefit is the reduction of interaction required to validate a journey. The absence of a deliberate tap or presentation action can make passage through access points more natural and potentially more convenient, especially when passengers are carrying luggage or otherwise unable to interact easily with conventional validators.

From the operational perspective, the demonstration provided an opportunity to assess how UWB-based detection and validation can be incorporated into an existing station environment.

The involvement of GVB technical and operational representatives was particularly valuable in assessing the relevance of the solution from the perspective of a transport operator.

The feedback also highlighted the potential relevance of the technology for inclusive mobility. Automatic detection of a passenger requiring assistance can support earlier awareness by station staff and potentially improve the coordination of assistance services.

**Areas for Future Improvement:**
The feedback and observations collected during the demonstration also provide directions for further development. Future validation activities should investigate:

- Scalability to higher passenger volumes and more intensive station flows;
- Long-duration operation under representative service conditions;
- Further optimisation of detection and positioning performance;
- Integration with a broader range of existing ticketing and station-management systems;
- Assessment of the operational procedures required for deployment and maintenance;
- Validation with a larger and more diverse population of end-users, including a broader representation of passengers with accessibility needs;
- Further assessment of the user experience over repeated journeys rather than during a single demonstration event.

These aspects represent the natural next steps towards wider operational deployment and do not detract from the capabilities demonstrated during the Validation Event.

**Overall Conclusions:**
The stakeholder feedback supports the technical results of the Amsterdam demonstration and confirms the relevance of hands-free technology as an approach for simplifying passenger interaction with transport infrastructure. The combination of frictionless access, positioning-based services, intermodal support, and passenger assistance provides a broader value proposition than ticket validation alone.

The feedback also confirms the importance of considering both passenger experience and operational integration when moving towards deployment. The Amsterdam demonstration therefore provides a useful basis for further validation at larger scale and for assessing the conditions under which hands-free services could be integrated into future inclusive and seamless mobility environments.

### 10.3.4 Evaluation of outcomes and Performance indicators (PI)

The evaluation of the Amsterdam demonstration confirms that the main objectives defined for Task 23.3 were successfully addressed. The assessment is based on the evidence collected during the Validation Event, including system-generated results, observations from the demonstration scenarios, and feedback from participating stakeholders and end-users.

The evaluation focused on the demonstrated hands-free functionalities and their ability to provide seamless interaction between the passenger, the station infrastructure, and the supporting back-office systems.

**Demonstration Outcomes:**
The evaluation of the demonstration outcomes is summarized below.

| Outcome | Evaluation | Status |
|---|---|---|
| **Hands-free UWB walk-in** | The demonstration successfully validated passenger access through an automated gate using a registered UWB wearable, without requiring a physical validation gesture. | **Achieved** |
| **Hands-free UWB walk-out** | The demonstration successfully validated the corresponding exit process, with the passenger detected and validated through the UWB infrastructure before the gate granted access. | **Achieved** |
| **UWB-supported intermodal transfer** | The demonstration showed how UWB-based passenger detection can support a seamless transfer experience by triggering contextual information following passage through the access point. | **Achieved** |
| **UWB-based station assistance** | The demonstration validated the automatic detection of a passenger associated with an assistance profile and the generation of a notification to station staff. | **Achieved** |
| **Integration with existing station infrastructure** | The demonstrated solution successfully interacted with the existing station access-control environment and the supporting back-office components, confirming the feasibility of its integration in a relevant operational context. | **Achieved** |
| **Passenger experience and accessibility** | Observations and stakeholder feedback indicated that the hands-free interaction could simplify passenger access and has particular potential for improving accessibility and reducing physical interaction requirements. | **Achieved** |

**Performance Indicator Evaluation:**
The Performance Indicators relevant to the demonstration were assessed using the technical evidence and observations collected during the Validation Event.

- **PI 1 – Successful Hands-Free Validation:**
  The demonstration confirmed the ability of the UWB-based solution to detect a registered passenger, determine the relevant position and zone, and trigger the corresponding access decision without requiring manual interaction with the gate.
  The evaluation confirmed:
  - Detection of the UWB wearable within the relevant detection zone;
  - Continuous position processing through the RTLS;
  - Validation and access-control processing through the HFCS;
  - Automatic transmission of the access decision to the gate;
  - Successful execution of both walk-in and walk-out scenarios.

  **Status: Achieved**

- **PI 2 – Seamless Intermodal Transfer Support:**

The intermodal transfer scenario demonstrated the ability to use the UWB-based detection and access process as part of a continuous passenger journey. Following the exit process, contextual transfer information was provided to support the passenger's next travel segment.
The evaluation confirmed the successful execution of the defined transfer scenario and demonstrated the potential of UWB technology to support seamless interaction across stages of a multimodal journey.

**Status: Achieved**

- **PI 3 – Passenger Assistance Support:**
  The assistance scenario demonstrated the ability to associate a UWB wearable with an assistance profile and automatically trigger a notification when the passenger entered the defined detection area.
  The evaluation confirmed:
  - Detection of the relevant UWB tag;
  - Identification of the associated assistance profile;
  - Triggering of the assistance workflow;
  - Receipt of the notification by station staff.

  **Status: Achieved**

- **PI 4 – System Integration and Operational Functionality:**
  The successful execution of the demonstration scenarios provided evidence that the UWB infrastructure, RTLS, HFCS, access-control equipment and supporting systems could operate together in the relevant station environment.
  The results confirmed the end-to-end functionality required for the selected demonstration scenarios and the feasibility of integrating the hands-free solution with existing station infrastructure.

  **Status: Achieved**

**Overall Assessment:**
Overall, the evaluation confirms that the targeted demonstration outcomes and associated Performance Indicators were achieved within the scope of the Amsterdam demonstration. The Validation Event provided evidence of the technical feasibility of UWB-based hands-free access and its extension to intermodal transfer and passenger assistance services.

The results also indicate that the value of the solution extends beyond contactless access itself. By combining positioning, access validation and contextual services, the demonstrated approach can contribute to a more seamless and inclusive passenger experience.

The stakeholder feedback further supports the relevance of the demonstrated functionalities, while identifying scalability, broader operational deployment, and validation with larger and more diverse passenger populations as appropriate areas for future assessment.

Based on the successful execution of the defined scenarios, the collected technical evidence, and the feedback from expert operational and technical stakeholders, the demonstration provides the evidence required to support the targeted **TRL7** assessment of the demonstrated solution.

### 10.3.5 Impact assessment

The Amsterdam demonstration provides evidence of the potential impact of UWB-based hands-free mobility services on passengers and transport operators, with relevance to users who may experience physical or cognitive barriers during conventional access and travel processes. By combining automatic passenger detection, hands-free access, intermodal transfer support, and station assistance, the demonstrated approach can contribute to a more seamless, accessible, and passenger-centred mobility experience.

**Impact on Passengers and PRM:**
The most direct impact concerns passengers using the demonstrated hands-free services. The removal of the need for a physical validation gesture can simplify access and exit processes, particularly for passengers carrying luggage, using mobility aids, or experiencing difficulties interacting with conventional ticketing equipment.

For Persons with Reduced Mobility (PRM) and passengers requiring assistance, the automatic detection and notification mechanism can facilitate earlier and more targeted support from station staff. This can reduce the need for passengers to actively request assistance and can contribute to a more predictable and independent travel experience.
Potential benefits include:

- Reduced physical interaction with gates and validation equipment;
- Easier access for passengers with mobility or dexterity limitations;
- Reduced cognitive effort associated with conventional validation procedures;
- Improved independence and confidence when navigating the station;
- More timely and targeted assistance when required.

**Impact on the Passenger Journey:**
The demonstrated UWB functionality also has potential to improve continuity throughout the passenger journey. The combination of hands-free access and contextual information following an intermodal transfer can reduce friction at transition points between transport services.
This approach could contribute to:

- Smoother transitions between transport modes;
- Reduced interruption of the passenger journey at access points;
- Improved orientation during transfers;

The impact is particularly relevant in intermodal hubs, where passengers may need to navigate complex environments and interact with several transport services within a single journey.

**Impact on Transport Operators and Station Management:**
For transport operators and station managers, automatic passenger detection and assistance triggering could improve the way accessibility services are delivered. Instead of relying exclusively on manual requests or fixed procedures, staff can receive contextual information when a passenger requiring assistance is detected within a predefined area.

Potential operational benefits include:

- More targeted allocation of assistance resources;
- Improved awareness of passenger assistance needs;
- Reduced reliance on manual intervention for routine access processes;
- Improved coordination between passenger detection and station operations;
- Potential optimisation of passenger flows in access-controlled areas.

The demonstrated integration with existing station access infrastructure also indicates the potential for introducing such services without fundamentally changing the passenger access model.

**Contribution to Inclusive and Seamless Mobility:**
Beyond the individual functionalities, the demonstration illustrates how positioning, access control and passenger assistance can be combined to create a more inclusive mobility environment.
The approach can contribute to reducing barriers that may affect passengers differently depending on their physical capabilities, familiarity with the transport environment, or specific assistance needs. In this respect, the technology has potential to support the broader objective of making multimodal public transport more accessible and easier to use.

**Long-Term Impact and Future Deployment:**
The results provide a basis for further investigation of UWB-based hands-free services in larger and more diverse operational environments. Future deployment could extend the approach to additional stations, transport operators, and multimodal journeys while assessing scalability, interoperability, passenger acceptance, and operational performance over longer periods.

Further validation with larger and more diverse passenger populations would also be valuable, particularly to quantify the benefits for PRM and other passengers who may experience barriers with conventional access and navigation processes.

The Amsterdam demonstration should therefore be considered an important step towards more seamless and inclusive station services. By reducing the need for physical interaction and enabling context-aware assistance, the demonstrated solution has the potential to improve both **passenger independence and operational efficiency**, while supporting the wider evolution towards more accessible and integrated European multimodal mobility.

# 11. Task 23.4 – Demonstration in Berlin and Leipzig

As rail networks expand and passenger numbers increase, railway operators require innovative solutions to enhance platform capacity at heavily frequented stations while simultaneously improving passenger safety. The Illuminated Platform Edge as an optimized information system enhances the early orientation of waiting passengers, enabling them to position themselves strategically on the platform. Additionally, the use of coloured light signals supports barrier-free travel by increasing contrasts in hazardous areas and visually warning of approaching trains.

The aim of the demonstrators in Berlin and Leipzig is to test the illuminated platform edge system with regard to

- Improve stopping times and punctuality,
- Improve capacity utilization,
- Increase attention and the perception of safety and
- Increase customer satisfaction

To measure the effectiveness of the defined use cases below, technical solutions like video heatmaps and train data (SQL-codes) and a market research institute was commissioned to conduct customer surveys and customer observations in several stages. Two demonstrators (Berlin and Leipzig) with different conditions are used for the validation.

...

| Use case ID | TEs | Name | Description |
|---|---|---|---|
| UC-FP1-WP19-28 | TE22 | Illuminated Platform Edge “Attention” | The LED bricks on the platform surface flash red to indicate the arrival and departure of the train. This is intended to increase customer awareness at the edge of the platform. |
| UC-FP1-WP19-29 | TE22 | Illuminated Platform Edge “Orientation” | The boarding area of the train (train stop position) is indicated by a white running light that runs dynamically towards the train stop position. The aim is to make it easier for customers to find their way around the platform. |
| UC-FP1-WP19-30 | TE22 | Illuminated Platform Edge “Capacity” | By displaying the traffic light colours, red, green and yellow, the capacity of the arriving train is displayed in the stopping area. This should help customers to spread out better on the platform and find a free seat more quickly. At the same |

| | | | |
|---|---|---|---|
| | | | time, the handling of the train should be optimized. |

## 11.1 Demo implementation phase

### 11.1.1 Recruitment of end-users

The end users of the demonstrator were the passengers using the S-Bahn platform at Berlin Südkreuz, with Leipzig Hauptbahnhof planned as a second deployment site within the same demonstration logic. The project therefore did not rely on a separate, artificially recruited test panel, but on real passenger flows in station operation. This was important because the concept was intended to influence everyday behaviour in a public station environment, especially around platform edge safety, orientation, and boarding guidance.

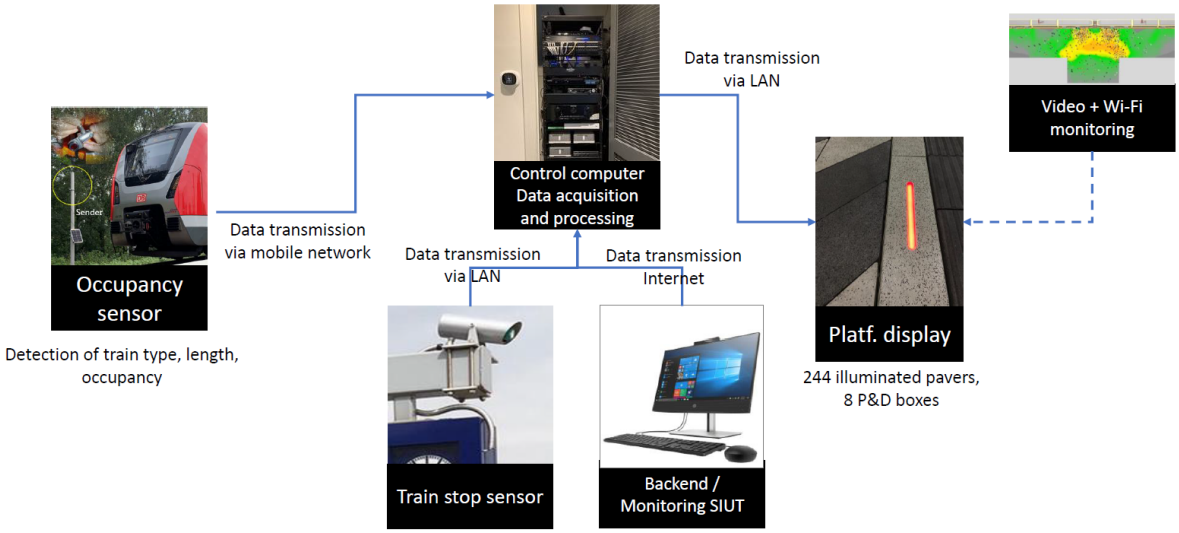
The evaluation design also included operational stakeholders and expert groups where needed, such as DB specialists from construction, electrotechnics, ITK, maintenance, operations, and railway management, as well as S-Bahn Berlin and external partners. In addition, representatives of accessibility-related organisations and the railway operating environment were involved in tests and reviews, particularly where the colour concept, contrast perception, and platform safety needed expert validation. The project therefore combined public users and institutional stakeholders as complementary groups for implementation and feedback.

### 11.1.2 Deployment of demonstration environment

The demonstration environment consists of one coherent technical system combining LED floor elements, PD boxes, power and data cabling, a control computer, middleware, a train stop sensor, and a load sensor that provides real-time train occupancy information. In the Berlin pilot at track 1 of Berlin Südkreuz, the system was implemented with 245 LED concrete blocks, eight PD boxes, and the corresponding data and power infrastructure along approximately 150 metres of platform edge parallel to the tactile guidance system.

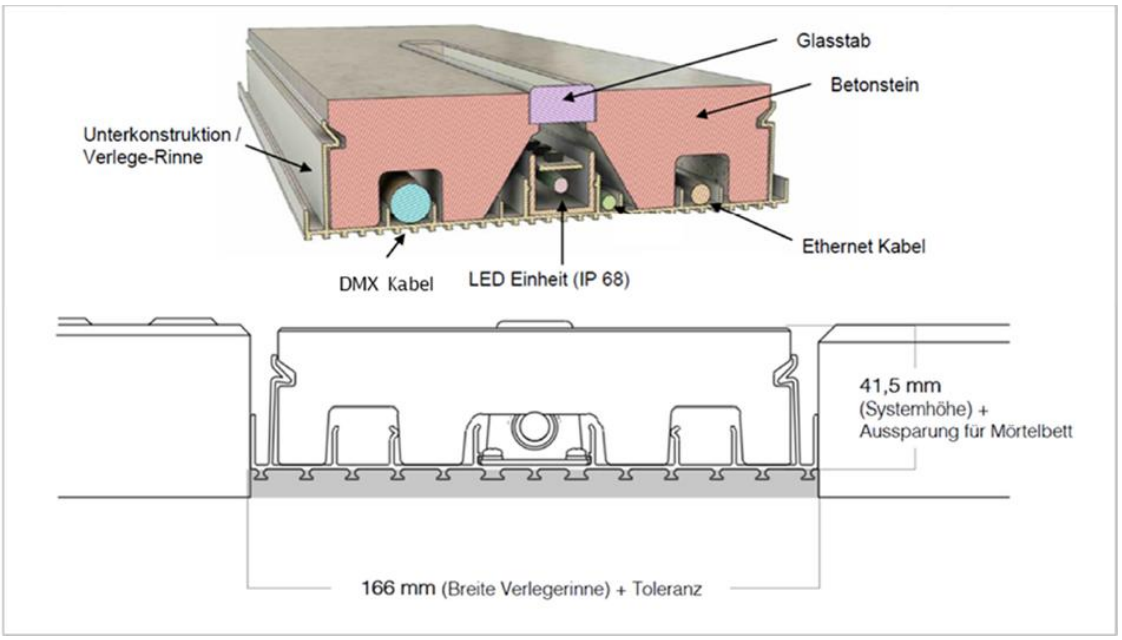
# Functional system architecture

Piloting various innovations as an overall system at Südkreuz station




*System architecture of the light-emitting platform edge pilot at Berlin Südkreuz*

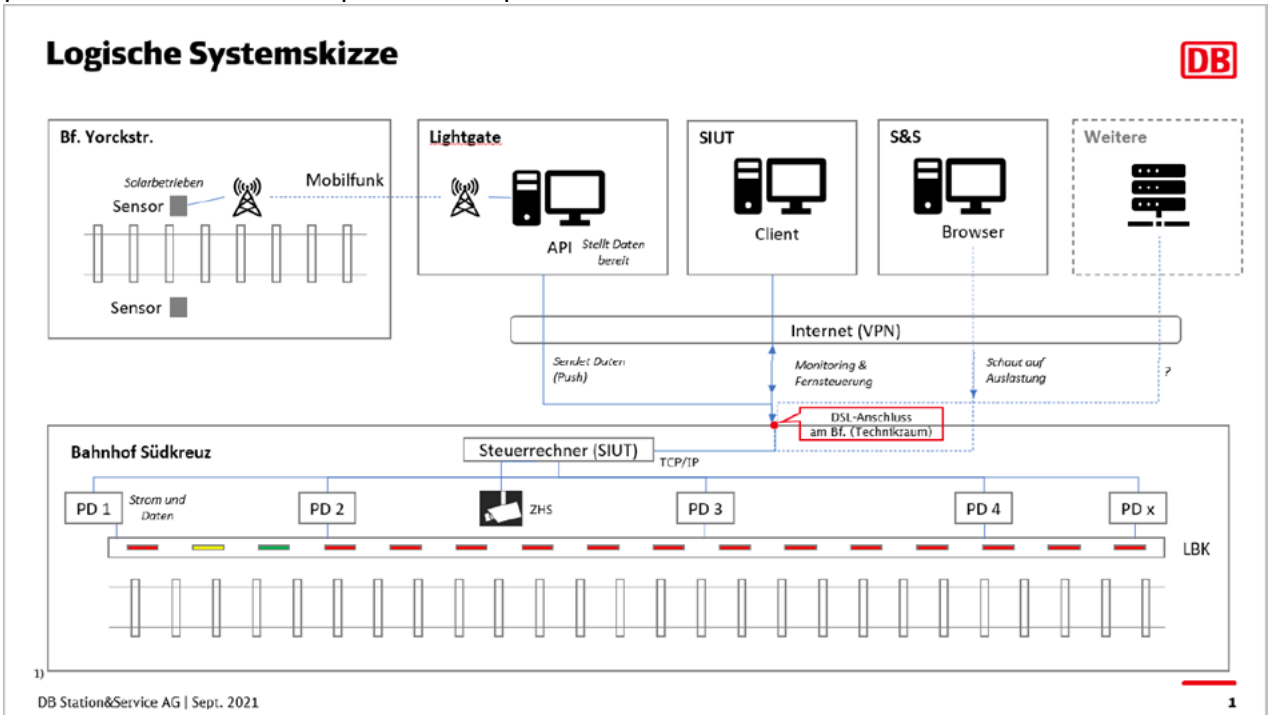
The system was installed as a baulked and integrated platform-side solution, with the existing floor covering opened along the planned route, an installation channel or levelling layer prepared, and the LED concrete blocks precisely fitted into the existing grid. This setup allows the system to react in real time to train occupancy and operational conditions, making the platform edge display dynamic rather than static.




*LED stone cross-section showing the substructure, installation channel, LED unit, and cable routing.*

The local demonstrator components use LAN and internet connections outside the DB core infrastructure, while the backend for processing the load-sensor data is hosted by DB Systel within

the DB WAN and forwards the processed train and occupancy information to the control computer in real time. The middleware receives incoming data from the sensors, validates and processes it, and then transmits commands to the lighting control software so that the relevant display pattern can be shown on the light-emitting platform edge. In operation, stable performance is ensured through authenticated interfaces, logged access, continuous monitoring, and predefined fallback procedures for special operational situations or technical faults.




*Logical system diagram of the platform-edge lighting system, showing the sensor, Lightgate backend, SIUT control computer, and network connections.*

For Leipzig Hauptbahnhof (tief), the demonstration plan includes a comparable system architecture adapted to the local conditions of an underground, high-frequency S-Bahn stop. In this sense, the demonstrator is conceived as one common solution logic deployed at two sites, while allowing project-specific adaptation of installation details, power distribution, and local integration into the station environment. The two-site deployment also makes it possible to compare performance and operational integration under slightly different station conditions.

### 11.1.3 Collect and process demonstration data

The measurement concept is structured around one baseline measurement and three impact measurements aligned with the different stages of the display concept, making it possible to compare changes over time in perception, safety, passenger distribution, satisfaction, and stop-time compliance. This combination of real-time operational data and structured evaluation data is a central element of the demonstrator design because it links system behaviour, passenger response, and railway performance in one assessment framework. For this purpose, the setup combines sensor-based live data, observational data, and retrospective operational records so that both immediate effects and longer-term trends can be assessed consistently.

Occupancy information is generated through the DB Lightgate system, which determines train model, train length, and occupancy by analysing the train windows with visible red LED light and converting the resulting raw data into three occupancy classes: low, medium, and high. These classes are then used in the colour logic of the light-emitting platform edge. In addition to this technical data stream, the evaluation concept includes customer surveys, platform observations, video analysis of passenger movement, and retrospective analysis of SQF database records to capture both customer-related and operational effects. The video analysis is used to examine how passengers move before and after train arrival, while the SQF records provide a structured basis for comparing target and actual stop times over the pilot period.

The measurement concept is therefore not limited to observing whether the display is active; it is designed to assess how the display is interpreted and how it influences passenger behaviour and railway operations. The baseline measurement establishes a reference point before the full effect of the system is introduced, and the three impact measurements then capture changes as the display concept progresses through its stages. In this way, the demonstrator uses one common data logic to connect live occupancy input, operational railway data, and passenger feedback, allowing the system effect to be evaluated both technically and from the user perspective.

### 11.1.4 Validation of demonstration data

The project documentation indicates that all relevant data streams and measurement concepts were validated before and during the pilot phase, and that the data collection process was tested and verified as part of the overall demonstrator setup. The load sensor had already been tested over a longer period at stations of the Hamburg S-Bahn, while the train stop sensor is based on a modified ultrasonic sensor type already used by DB in regular applications, which provided an initial level of confidence in the technical maturity of the data sources. The middleware then validates and processes incoming records before triggering the display logic, and all incoming datasets as well as the corresponding output signals are logged so that both the input data and the system response can be checked afterwards.

Beyond technical validation, the project also cross-checks its evidence base through the use of different data sources, namely passenger interviews, observations, video-based passenger-flow analysis, and SQF stop-time data, so that customer feedback and operational measurements can be interpreted together rather than in isolation. This means that the demonstrator does not rely on a single indicator, but on a controlled combination of live system data, behavioural observations, and railway performance records that can be compared across the baseline and the subsequent impact measurements.

At the same time, the Berlin results show that not all display modes were understood equally well by all passengers, which is relevant for data validation because it affects how the measured outcomes should be interpreted. For that reason, the evaluation framework should treat technical performance, user comprehension, and behavioural response as linked but distinct dimensions of the same dataset, rather than if a functioning display automatically produces a uniform passenger response.

### 11.1.5 Integration tests

Before and during commissioning, integration tests were carried out to ensure that all demonstrator components worked together under real operating conditions. These tests covered the interaction between the control computer, middleware, the train stop sensor, the load sensor backend, PD boxes, and the LED floor elements, with a particular focus on end-to-end data exchange and the correct triggering of light patterns. The purpose was not only to confirm that each component worked on its own, but also that the full chain from sensor input to visual output was correctly synchronized and operationally coherent.

The integration activities included checking server availability, accessibility of the control computer, activation and correct sequencing of the LED elements and PD boxes, display of the full RGB colour spectrum, and testing of the red flashing and white running-light patterns. In practical terms, this verified that the middleware received the expected sensor data, processed it without interface errors, and passed the correct commands to the lighting software so that the intended display pattern appeared at the right time and in the right sequence. The tests therefore confirmed that the system was aligned end to end and that the hardware, software, and data interfaces were functioning together as intended.
In addition, real-world tests were conducted together with S-Bahn Berlin to assess the effects of the display patterns from the perspective of train operations and train drivers, especially regarding glare, confusion with railway signalling, and operational irritation. These tests showed that the selected colour spectrum did not create a risk of confusion with existing signals, and that the defined brightness levels were acceptable from the perspective of train drivers both by day and in darkness. The test results formed an important basis for the subsequent risk management and temporary user approval of the system, because they demonstrated that technical function and operational safety were compatible.

### 11.1.6 Develop training materials

No formal training program was developed for passengers because the demonstrator was intentionally designed as a self-explanatory system for the general public. Instead, the project developed supporting communication and orientation materials that explain the meaning of the display patterns and help passengers interpret the signals shown on the platform edge.

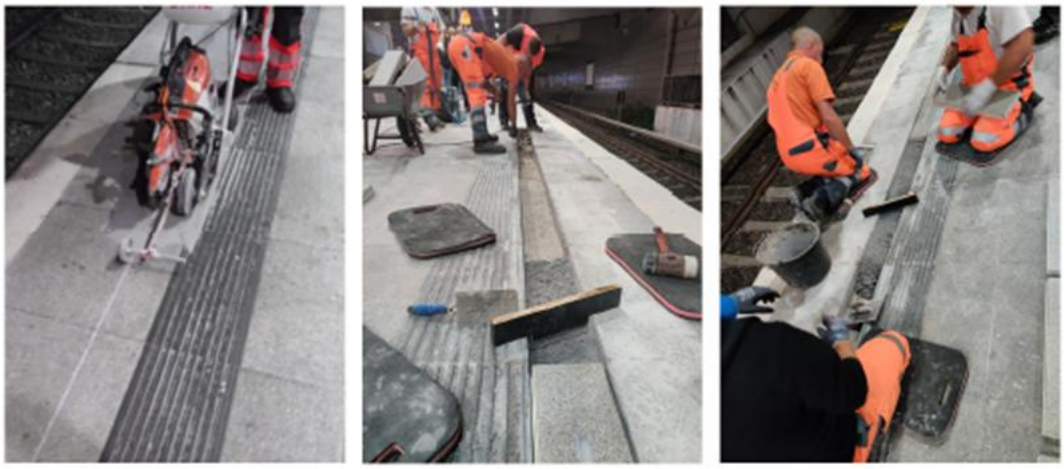



These materials included public DB webpages, an explanatory video, wall posters placed at the platform, and floor stickers (image above) designed in the DB Digital Flow style to draw attention to the system and explain the display logic. For internal stakeholders and operational staff,

process-related guidance was prepared for operation, monitoring, and troubleshooting so that faults and irregular situations could be addressed in a structured way.

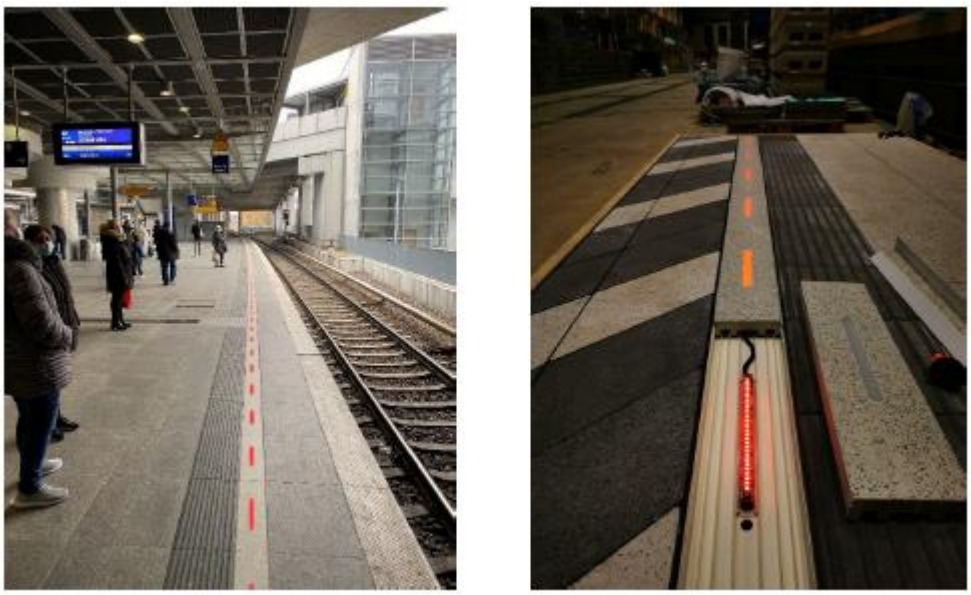
### 11.1.7 Perform installations (if necessary)

The demonstrator required a full structural and technical integration of the LED floor elements, power and data cabling, sensors, and peripheral equipment into the existing platform infrastructure. At Berlin Südkreuz, the installation was carried out over around 15 nights during regular service breaks, so that work could be performed in short, controlled sections without affecting daytime operations.



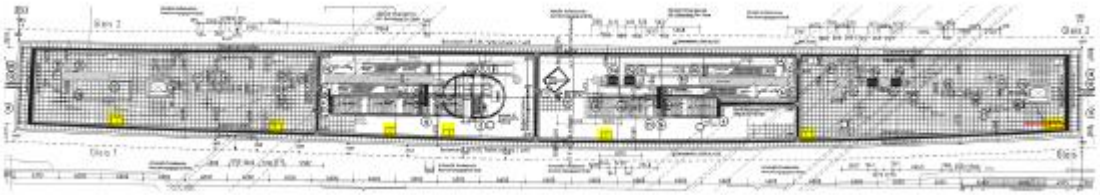
*Cutting out the existing paving*

The existing platform surface was opened along the joints, installation rails were embedded in a mortar bed to level and stabilise the substructure, the power and data cables were laid in the installation channel, the LED concrete slabs were snapped into place, and the joints were then grouted to complete the surface.

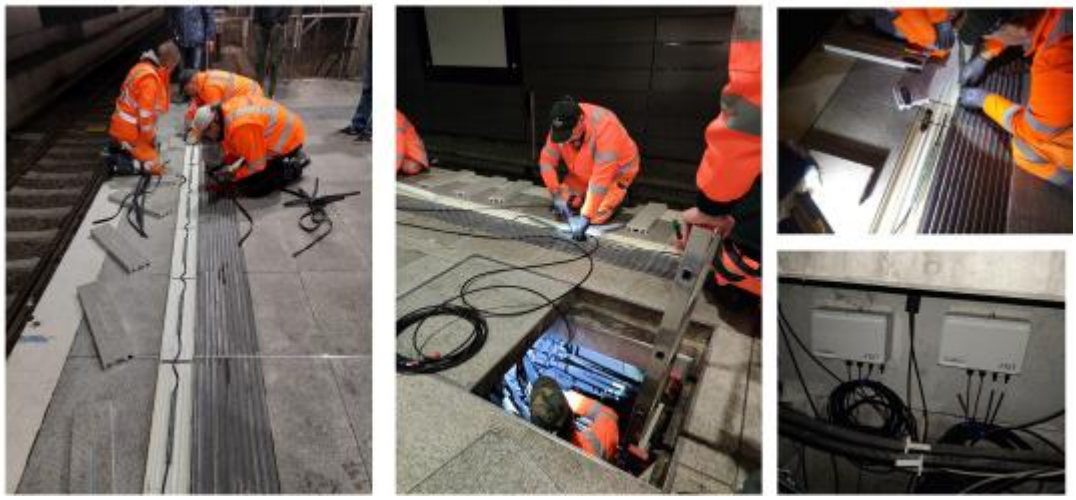


*Installed illuminated platform edge*

The PD boxes were installed in the cable ducts of the modular platform and configured to supply two LED chains each with both power and data. Their exact number and location were based on the structural conditions of the platform and had to be planned individually in advance.



*platform floor plan*



*Installation electrical components*

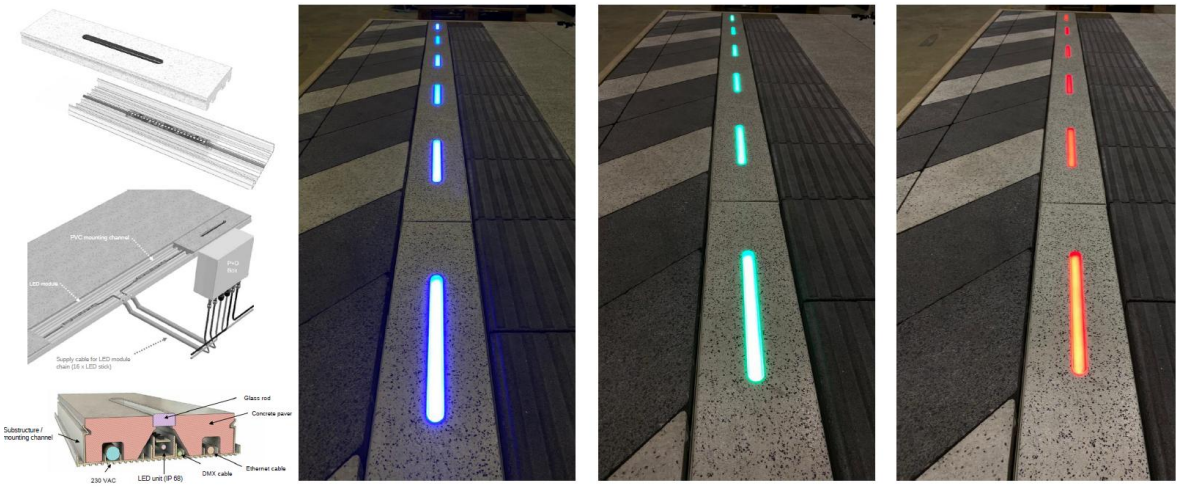
The electrical design and the overall construction concept were reviewed as part of the certification process, including assessment by the relevant DB specialist functions and an EBA-certified inspector, so that the installation met the required standards for load-bearing capacity, traffic safety, durability, electrical engineering, fire protection, accessibility, and maintenance.

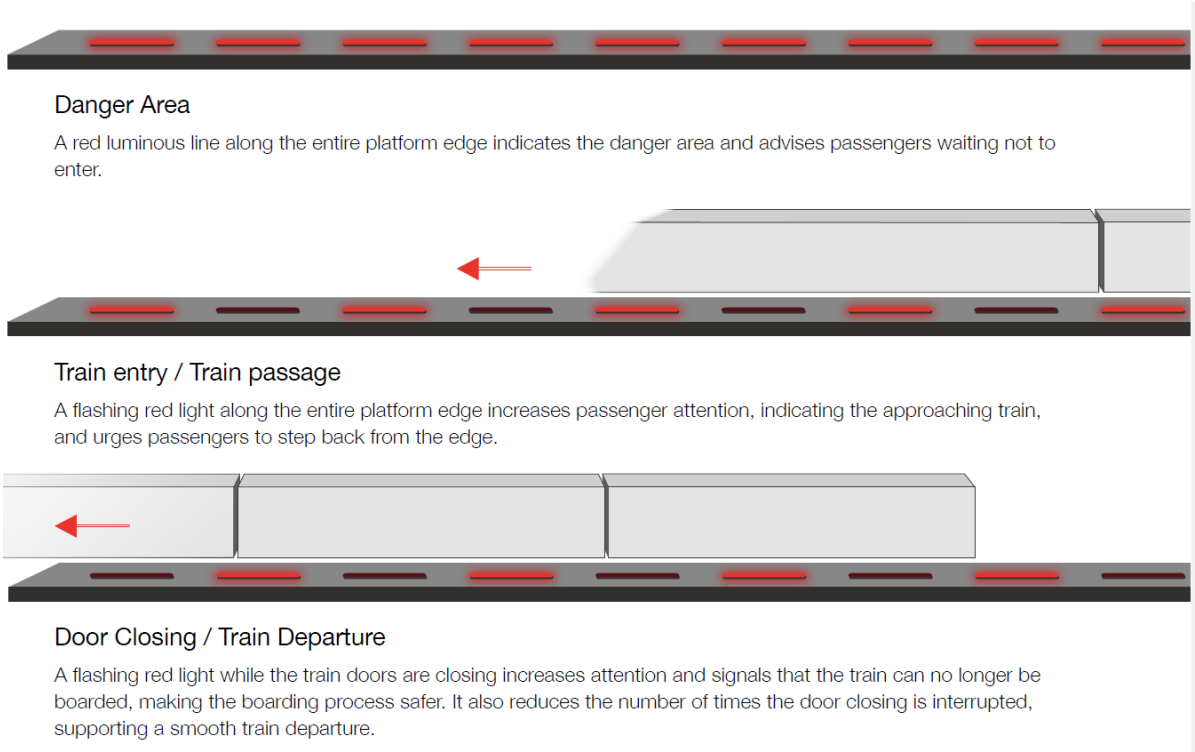
Before the full-scale installation, the project constructed a 5-metre test section at Berlin Südkreuz to verify the practical feasibility of the installation concept under real site conditions. In addition, earlier pilot experience from Hamburg-Hammerbrook was used to confirm key properties such as wear resistance, cleanability, maintainability, and general robustness of the LED floor elements. These preparatory steps reduced implementation risk and helped ensure that the final installation could be transferred into the platform environment without technical surprises.

At Leipzig, the demonstration plan includes a comparable installation on two platforms, each 220 m long, adapted to the station's underground and high-frequency operating environment while following the same overall implementation logic. The structural principle remains unchanged, but details such as cable routing, power distribution, access conditions, and installation sequencing must be adapted to the local platform geometry and operational constraints.

### 11.1.8 Validation tests

The validation tests were carried out after installation and commissioning to confirm that the demonstrator was already functioning as an integrated system before the formal validation event.



Danger Area

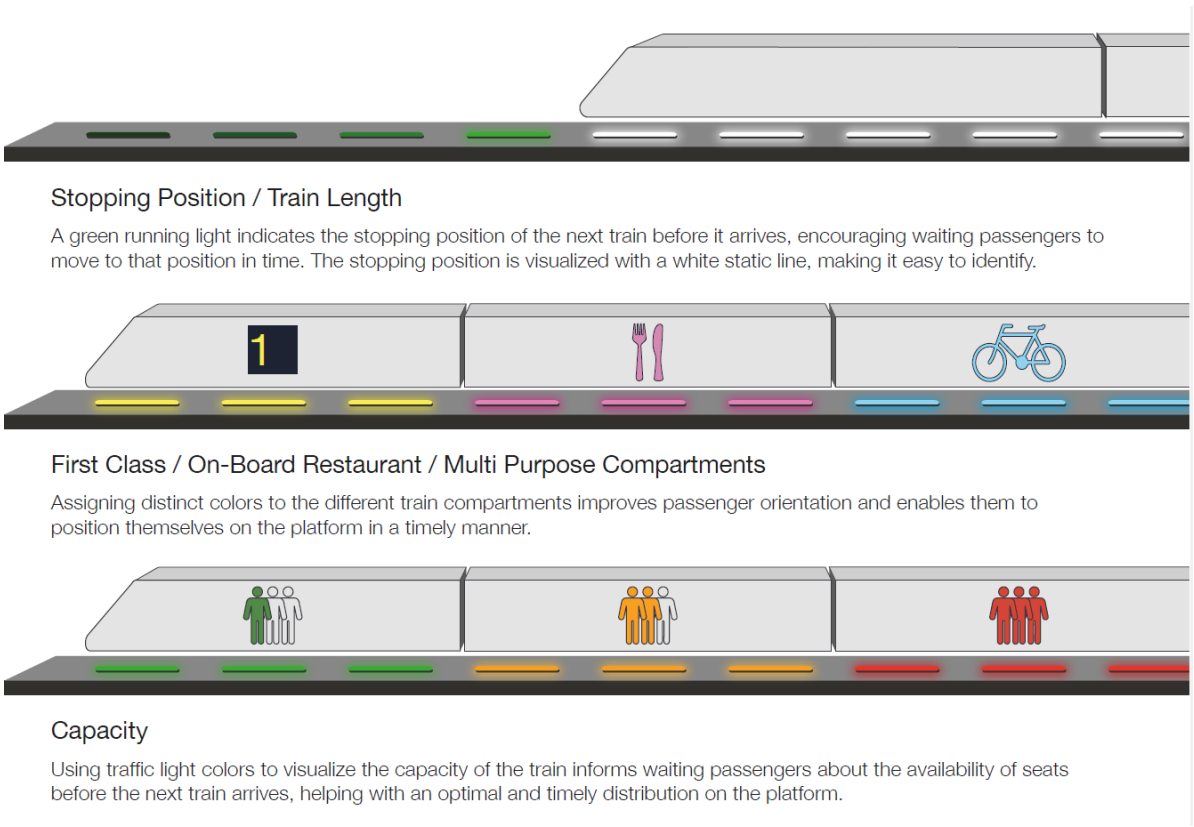
A red luminous line along the entire platform edge indicates the danger area and advises passengers waiting not to enter.

Train entry / Train passage

A flashing red light along the entire platform edge increases passenger attention, indicating the approaching train, and urges passengers to step back from the edge.

Door Closing / Train Departure

A flashing red light while the train doors are closing increases attention and signals that the train can no longer be boarded, making the boarding process safer. It also reduces the number of times the door closing is interrupted, supporting a smooth train departure.




*Possible functions of the illuminated platform edge*

The project had created that level of readiness by combining prior component testing, certified infrastructure planning, and operational dry runs: the load sensor had already been proven in longer-term use at Hamburg S-Bahn stations, the train stop sensor was based on a DB-standard ultrasonic sensor type, and the full system had been checked through integration tests covering the control computer, middleware, PD boxes, cabling, and LED floor elements. Together, these preparatory steps ensured that the demonstrator was not treated as an untested prototype, but as a system whose technical interaction and basic operational stability had already been verified in advance.

The Berlin validation concept used one baseline measurement and three impact measurements to assess the display stages step by step. This allowed the project to verify not only the correct lighting patterns, but also their sequence, timing, brightness, and interpretation by passengers and railway staff. The operational tests with S-Bahn Berlin were especially important because the system was installed in the danger zone and had to remain safe, non-irritating, and clearly distinguishable from railway signals; the tests confirmed that the colour spectrum and brightness levels were acceptable and did not cause confusion.

For Leipzig, the demonstration plan adds a second validation environment after construction completion and approval by the responsible authority, followed by a period of regular operation. Building on the already verified Berlin results, this second operational setting allows the project to compare performance, usability, and operational integration under different station conditions. In Leipzig, three functional tests were already carried out in Q3/Q4 2025, although the IT data integration still presented several challenges, especially in data transmission, sending, and

receiving.

### 11.1.9 Communication and Dissemination before demonstration execution

Before demonstration execution, the project used a structured communication approach to make the demonstrator visible, understandable, and operationally manageable for the relevant stakeholders. Public-facing communication was prepared through DB websites, an explanatory video, posters, and floor stickers, all of which were used to explain the purpose of the light-emitting platform edge and the meaning of the different display patterns. This helped ensure that passengers and other external audiences could understand the system already before entering the validation phase.

Internally, the project status was shared regularly through project dialogue, governance meetings, and coordination forums linked to the broader "Sicherheitsbahnhof Südkreuz" context. These exchanges served to keep the station management, technical teams, and operational stakeholders aligned on the current implementation status, the remaining open points, and the planned steps toward commissioning and validation. In practice, this meant that communication was not limited to one-off updates, but followed a recurring coordination process that supported planning, approvals, and operational readiness.

The Berlin pilot was also introduced in a public opening event. This event positioned the demonstrator not only as a technical pilot, but also as a visible innovation project with institutional relevance and wider public interest. At the same time, the event helped communicate the project's objectives, the intended passenger benefits, and the operational context in which the system would later be demonstrated.

### 11.1.10 Implementation of measures to gather results and KPI measurements

To measure the KPIs, the project used a combined setup of sensor data, operational records, and passenger feedback instruments. On the technical side, this included live train occupancy and stop information from the sensors, the middleware and control computer for processing and logging the incoming data, and the SQF database for retrospective stop-time analysis.
On the customer side, repeated survey waves, structured observations on the platform, and video-based passenger-flow analysis were used to capture subjective effects such as satisfaction, orientation, and perceived safety together with observable behaviour.
The KPI framework linked subjective and objective measures, so that passenger distribution and stop-time compliance could be assessed alongside passenger perceptions and response patterns. This made the KPI assessment robust because it relied on multiple cross-checked data sources rather than a single indicator.

### 11.1.11 Questionnaire and interviews guides for stakeholders/end-users

At the validation event, the project used questionnaires, interview guides, and observation sheets to capture both what passengers reported and how they behaved in the platform area. The evaluation followed one baseline measurement and three impact measurements, allowing the team to compare passenger positioning, information behaviour, perception of the platform environment, understanding of the illuminated line and other display modes, satisfaction with boarding, and sense of safety over time. In Berlin, the surveys were tablet-based and supplemented by structured observations, making it possible to collect both quantitative and qualitative feedback under real station conditions.

## 11.2 Demo execution phase

### 11.2.1 Software distribution to end users

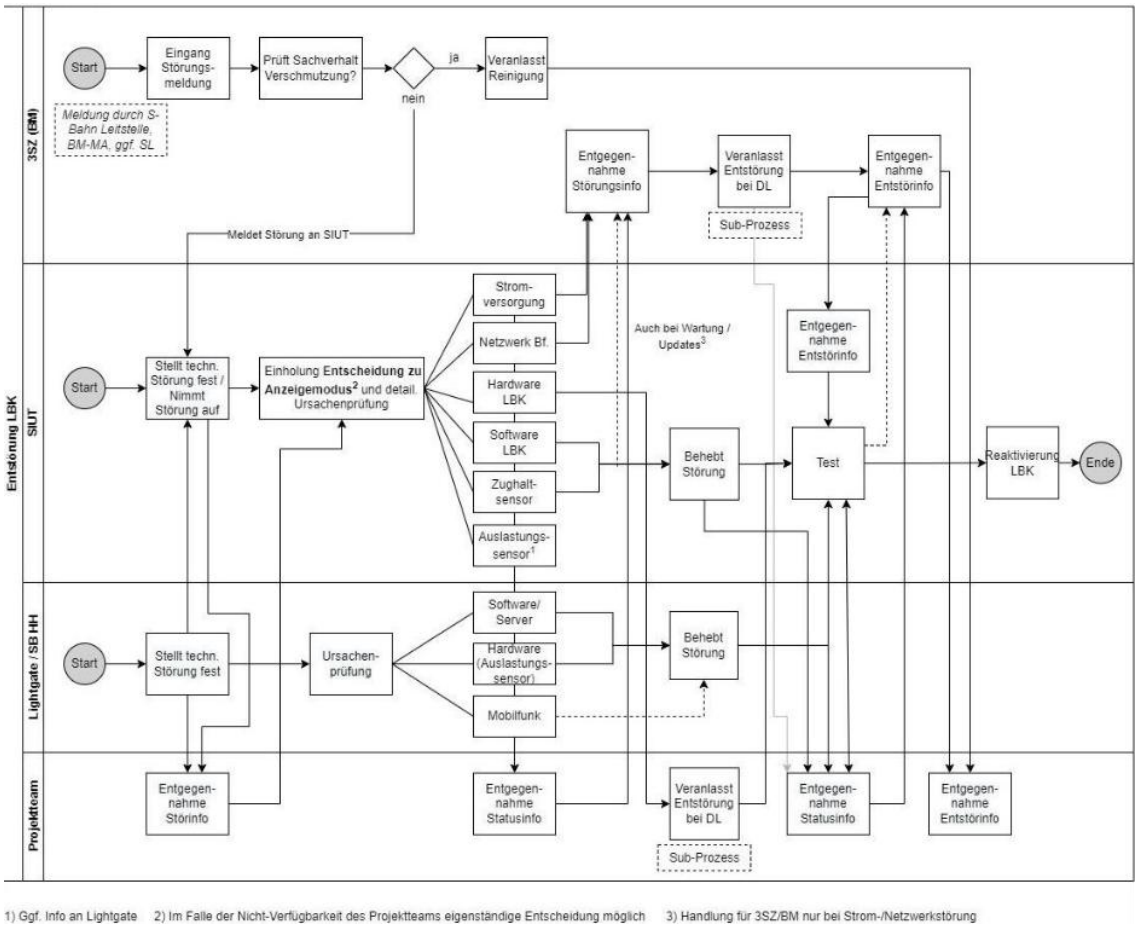
No software was distributed directly to end users.

Here, the interaction is indirect and takes place through the passengers' perception and behavioural response to the physical light signals on the platform edge, while the central software layer ensures that the display patterns are triggered correctly and consistently from the backend.

### 11.2.2 End users/outsiders training

For passengers, no formal training was provided because the system was intended to be intuitive in normal station use; instead, the project relied on the website, explanatory video, posters, and floor stickers to help passengers understand the light signals.

For project and station staff, the operating concept assigned technical monitoring and software support to the supplier, while the project team handled the display logic, operational adjustments, and communication of changes or shutdowns.



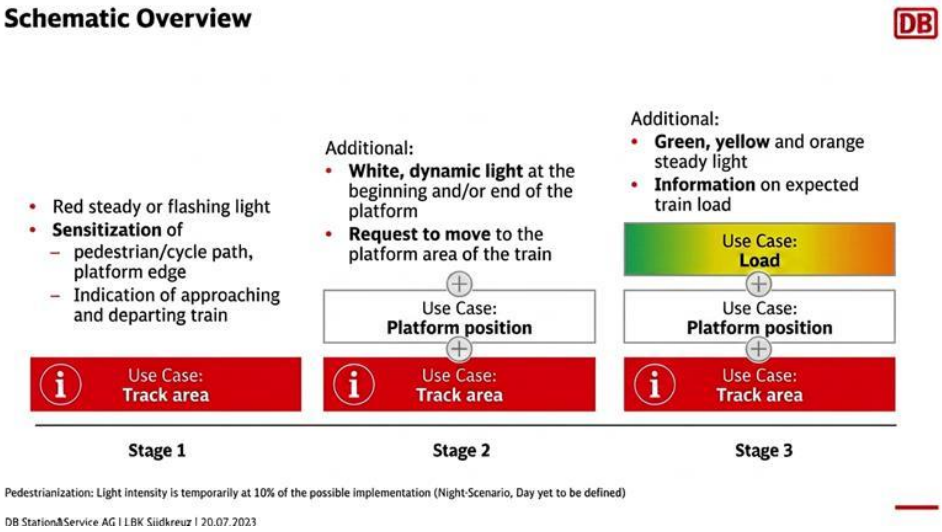

*Troubleshooting process*

### 11.2.3 Data collection for real-time demonstrations

As described in Section 11.1, the demonstration combines real-time operational data with evaluation data to both run the system and assess its impact. Live inputs such as train occupancy, stop detection, and system status are complemented by surveys, observations, video analysis, and SQF records to evaluate passenger behaviour and operational effects.

### 11.2.4 Validation Event

The validation event in Berlin was prepared as a field-based demonstration under real station conditions, with the goal of testing the display concept in live operation rather than in a closed workshop setting. It was monitored over approximately one and a half years of operation and followed a sequence of one baseline measurement and three impact measurements, each aligned with a specific display stage so that changes in passenger behaviour and perception could be compared over time.




*Schematic overview of the use cases*




*Sequence of display patterns in Phase 3*

Expert users and operational stakeholders were directly involved in the validation setup, with the DB InfraGO project team, station management, the developer and supplier team, and train drivers all contributing to system setup, monitoring, troubleshooting, operational coordination, and the test runs. The demonstration relied on the lighting control software, sensors, remote access, and video-surveillance access to ensure safe and consistent operation under real station conditions.

The validation focused on both customer-side and railway-operation-side effects. On the passenger side, it assessed customer guidance, perceived safety, orientation, visibility of the display, understanding of the illuminated line and other display modes, satisfaction with boarding, and the extent to which passengers followed the guidance. On the operational side, it examined display quality parameters such as colour spectrum, brightness, uniformity, glare, and possible

irritation effects for train drivers, because the system had to work without creating new operational risks.

To make the validation meaningful, the project used a combined evidence base. Customer surveys were run in repeated waves, supported by observations and anonymous video analysis of passenger movement, while SQF database data were used to check whether stop-time compliance changed under real operating conditions. This allowed the team to compare how passengers responded to the display logic with whether there was any measurable operational effect on train handling and punctuality.

For Berlin, the measured effects were interpreted against the local station context, including the layout of Südkreuz Gleis 1, the proximity of the stop position to the platform edge, and the fact that the platform was not highly capacity critical. That context mattered because it influenced how strongly the white running light and the capacity display could affect passenger movement, and it also explains why some effects were visible in customer perception but not in stop-time compliance.

For Leipzig, the validation was conducted in March 2026 with Station Management, project staff, an independent risk-management assessment body, and under the European risk management procedure, allowing the CSM validation event to be successfully completed. It was designed as a comparable field demonstration after installation and approval, using the same logic of real-world operation, test sequencing, and evidence collection. Leipzig therefore extends the Berlin validation to a second station environment, making it possible to compare performance across technically and operationally different settings.

### 11.2.5 Data collection for outcome and Performance indicator (PI) measurements

The evaluation used several data layers to assess both passenger effects and operational effects. Customer surveys, structured observations, and qualitative feedback captured perceived safety, orientation, boarding quality, understanding of the display logic, and the usefulness of the illuminated platform edge.

Video analysis examined passenger movement along the platform, especially before and during train arrival, while the SQF database provided actual and target stop-time data to check punctuality and stop-time compliance.

In addition, live system data such as train occupancy, stop detection, and system status were used to operate the demonstrator and interpret the results. Taken together, these sources formed one evidence base for comparing passenger response with operational performance.

### 11.2.6 End-user interviews

At the validation event, the interviews were carried out as tablet-based passenger interviews in

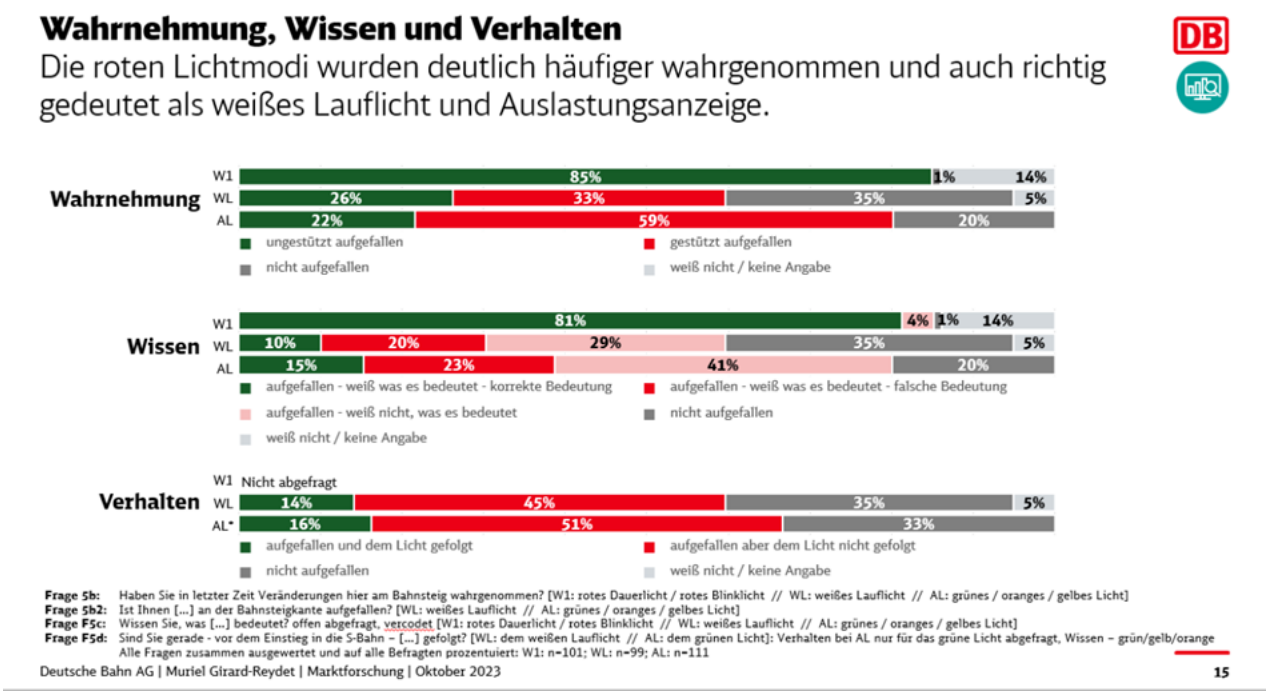
the S-Bahn environment during the demonstration period. They were structured around the main use-case themes: passenger positioning and information behaviour, understanding of the illuminated platform edge, perceived safety, satisfaction with boarding, and suggestions for improvement.

The interview setup was not a one-off discussion format, but part of a broader field evaluation in which surveys were repeated across measurement waves. In Berlin, the interview results were combined with structured observations, video analysis, and later SQF database checks so that subjective passenger responses could be compared with actual behaviour and operational performance.

What the interviews added was the passenger perspective on how well the display logic was understood. The Berlin results indicate that the system was generally seen as helpful and safety-enhancing, but some display modes beyond the basic safety signal were not interpreted equally well by all users, which is why the interview data were important for explaining differences between perceived impact and measured operational effect.

### 11.2.7 Demonstration event summary

The validation event showed that the light-emitting platform edge was technically operable under real station conditions and clearly noticed by passengers. The strongest effects were on passenger attention, perceived safety, and the subjective quality of boarding and wayfinding. Customer-side survey results indicate that the system was generally well received, with high agreement that it increased safety at the platform edge and helped passengers orient themselves better. In Berlin, the white running light was noticed by many passengers and followed by around a quarter of respondents, while the red warning light was the most clearly understood signal. At the same time, the more advanced capacity display was less effective. Only a minority of passengers understood the capacity colours correctly or changed their position accordingly, which suggests that some display modes need more time, stronger passenger density, or a different station layout before their impact becomes clearly measurable.




*Perception, knowledge and behaviour*

Operationally, the Berlin site did not show a significant improvement in stop-time compliance or capacity utilisation. The SQF database analysis and video-based movement analysis did not provide clear evidence of a measurable operational gain, which means the demonstrator's operational benefit appears to be more context-dependent than its customer benefit.

## 11.3 Demo evaluation phase

### 11.3.1 Dissemination Event

The dissemination of the demonstration results was carried out during the **FP1 MOTIONAL event held in Madrid on 7 May 2026**, organised as a hybrid event combining both on-site and online participation. The event took place at **ADIF's Training Center in Madrid** and gathered project partners, stakeholders and external participants to present the main outcomes of the project and the results of the demonstration activities.

The event included an opening session, a keynote, and a project storyline presentation supported by a demonstration video. This was followed by two demonstration showcase sessions, where different developments across the project were presented, and concluded with a roundtable discussion focused on challenges, lessons learned and future opportunities.

## Agenda

| Start | Duration | Description |
|---|---|---|
| 10:00-10:10 | 10 min | **Welcome and Opening Remarks**<br>- Objectives of the dissemination event 5 and overview |
| 10:10-10:20 | 10 min | **Keynote** |
| 10:20-10:35 | 15 min | **Storyline Presentation**<br>- "A Seamless Rail Journey: Connecting Travellers and Operators" - showcase of video |
| 10:35-11:20 | 45 min | **Demonstrations Showcase (Part 1)** |
| 11:20-12:05 | 45 min | **Coffee break** |
| 12:05-12:50 | 45 min | **Demonstrations Showcase (Part 2)** |
| 12:50-13:50 | 60 min | **Lunch** |
| 13:50-14:50 | 60 min | **Roundtable discussion**<br>- Challenges, Lessons learned and collaboration, opportunities in the future & beyond!<br>- Impact and EU benefit |
| | | **End of Meeting** |
| 15:00-16:00 | 60 min | **Guided visit to the Railway Museum (Optional)** |

*Event agenda*

During these showcase sessions, INDRA presented the developments corresponding to several Work Packages, including WP20/21, WP22/23 and WP24/25. In particular, for WP22/23, the presentation highlighted the frictionless validation, indoor guidance and ABT functionalities integrated within the MaaS application, as well as the results obtained from the Madrid demonstration.

The dissemination activities were supported by a combination of materials, including a demonstration video illustrating the main use cases and functionalities, and a technical presentation explaining the developed solutions and validation outcomes. These materials facilitated an effective communication of both the technical approach and the user-oriented benefits of the demonstrated system.



*event photo*

Overall, the dissemination event provided an opportunity to present the demonstration results to a broader audience, increasing the visibility of the project and enabling interaction with relevant stakeholders. It also contributed to fostering discussion on the applicability, future development and potential deployment of the demonstrated solutions in real operational contexts.

### 11.3.2 TRL validation

The demonstrator was validated in a real station environment with integrated hardware and software components, combined with real end-user testing and operational stakeholder involvement. The system had already been checked through component tests, integration tests, and real-world tests with S-Bahn Berlin, confirming safe operation and compatibility with railway signalling. On that basis, the solution reaches a maturity level corresponding to **TRL 6–7**.

### 11.3.3 Analyse feedback from stakeholders

Stakeholder feedback was overall very positive regarding the system's role in passenger guidance and safety support, while also highlighting a clear need to improve the intuitive understanding of some display layers, especially the capacity-related colour coding. The feedback base combined structured customer surveys, observations, interviews, and exchanges with project and external stakeholders during the pilot and dissemination activities.





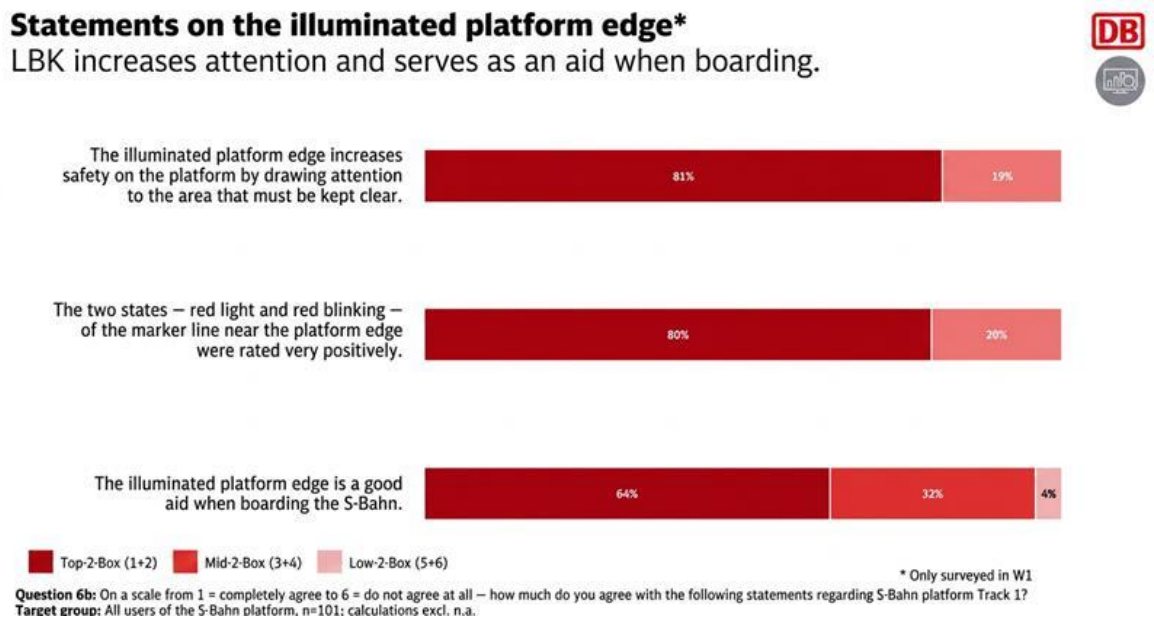

**Methodology**

- Interviews via tablets in the S-Bahn departing outbound from Track 1 at Berlin Südkreuz Station:
  - NM: n=130 interviews, Duration avg. 4.1 min.
  - W1: n=101 interviews, Duration avg. 5.9 min.
  - W2: n=104 interviews, Duration avg. 7.8 min.
- Observations at Platform Track 1, Berlin Südkreuz Station:
  - NM: 73 observations at 4 different platform positions over 2 days.
  - W1: 74 observations at 4 different platform positions over 2 days.
  - W2: 70 observations at 4 different platform positions over 2 days.

*Perception, knowledge, behaviour and satisfaction*

Project and stakeholder feedback showed that project partners, station staff, and other railway stakeholders considered the system technically and operationally promising. At the same time, they stressed that the system must remain robust, maintainable, and compatible with station operations, especially because some components are installed in the danger zone.

The key distinction in the feedback is between acceptance of the concept and immediate comprehension of each information layer. Stakeholders clearly supported the idea of the system as a safety and guidance tool, but the pilot showed that not all display modes are equally self-explanatory in everyday use. In particular, the more abstract capacity colours require additional explanation, better visual coding, or supplementary communication measures if the system is to be used effectively at scale.




*Effect of the illuminated platform edge*

### 11.3.4 Evaluation of outcomes and Performance indicators (PI)

The evaluation of outcomes shows a clear distinction between customer-related effects and operational performance indicators. Overall, the demonstrator was well received by passengers, and the results indicate that it successfully increased attention in the platform-edge area, improved the perceived sense of safety, and supported a more positive boarding and station-guidance experience. These findings are consistent across the customer surveys and observational evidence reported in the final report.

At the level of passenger guidance, the system produced mixed but still meaningful effects. The white running light for the stopping position was noticed by many passengers, but only a smaller share correctly understood its meaning or followed it in practice, which suggests that the cue was visible but not yet fully self-explanatory in everyday use. The capacity display in green, yellow, and orange showed even weaker effects: although the green signal was noticed by most respondents, fewer passengers recognized the full colour logic, and only a limited share reported following the display.

In behavioural terms, the observed redistribution on the platform remained small, which indicates that the intended steering effect was only partially achieved. The operational KPI and PI analysis did not demonstrate significant improvements in stop-time adherence or capacity utilization.

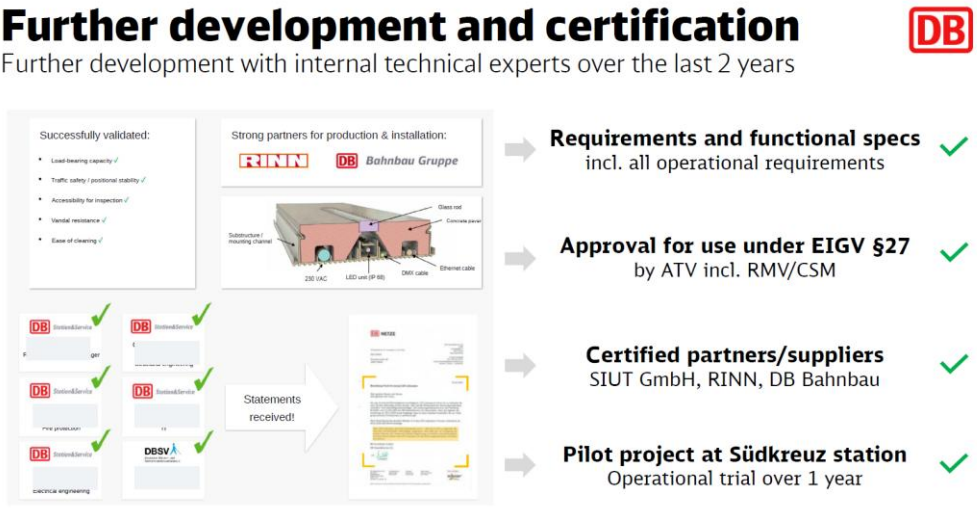
This conclusion is supported by the video analysis, which examined the movements of 21,488 passengers across 306 short trains and found no significant change in the distribution pattern between the control and intervention groups. The SQF database review, based on around 140,000 records, likewise showed no significant difference in the actual versus scheduled stopping times with and without the system.

These results should be interpreted in the context of the local conditions at Berlin Südkreuz, where the platform was not strongly capacity-critical, passenger load was often relatively low, and the station geometry limited the room for visible redistribution effects. As a result, the demonstrator proved its value as a customer-facing guidance and safety-support tool, but not as a system whose impact on operational KPIs could be clearly quantified at this site.

### 11.3.5 Impact assessment

The demonstrator is likely to have a clear user-level impact in terms of making the platform environment more legible, more reassuring, and easier to understand in the moment of boarding. The report shows that passengers noticed the red lighting patterns most strongly, understood their meaning in most cases, and reacted by keeping the free area near the platform edge less occupied when the warning light was active. It also reports very high agreement that the system increases safety at the platform edge, which suggests that the main value for the user group lies in improved awareness and a stronger subjective sense of control in a high-risk environment.

Importantly, the system was not only tested technically but also formally certified through specialist review and granted temporary user approval under EIGV §27, confirming that the DB-specific requirements for safety, durability, fire protection, electrical engineering, IT, accessibility, and operation were met.




*Development and certification of the light emitting platform edge*

For wider deployment, the findings suggest that the concept is promising, but future pilots should test it in more demanding environments and with clearer information design. The report itself indicates that the weaker operational effects at Berlin Südkreuz are linked to the local context, including moderate occupancy and the platform geometry, so stronger effects may emerge at busier sites with more crowding and more uneven passenger distribution. A broader rollout would therefore benefit from further work on scalability, simplification of the information layers, and adaptation to site-specific operating conditions, so that the user group can gain not only better visibility and reassurance but also more consistent behavioural guidance in everyday use.

# 12. TRL validation summary

The demonstrations conducted within Work Package 23 of the Europe's Rail FP1 MOTIONAL project successfully validated the developed Technical Enablers **TE20, TE21 and TE22** across a range of representative operational environments in Spain, the Netherlands and Germany.

The four demonstrations addressed complementary aspects of inclusive and seamless rail-based mobility, including travel assistance for Persons with Reduced Mobility (PRM), hands-free passenger validation, platform-based guidance, and passenger-flow and accessibility support. The demonstrations were conducted in real or operationally representative railway and public transport environments and involved transport operators, infrastructure managers, technology providers, operational staff, and end-users.

The table below summarizes the target and achieved Technology Readiness Levels (TRLs) for each WP23 demonstration, together with the main validation context and outcomes.

**Table 4. TRL summary**

| Demo | Target TRL | Achieved TRL | Comments |
|---|---|---|---|
| **Demo 23.1 – Demonstration in Madrid** | **TRL 6–7** | **TRL 6–7** | Successfully validated integrated frictionless validation, indoor guidance and Account-Based Ticketing functionalities in the Metro de Madrid environment. The demonstration combined mobile application services, positioning infrastructure, validation equipment and backend systems and involved end-users, including PRM users. The use of real station infrastructure and realistic operational configurations provided evidence of system maturity in a relevant operational environment. |
| **Demo 23.2 – Demonstration in Málaga – Robot** | **TRL 6** | **TRL 6** | Validated the assistive robot and associated accessibility services in the real operational environment of María Zambrano station in Málaga. The Validation Event was conducted with controlled users, including volunteers from associations representing people with disabilities. The demonstration provided evidence of the solution's capability to support passengers with different accessibility needs under realistic station conditions. |
| **Demo 23.2 – Demonstration in Málaga – Accessible Software + Totem** | **TRL 6** | **TRL 6** | Demonstrated the accessibility-oriented software and totem solution in a real station environment with users representing different disability profiles. The validation showed a high level of independent task completion, with users completing **67 out of 72 challenges independently**, four with some difficulty and one without being able to complete it independently. |
| **Demo 23.2 – Demonstration in Málaga –** | **TRL 5** | **TRL 6–7** | The Gobos solution exceeded its initial target TRL. It was demonstrated in a real operational environment with actual passenger flows, providing evidence of a higher |

| | | | |
|---|---|---|---|
| **Gobos** | | | level of maturity than initially targeted. Stakeholder feedback was positive regarding its potential to improve passenger guidance and platform organisation. |
| **Demo 23.2 – Demonstration in Asturias (Villalegre) – Gap Filler** | **TRL 5** | **TRL 6–7** | The gap-filler solution was demonstrated in Villalegre station under actual service conditions with live railway traffic. The achieved maturity is therefore considered closer to TRL 6–7, exceeding the initial TRL 5 target. |
| **Demo 23.3 – Demonstration in Amsterdam** | **TRL 7** | **TRL 7** | Successfully demonstrated the integrated UWB-based Hands-Free Seamless Travelling solution in Amsterdam Central Station. The demonstrator was integrated with existing GVB access-control and ticketing infrastructure and validated with users having technical and operational knowledge of the environment. The demonstration provided evidence of operation in the relevant environment for which the solution is intended. |
| **Demo 23.4 – Demonstration in Berlin and Leipzig** | **TRL 6–7** | **TRL 6–7** | Validated the illuminated platform-edge solution with integrated sensors, middleware, control software and LED-floor elements in real railway environments. The Berlin demonstration included operational testing with S-Bahn Berlin and train drivers, confirming acceptable brightness, colour spectrum and compatibility with railway signalling. The Leipzig validation extended the assessment to a second operational environment. |

**Overall TRL assessment:**
Taken together, the WP23 demonstrations provide evidence that the targeted technologies progressed from validated prototypes towards systems demonstrated in relevant or real operational environments.

The strongest evidence of advanced maturity is provided by the **Amsterdam demonstration**, which achieved **TRL 7** through the integration of the UWB-based hands-free solution with existing GVB ticketing and access-control infrastructure and its validation in Amsterdam Central Station.

The **Madrid demonstration** achieved **TRL 6–7**, supported by the deployment of integrated hardware and software components in the Metro de Madrid network, the execution of end-to-end scenarios and validation with real end-users.

The Málaga demonstrations provided evidence of **TRL 6 and above**, including a particularly strong accessibility validation in which participants completed **67 of 72 challenges independently**. The Gobos demonstration further exceeded its original TRL 5 target by reaching a maturity level assessed as **TRL 6–7** in a real operational environment.

The **Asturias gap-filler** similarly exceeded its original TRL 5 target, reaching a maturity level considered closer to **TRL 6–7** through demonstration under live railway service conditions.

Finally, the **Berlin and Leipzig demonstration** provided evidence corresponding to **TRL 6–7**, combining system-level integration, real railway operation, operational validation with train drivers and station stakeholders, and validation across two different station environments.

Overall, the WP23 results demonstrate that **TE20, TE21 and TE22 have reached the maturity required for further pilot deployment and larger-scale operational validation**, while also identifying the need for continued testing with larger and more diverse passenger populations, higher operational loads, and longer-term operational conditions.

# 13. Conclusions

The demonstrations conducted within **Work Package 23 of the Europe's Rail FP1 MOTIONAL project** have successfully validated innovative services for **inclusive, accessible and passenger-centric rail-based mobility**. Covering **four demonstration activities across Madrid, Málaga, Amsterdam, Berlin, Leipzig and Villalegre**, the work addressed the complementary Technical Enablers **TE20 – Travel Assistance Across Modes, TE21 – Hands-free Solutions and TE22 – Platform-based Guidance**.

The demonstrations collectively moved beyond component-level testing by integrating the developed solutions with real or representative transport infrastructure and by validating them with end-users, transport operators, infrastructure managers and operational experts.

**Key achievements across the demonstrations include:**

- **Madrid Demonstration:** The demonstration validated the integration of **frictionless validation, indoor guidance and Account-Based Ticketing** within the Metro de Madrid environment. The solution combined mobile application services, positioning infrastructure, validation equipment and backend systems and was tested with end-users, including PRM users. The demonstration achieved **TRL 6–7** and provided evidence of the feasibility of integrated accessibility and seamless-validation services in a real public-transport environment.
- **Málaga – Robot Demonstration:** The assistive robot solution was validated in the real operational environment of **María Zambrano station**, involving controlled users including volunteers from associations representing people with disabilities. The demonstration achieved the targeted **TRL 6** and provided evidence of the potential of robotic assistance to support passengers with different accessibility needs.
- **Málaga – Accessible Software and Totem Demonstration:** The accessibility-oriented software and totem solution demonstrated a high level of independent task completion. Users completed **67 out of 72 challenges independently**, while four challenges were completed with some difficulty and only one challenge could not be completed independently. The feedback was particularly positive among users with visual, hearing, PRM and cognitive accessibility needs, while also identifying areas for further accessibility improvements.
- **Málaga – Gobos Demonstration:** The Gobos solution demonstrated passenger-guidance capabilities in a **real operational environment with actual passenger flows**, reaching **TRL 6–7**, above the original TRL 5 target. Stakeholders positively assessed the concept and its potential contribution to passenger guidance and platform organisation.
- **Asturias/Villalegre Gap-Filler Demonstration:** The gap-filler solution was validated under **actual service conditions with live railway traffic**, reaching a maturity level considered closer to **TRL 6–7**, compared with the original TRL 5 target. This provided additional evidence of the feasibility of deploying accessibility and passenger-support technologies in operational railway environments.
- **Amsterdam Demonstration:** The Hands-Free Seamless Travelling demonstrator achieved **TRL 7**, representing the highest maturity level achieved within the WP23 demonstrations. The UWB-based solution was integrated with the existing GVB ticketing and access-control

infrastructure at Amsterdam Central Station and successfully validated in the relevant operational environment. The demonstration confirmed the feasibility of hands-free walk-in and walk-out, intermodal transfer support and automated assistance triggering.

- **Berlin and Leipzig Demonstration:** The illuminated platform-edge solution reached **TRL 6–7** through validation in real railway environments. The demonstration combined sensors, middleware, control software and LED-floor elements and assessed both passenger effects and railway operational aspects. In Berlin, operational tests with S-Bahn Berlin and train drivers confirmed that the selected colour spectrum and brightness levels were compatible with railway signalling and acceptable from an operational perspective.

**Quantitative achievements:**
Across WP23, the demonstrations provided a broad evidence base combining technical measurements, system logs, operational observations, questionnaires, interviews and user testing. The most concrete quantitative results include:

- **4 main WP23 demonstration activities**, covering **TE20, TE21 and TE22** across multiple European operational environments.
- **67/72 accessibility challenges** completed independently in the Málaga Accessible Software + Totem validation.
- **TRL 6–7** achieved in Madrid.
- **TRL 6** achieved for the Málaga Robot demonstration.
- **TRL 6–7** achieved for the Málaga Gobos and Asturias Gap-Filler demonstrations.
- **TRL 7** achieved for the Amsterdam Hands-Free demonstration.
- **TRL 6–7** achieved for the Berlin and Leipzig illuminated platform-edge demonstration.
- In the Berlin evaluation, video analysis covered **21,488 passengers across 306 short trains**, while the SQF database analysis included approximately **140,000 records**. These measurements did not show a statistically significant change in passenger distribution or stop-time compliance at the Berlin Südkreuz site, highlighting the importance of considering local operational conditions when assessing the impact of passenger-guidance technologies.

**Lessons learned and future perspectives:**
Across the demonstrations, a common conclusion emerged: the technical feasibility of inclusive mobility services has been demonstrated, but successful large-scale deployment depends on the interaction between technology, passenger behaviour, operational processes and the characteristics of the deployment environment.

The demonstrations confirmed the potential of **hands-free technologies, intelligent passenger guidance, assistive services and accessibility-oriented digital interfaces** to improve the passenger experience and reduce barriers to travel. At the same time, the results showed that user-facing information needs to be sufficiently intuitive, particularly when several information layers or interaction modes are introduced.

The demonstrations also highlighted the importance of testing solutions with **larger and more diverse populations of end-users**, including a broader representation of passengers with

accessibility needs. Further validation under higher passenger densities, longer operating periods, additional stations and different infrastructure configurations would provide stronger evidence of scalability and long-term operational benefits. The Berlin results, for example, indicate that the operational effect of passenger-guidance systems can depend significantly on local station geometry and passenger occupancy.

Overall, the WP23 demonstrations provide a strong foundation for the future deployment of **inclusive and seamless rail-based mobility services**. The achieved TRL levels, together with the technical evidence and feedback collected from users and operational stakeholders, demonstrate that the developed solutions have progressed beyond laboratory validation towards realistic operational application.

In conclusion, the demonstrations contribute to the MOTIONAL vision of **inclusive, accessible and seamless door-to-door mobility** by demonstrating how TE20, TE21 and TE22 can complement one another to address different barriers encountered by passengers during multimodal journeys. The results establish a solid basis for future industrialisation, larger-scale pilot deployments and integration of these technologies into interoperable European rail and multimodal mobility ecosystems.

# 14. Annexes

## 14.1 Annex 1: Example of feedback from users through google forms questionnaire (Robot)

Full feedback from users through questionnaire provided by a link to google forms:

| |
|---|
| Increase the volume of the iPad |
| Improve turns and braking when the user is using the grip system |
| Increase the volume |
| Add a sound signal to warn people |
| Consult contextual scene |
| Increase speed, signal robots with people with disabilities |
| The speaker facing the user. Add a bell on demand or an acoustic signal during accompaniment. Turns. A bit of speed |
| Increase speed |
| Regarding movement, it would be great if it could go a bit faster, always considering safety during movements. It would be interesting to add an acoustic warning system when it cannot pass, as verbal messages do not seem to have much effect in noisy environments. In the app, I would try to improve the presentation of the free hours that can be selected. The carousel that appears when opening the app, at least on iOS, has an unlabelled button, which is the first element VoiceOver sees, and navigating through the text is strange, sometimes it repeats things, and the skip button changes to the let's go button without doing anything. When editing personal data, when saving, apparently nothing happens. |
| Messages in the app can be improved, as well as some errors like when it freezes if we lock the phone during an accompaniment. |
| Add images of the destinations |
| Increase speed |
| Increase speed |
| Edit the reservation time, more intuitive speed |
| Increase speed |
| Increase speed |
| Increase speed |
| Increase speed and sound volume |
| Improve sound, and listen through the phone |
| Improve speakers |
| Smoother movements |
| More accessible tablets |

## 14.2Annex 2: Test cases accessible tool




### Test Case VT01

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Madrid
b) Hora y vía de llegada del próximo tren procedente de Sevilla.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario la información que debe obtener del tótem y se le coloca junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem, utilizando el lector de pantalla, hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario se acerca al tótem siguiendo los encaminamientos podotáctiles hasta alcanzarlo.
2. El usuario reconoce los elementos y forma del tótem (pantallas, botones, relieves Braille, etc.).
3. El usuario toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla.
4. El usuario conoce el contenido de cada pantalla gracias al altavoz y el lector de pantalla.
5. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
6. Tras la navegación, el usuario escucha la hora y vía del próximo tren con destino Madrid.
7. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
8. Tras la nueva navegación, el usuario escucha la hora y vía del próximo tren procedente de Sevilla.
9. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
10. Tras la nueva navegación, el usuario escucha la frecuencia de paso del Metro.
11. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 9:35 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case VT02

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la vía en la que está estacionado su tren utilizando un billete de tren y el lector de códigos QR.

**Objetivo**: Averiguar de manera autónoma:

a) Ubicación del lector de códigos QR.
b) Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Tótem

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando el lector de pantalla, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al lector de códigos QR, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario se acerca al tótem siguiendo los encaminamientos podotáctiles hasta alcanzarlo.
2. El usuario reconoce los elementos y forma del tótem (pantallas, botones, relieves Braille, etc.).
3. El usuario toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla.
4. El usuario conoce el contenido de cada pantalla gracias al altavoz y el lector de pantalla.
5. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
6. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
7. El tótem indica la situación del lector de códigos QR.
8. El usuario coloca el billete frente al lector de códigos QR.
9. El tótem indica la vía en la que está estacionado el tren.
10. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 10:00 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** No Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case VT03

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para solicitar un robot asistencial que lo acompañe hasta la vía en la que está su tren.

**Objetivo**: Llegar desde el tótem hasta la cabina de cabecera de andén asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Tótem

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case VT02)

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para solicitar un robot que lo acompañe hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y asistido por dicho robot, debe llegar a la cabina de la cabecera del andén de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case VT02), el usuario selecciona la opción "¿Cómo llegar?", sigue el proceso indicado por el tótem hasta que llega el robot al punto de encuentro en el tótem. El usuario localiza el robot y realiza el recorrido hasta la cabina de la cabecera de su vía utilizando el robot asistencial.

**Secuencia de pasos:**

1. En la pantalla en la que el tótem indica la vía en la que está estacionado el tren del billete escaneado (Test Case VT02), el usuario pulsa la opción ¿Cómo llegar?
2. El tótem muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Solicitar Robot".
4. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
5. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot.
6. El usuario pulsa "Comenzar acompañamiento" y se acerca al robot.
7. El usuario toca la pantalla del robot o se agarra del asa y comienza el acompañamiento.
8. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
9. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 10:45 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







# Test Case VT04

## Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para acceder al Guiado con móvil (Navilens) y realizará el recorrido hasta la vía en la que está su tren siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el tótem hasta la cabina de cabecera de andén siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Tótem

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case VT02)

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para solicitar Guiado por móvil hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y que debe llegar a la cabina de la cabecera del andén de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case VT02), el usuario selecciona la opción "¿Cómo llegar?" y seguidamente "Guiado por móvil", sigue el proceso indicado por el tótem y realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. En la pantalla en la que el tótem indica la vía en la que está estacionado el tren del billete escaneado (Test Case VT02), el usuario pulsa la opción ¿Cómo llegar?
2. El tótem muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Guiado por móvil".
4. En la pantalla del tótem aparece un código QR, y un mensaje solicitando al usuario que escanee con el móvil (de pruebas) el código QR que le aparece en la pantalla del tótem, y que una vez se abra la aplicación Navilens en su móvil, debe ir escaneando códigos Navilens hasta llegar a la cabina de la cabecera de su vía.
5. Se abre la app Navilens en el móvil de pruebas.
6. El usuario realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 10:20 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case VT06

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para solicitar un robot asistencial que lo acompañe hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el tótem hasta el "Mostrador de venta de billetes Cercanías" asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para solicitar un robot que lo acompañe hasta el "Mostrador de venta de billetes Cercanías", y asistido por dicho robot, debe llegar al citado mostrador de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando el lector de pantalla, hasta llegar al botón "Mostrador de venta de billetes Cercanías", el usuario selecciona la opción "Solicitar robot", sigue el proceso indicado por el tótem hasta que llega el robot al punto de encuentro en el tótem.

El usuario localiza el robot y realiza el recorrido hasta el citado mostrador asistido por el robot asistencial.

**Secuencia de pasos:**

1. El usuario se acerca al tótem siguiendo los encaminamientos podotáctiles hasta alcanzarlo.
2. El usuario reconoce los elementos y forma del tótem (pantallas, botones, relieves Braille, etc.).
3. El usuario toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla.
4. El usuario conoce el contenido de cada pantalla gracias al altavoz y el lector de pantalla.
5. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
6. Tras la navegación, el usuario llega a la pantalla con el botón "Mostrador de venta de billetes Cercanías" y lo pulsa.
7. El tótem muestra la ruta accesible hacia este mostrador y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
8. El usuario selecciona "Solicitar Robot".
9. El tótem ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".

10. El usuario selecciona “Agarrado al asa”.
11. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
12. El usuario puede pulsar “Localizar a mi robot” para volver a oír el sonido emitido por el robot.
13. Cuando el usuario ha localizado la ubicación del robot pulsa “Comenzar acompañamiento” y se acerca al robot.
14. El usuario se agarra del asa del robot y comienza el acompañamiento.
15. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
16. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 11:10 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case VT07

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para acceder al Guiado por móvil, y realizará el recorrido hasta un punto de interés de la estación siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el tótem hasta los aseos siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para solicitar guiado con móvil hasta los aseos, y que debe llegar a los mismos de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando el lector de pantalla, hasta llegar al botón "Aseos", el usuario selecciona la opción "Guiado por móvil", sigue el proceso indicado por el tótem y realiza el recorrido hasta los aseos siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. El usuario se acerca al tótem siguiendo los encaminamientos podotáctiles hasta alcanzarlo.
2. El usuario reconoce los elementos y forma del tótem (pantallas, botones, relieves Braille, etc.).
3. El usuario toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla.
4. El usuario conoce el contenido de cada pantalla gracias al altavoz y el lector de pantalla.
5. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
6. Tras la navegación, el usuario llega a la pantalla con el botón "Aseos" y lo pulsa.
7. El tótem muestra la ruta accesible hacia los aseos y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
8. El usuario selecciona "Guiado por móvil".
9. En la pantalla del tótem aparece un código QR, y un mensaje solicitando al usuario que escanee con el móvil (de pruebas) el código QR que le aparece en la pantalla del tótem, y que una vez se abra la aplicación Navilens en su móvil, debe ir escaneando códigos Navilens hasta llegar al aseo.
10. Se abre la app Navilens en el móvil de pruebas.
11. El usuario realiza el recorrido hasta los aseos siguiendo las indicaciones de Navilens.
12. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 11:40 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case VM01

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Madrid
b) Hora y vía de llegada del próximo tren procedente de Sevilla.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad lector de pantallas, tamaño de letra, contraste, etc.).

**Datos de entrada:**

Se indica al usuario la información que debe obtener de la app móvil.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional, utilizando el narrador de pantalla o lector de pantalla, hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario conoce el contenido de cada pantalla gracias a talkback o VoiceOver (lector de pantalla).
3. El usuario se mueve por las pantallas y selecciona opciones utilizando talkback o VoiceOver (lector de pantalla).
4. Tras la navegación, el usuario escucha la hora y vía del próximo tren con destino Madrid.
5. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
6. Tras la nueva navegación, el usuario escucha la hora y vía del próximo tren procedente de Sevilla.
7. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
8. Tras la nueva navegación, el usuario escucha la frecuencia de paso del Metro.
9. Fin del test case.

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 9:40 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case VM02

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para conocer la vía en la que está estacionado su tren utilizando un billete de tren y la app Motional.

**Objetivo**: Averiguar de manera autónoma la Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el acceso a la estación por c/Mendívil (para agilizar el Test Case VM03).

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional utilizando el lector de pantalla, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al móvil, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario conoce el contenido de cada pantalla gracias a talkback o VoiceOver (lector de pantalla).
3. El usuario se mueve por las pantallas y selecciona opciones utilizando talkback o VoiceOver (lector de pantalla).
4. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
5. El usuario escanea el billete con el móvil.
6. La app móvil indica la vía en la que está estacionado el tren.
7. Fin del test case.







## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 10:00 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

FP1 MOTIONAL
Europe's Rail

## Test Case VM03

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para solicitar un robot asistencial que lo acompañe hasta la vía en la que está su tren.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (acceso a estación c/ Mendívil), hasta la cabina de cabecera de andén asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case VM02).

Se coloca al usuario en el acceso a la estación por la c/ Mendívil.

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para solicitar un robot que lo acompañe hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y asistido por dicho robot, debe llegar a la cabina de la cabecera del andén de manera autónoma desde su ubicación actual.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case VM02), el usuario selecciona la opción "¿Cómo llegar?", sigue el proceso indicado por la app Motional hasta que llega el robot al punto de encuentro en el que se encuentra el usuario.

El usuario localiza el robot y realiza el recorrido hasta la cabina de la cabecera de su vía asistido por el robot asistencial.

**Secuencia de pasos:**

1. En la pantalla en la que la app Motional indica la vía en la que está estacionado el tren del billete escaneado (Test Case VM02), el usuario pulsa la opción ¿Cómo llegar?
2. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Solicitar Robot".
4. La app Motional muestra una pantalla con posibles puntos de encuentro usuario-robot.
5. El usuario selecciona "Salida estación a c/ Medívil".
6. En la siguiente pantalla, la app ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
7. El usuario selecciona "Agarrado al asa".
8. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.

FP1 MOTIONAL
Europe's Rail

9. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot para localizarlo por el sonido.
10. Cuando el usuario ha localizado la ubicación del robot pulsa "Comenzar acompañamiento" y se acerca al robot.
11. El usuario se agarra del asa del robot y comienza el acompañamiento.
12. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
13. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 10:25 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

FP1 MOTIONAL
Europe's Rail

## Test Case VM04

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para acceder al Guiado con móvil (Navilens), y realizará el recorrido hasta la vía en la que está su tren siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (acceso a estación c/ Héroe de Sostoa) hasta la cabina de cabecera de andén siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case VM02).

Se coloca al usuario en el acceso a la estación de c/Héroe de Sostoa.

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para solicitar guiado con móvil (Navilens), hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y que debe llegar a la cabina de la cabecera del andén de manera autónoma desde su ubicación actual.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case VM02), el usuario selecciona la opción "¿Cómo llegar?", y seguidamente "Guiado por móvil".

El usuario sigue el proceso indicado por la app Motional y realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. En la pantalla en la que la app Motional indica la vía en la que está estacionado el tren del billete escaneado (Test Case VM02), el usuario pulsa la opción ¿Cómo llegar?
2. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Guiado por móvil".
4. En la pantalla del móvil aparece un enlace, y un mensaje solicitando al usuario que pulse el enlace que le aparece en la pantalla del tótem, y que una vez se abra la aplicación Navilens en su móvil, debe ir escaneando códigos Navilens hasta llegar al aseo.
5. Se abre la app Navilens en el móvil de pruebas.
6. El usuario realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 11:15 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

FP1 MOTIONAL
Europe's Rail

## Test Case VM06

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para solicitar un robot asistencial que lo acompañe hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (vía de estacionamiento de su tren tras realizar Test Case VM04), hasta la máquina de autoventa Cercanías Sur.

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el encaminamiento podotáctil junto a la cabina de cabecera de andén.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para solicitar un robot que lo acompañe hasta la máquina de autoventa de billetes de Cercanías Sur, y asistido por dicho robot, debe llegar a dicha máquina de manera autónoma desde su ubicación actual.

**Resultados esperados:**

El usuario navega de forma autónoma en la app Motional utilizando el lector de pantalla, hasta llegar al botón "Máquina de autoventa Cercanías Sur", el usuario selecciona la opción "Solicitar robot", sigue el proceso indicado por la app hasta que llega el robot al punto de encuentro en el que se encuentra el usuario.

El usuario localiza el robot y realiza el recorrido hasta la máquina de autoventa asistido por el robot asistencial.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario conoce el contenido de cada pantalla gracias a talkback o VoiceOver (lector de pantalla).
3. El usuario se mueve por las pantallas y selecciona opciones utilizando talkback o VoiceOver (lector de pantalla).
4. Tras la navegación, el usuario llega hasta la opción "Máquina de autoventa Cercanías Sur".
5. La app Motional muestra la ruta accesible hacia este punto de la estación y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
6. El usuario selecciona "Solicitar Robot".
7. La app Motional muestra una pantalla con posibles puntos de encuentro usuario-robot.
8. El usuario selecciona "Vía XX (en función de la vía en que se encuentre)".
9. En la siguiente pantalla, la app ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
10. El usuario selecciona "Agarrado al asa".

FP1 MOTIONAL
Europe's Rail

11. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
12. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot para localizarlo por el sonido.
13. Cuando el usuario ha localizado la ubicación del robot pulsa "Comenzar acompañamiento" y se acerca al robot.
14. El usuario se agarra del asa del robot y comienza el acompañamiento.
15. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
16. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 11:35 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case VM07

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para acceder al Guiado con móvil (Navilens), y realizar un recorrido hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (máquina de autoventa Cercanías Sur tras realizar Test Case VM06) hasta la vía 11 de Cercanías siguiendo las indicaciones de Navilens (o en su defecto hasta el ascensor que da acceso a dicha vía).

**Precondiciones:**

Usuario: Discapacidad visual.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el encaminamiento podotáctil junto a la máquina de autoventa.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para solicitar guiado con móvil (Navilens), hasta la vía 11 de Cercanías, y que debe llegar de manera autónoma desde su ubicación actual.

**Resultados esperados:**

El usuario navega de forma autónoma en la app Motional utilizando el lector de pantalla, hasta llegar al botón "Vía 11", el usuario selecciona la opción "Guiado por móvil".

El usuario sigue el proceso indicado por la app Motional y realiza el recorrido hasta bajar al andén siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario conoce el contenido de cada pantalla gracias a talkback o VoiceOver (lector de pantalla).
3. El usuario se mueve por las pantallas y selecciona opciones utilizando talkback o VoiceOver (lector de pantalla).
4. Tras la navegación, el usuario llega hasta la opción "Vía 11".
5. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
6. El usuario selecciona "Guiado por móvil".
7. En la pantalla del móvil aparece un enlace, y un mensaje solicitando al usuario que pulse el enlace que le aparece en la pantalla del tótem, y que una vez se abra la aplicación Navilens en su móvil, debe ir escaneando códigos Navilens hasta llegar al aseo.
8. Se abre la app Navilens en el móvil de pruebas.
9. El usuario realiza el recorrido hasta bajar al andén (o en su defecto hasta el ascensor que da acceso), siguiendo las indicaciones de Navilens.
10. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 12:15 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Visual/ONCE

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case AT01

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Madrid
b) Hora y vía de llegada del próximo tren procedente de Sevilla.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario la información que debe obtener del tótem y se le coloca junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem, haciendo uso del bucle de inducción magnética si procede (utilización de audífono), o bien, mediante la lectura de la pantalla, hasta obtener la información solicitada.

**Secuencia de pasos:**

1. En función de la discapacidad del usuario, éste toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla y activa su audífono para recibir la señal del bucle de inducción magnética, o bien, lee directamente de la pantalla.
2. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
3. Tras la navegación, el usuario escucha la hora y vía del próximo tren con destino Madrid.
4. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
5. Tras la nueva navegación, el usuario escucha la hora y vía del próximo tren procedente de Sevilla.
6. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
7. Tras la nueva navegación, el usuario escucha la frecuencia de paso del Metro.
8. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 15:20 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case AT02

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la vía en la que está estacionado su tren utilizando un billete de tren y el lector de códigos QR.

**Objetivo**: Averiguar de manera autónoma:

a) Ubicación del lector de códigos QR.
b) Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Tótem

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem haciendo uso del bucle de inducción magnética si procede (utilización de audífono), o bien, mediante la lectura de la pantalla, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al lector de códigos QR, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. En función de la discapacidad del usuario, éste toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla y activa su audífono para recibir la señal del bucle de inducción magnética, o bien, lee directamente de la pantalla.
2. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
3. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
4. El tótem indica la situación del lector de códigos QR.
5. El usuario coloca el billete frente al lector de códigos QR.
6. El tótem indica la vía en la que está estacionado el tren.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 15:50 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case AT03

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para solicitar un robot asistencial que lo acompañe hasta la vía en la que está su tren.

**Objetivo**: Llegar desde el tótem hasta la cabina de cabecera de andén asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Tótem

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case AT02)

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para solicitar un robot que lo acompañe hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y asistido por dicho robot, debe llegar a la cabina de la cabecera del andén de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case AT02), el usuario selecciona la opción "¿Cómo llegar?", sigue el proceso indicado por el tótem hasta que llega el robot al punto de encuentro en el tótem. El usuario localiza el robot y realiza el recorrido hasta la cabina de la cabecera de su vía utilizando el robot asistencial.

**Secuencia de pasos:**

1. En la pantalla en la que el tótem indica la vía en la que está estacionado el tren del billete escaneado (Test Case AT02), el usuario pulsa la opción ¿Cómo llegar?
2. El tótem muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Solicitar Robot".
4. En la siguiente pantalla, el tótem ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
5. El usuario selecciona "Siguiendo al robot".
6. El usuario espera hasta que llegue el robot y se detenga junto al tótem.
7. Cuando el robot se ha detenido, el usuario pulsa "Comenzar acompañamiento" y se acerca al robot.
8. El usuario toca la pantalla del robot y comienza el acompañamiento.
9. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
10. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 16:20 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case AT07

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para acceder al Guiado por móvil, y realizará el recorrido hasta un punto de interés de la estación siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el tótem hasta los aseos siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para solicitar Guiado por móvil hasta los aseos, y que debe llegar a los mismos de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem haciendo uso del bucle de inducción magnética si procede (utilización de audífono), o bien, mediante la lectura de la pantalla, hasta llegar al botón "Aseos", el usuario selecciona la opción "Guiado por móvil", sigue el proceso indicado por el tótem y realiza el recorrido hasta los aseos siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. En función de la discapacidad del usuario, éste toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla y activa su audífono para recibir la señal del bucle de inducción magnética, o bien, lee directamente de la pantalla.
2. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
3. Tras la navegación, el usuario llega a la pantalla con el botón "Aseos" y lo pulsa.
4. El tótem muestra la ruta accesible hacia los aseos y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
5. El usuario selecciona "Guiado por móvil".
6. En la pantalla del tótem aparece un código QR, y un mensaje solicitando al usuario que escanee con el móvil (de pruebas) el código QR que le aparece en la pantalla del tótem, y que una vez se abra la aplicación Navilens en su móvil, debe ir escaneando códigos Navilens hasta llegar al aseo.
7. Se abre la app Navilens en el móvil de pruebas.
8. El usuario realiza el recorrido hasta los aseos siguiendo las indicaciones de Navilens.
9. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 16:30 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case AT08

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la ruta accesible hasta un punto de interés de la estación.

**Objetivo**: Que el voluntario tenga una idea aproximada de cómo llegar a alguna máquina de autoventa de tickets de Cercanías desde el tótem, mostrándole un plano con la ruta accesible. (No es objetivo recorrerla).

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para visualizar la ruta accesible hasta alguna máquina de venta de tickets.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem haciendo uso del bucle de inducción magnética si procede (utilización de audífono), o bien, mediante la lectura de la pantalla, hasta llegar a alguno de los botones "Máquina de autoventa Cercanías", el usuario pulsa el botón, y el tótem mostrará sobre un plano de la estación la ruta accesible hacia la máquina de venta seleccionada.

**Secuencia de pasos:**

1. En función de la discapacidad del usuario, éste toca la pantalla en la esquina inferior izquierda para activar el lector de pantalla y activa su audífono para recibir la señal del bucle de inducción magnética, o bien, lee directamente de la pantalla.
2. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
3. Tras la navegación, el usuario llega a la pantalla con los botones "Máquina de autoventa Cercanías" y pulsa alguno de ellos.
4. El tótem muestra la ruta accesible hacia la máquina de autoventa sobre el plano de la estación.
1. El usuario observa el plano, su entorno, se orienta e indica verbalmente qué dirección tomaría.
5. El usuario intenta llegar al destino recordando la ruta accesible que ha visto en el plano (opcional, sólo si el usuario se siente capacitado y quiere intentarlo).
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 16:35 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case AM01

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Granada.
b) Hora y vía de llegada del próximo tren procedente de Barcelona.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad lector de pantallas, tamaño de letra, contraste, etc.).

**Datos de entrada:**

Se indica al usuario la información que debe obtener de la app móvil.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario lee la hora y vía del próximo tren con destino Granada.
4. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
5. Tras la nueva navegación, el usuario lee la hora y vía del próximo tren procedente de Barcelona.
6. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
7. Tras la nueva navegación, el usuario lee la frecuencia de paso del Metro.
8. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 15:20 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case AM02

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para conocer la vía en la que está estacionado su tren utilizando un billete de tren y la app Motional.

**Objetivo**: Averiguar de manera autónoma la Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el acceso a la estación por c/Héroe de Sostoa (para agilizar el Test Case AM04).

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al móvil, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
4. El usuario escanea el billete con el móvil.
5. La app móvil indica la vía en la que está estacionado el tren.
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 15:35 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

FP1 MOTIONAL
Europe's Rail

## Test Case AM04

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para acceder al Guiado con móvil (Navilens), y realizará el recorrido hasta la vía en la que está su tren siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (acceso a estación c/ Héroe de Sostoa) hasta la cabina de cabecera de andén siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case AM02).

Se coloca al usuario en el acceso a la estación de c/Héroe de Sostoa.

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para solicitar guiado con móvil (Navilens), hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y que debe llegar a la cabina de la cabecera del andén de manera autónoma desde su ubicación actual.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case AM02), el usuario selecciona la opción "¿Cómo llegar?", y seguidamente "Guiado por móvil".

El usuario sigue el proceso indicado por la app Motional y realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. En la pantalla en la que la app Motional indica la vía en la que está estacionado el tren del billete escaneado (Test Case AM02), el usuario pulsa la opción ¿Cómo llegar?
2. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Guiado por móvil".
4. En la pantalla del móvil aparece un enlace, y un mensaje solicitando al usuario que pulse el enlace que le aparece en la pantalla, y que una vez se abra la aplicación Navilens en su móvil, debe ir escaneando códigos Navilens hasta llegar a la cabina de cabecera de andén de la vía en la que está estacionado su tren.
5. Se abre la app Navilens en el móvil de pruebas.
6. El usuario realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 15:40 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case AM05

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para conocer la ruta accesible hasta la vía en la que está su tren.

**Objetivo**: Que el voluntario tenga una idea aproximada de cómo llegar a su vía desde su ubicación, mostrándole un plano con la ruta accesible. (No es objetivo recorrerla).

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se conoce la vía en la que está estacionado el tren de los TC anteriores.

Se coloca al usuario en uno de los puntos de interés de la estación de entre los establecidos en el proyecto. (En el punto de venta de billetes de Renfe).

**Datos de entrada:**

Vía a la que debe dirigirse el usuario.

Se indica al usuario que debe usar la app Motional para visualizar la ruta accesible hasta la vía en la que está estacionado su tren.

**Resultados esperados:**

El usuario navega por las distintas pantallas de la app Motional hasta seleccionar la vía solicitada, y la app Motional mostrará un plano de la estación y la ruta accesible hacia su vía.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas hasta llegar a la pantalla de Vías.
3. El usuario selecciona la Vía que se le ha solicitado.
4. El móvil muestra la ruta accesible hacia la vía sobre el plano de la estación.
5. El usuario observa el plano, su entorno, se orienta e indica verbalmente qué dirección tomaría.
6. El usuario intenta llegar al destino observando la ruta accesible que le muestra el móvil (opcional, sólo si el usuario se siente capacitado y quiere intentarlo).
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 16:00 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

# Test Case AM06

## Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para solicitar un robot asistencial que lo acompañe hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (vía de estacionamiento de su tren tras realizar Test Case AM04), hasta el Centro de Viajeros Renfe asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad auditiva. Necesario traductor de lengua de signos.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el encaminamiento podotáctil junto a la cabina de cabecera de andén.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para solicitar un robot que lo acompañe hasta el Centro de Viajeros de Renfe, y asistido por dicho robot, debe llegar a dicho lugar de manera autónoma desde su ubicación actual.

**Resultados esperados:**

El usuario navega de forma autónoma en la app Motional, hasta llegar al botón "Centro de viajeros Renfe", el usuario selecciona la opción "Solicitar robot", sigue el proceso indicado por la app hasta que llega el robot al punto de encuentro en el que se encuentra el usuario.

El usuario localiza el robot y realiza el recorrido hasta el Centro de Viajeros asistido por el robot asistencial.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario selecciona "Servicios de la Estación".
3. El usuario selecciona la "Centro de viajeros Renfe".
4. La app Motional muestra la ruta accesible hacia este punto de la estación y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
5. El usuario selecciona "Solicitar Robot".
6. La app Motional muestra una pantalla con posibles puntos de encuentro usuario-robot.
7. El usuario selecciona "Vía XX (en función de la vía en que se encuentre)".
8. En la siguiente pantalla, la app ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
9. El usuario selecciona "Agarrado al asa".
10. El usuario espera hasta que llegue el robot y se detenga junto a la cabina de cabecera de andén.
11. Cuando el robot se ha detenido, el usuario pulsa "Comenzar acompañamiento" y se acerca al robot.

12. El usuario se agarra del asa y comienza el acompañamiento.
13. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
14. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 15/07/2026 16:10 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Hearing impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case CT01

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Fuengirola.
b) Hora y vía de llegada del próximo tren procedente de Álora.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario la información que debe obtener del tótem y se le coloca junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
2. Tras la navegación, el usuario lee (o escucha) la hora y vía del próximo tren con destino Fuengirola.
3. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
4. Tras la nueva navegación, el usuario lee (o escucha) la hora y vía del próximo tren procedente de Álora.
5. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
6. Tras la nueva navegación, el usuario lee (o escucha) la frecuencia de paso del Metro.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 9:45 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case CT02

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la vía en la que está estacionado su tren utilizando un billete de tren y el lector de códigos QR.

**Objetivo**: Averiguar de manera autónoma:

a) Ubicación del lector de códigos QR.
b) Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Tótem

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al lector de códigos QR, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
2. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
3. El tótem indica la situación del lector de códigos QR.
4. El usuario lee (o escucha) la ubicación del lector y coloca el billete frente al lector de códigos QR.
5. El tótem indica la vía en la que está estacionado el tren.
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 9:50 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Evidence: Motional demonstrator evaluation form.







# Test Case CT03

## Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para solicitar un robot asistencial que lo acompañe hasta la vía en la que está su tren.

**Objetivo**: Llegar desde el tótem hasta la cabina de cabecera de andén asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Tótem

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case CT02)

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para solicitar un robot que lo acompañe hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y asistido por dicho robot, debe llegar a la cabina de la cabecera del andén de manera autónoma.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case CT02), el usuario selecciona la opción "¿Cómo llegar?", sigue el proceso indicado por el tótem hasta que llega el robot al punto de encuentro en el tótem. El usuario localiza el robot y realiza el recorrido hasta la cabina de la cabecera de su vía utilizando el robot asistencial.

**Secuencia de pasos:**

1. En la pantalla en la que el tótem indica la vía en la que está estacionado el tren del billete escaneado (Test Case CT02), el usuario pulsa la opción ¿Cómo llegar?
2. El tótem muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Solicitar Robot".
4. En la siguiente pantalla, el tótem ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
5. El usuario selecciona "Agarrado al robot".
6. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
7. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot.
8. Cuando el robot se ha detenido, el usuario pulsa "Comenzar acompañamiento" y se acerca al robot.
9. El usuario se agarra del asa del robot y comienza el acompañamiento.
10. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
11. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 10:55 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case CT07

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para acceder al guiado por móvil, y realizará el recorrido hasta un punto de interés de la estación siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el tótem hasta los aseos siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para solicitar guiado por móvil hasta los aseos, y que debe llegar a los mismos de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces hasta llegar al botón "Aseos", el usuario selecciona la opción "Guiado por móvil", sigue el proceso indicado por el tótem y realiza el recorrido hasta los aseos siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
2. Tras la navegación, el usuario llega a la pantalla con el botón "Aseos" y lo pulsa.
3. El tótem muestra la ruta accesible hacia los aseos y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
4. El usuario selecciona "Guiado por móvil".
5. En la pantalla del tótem aparece un código QR, así como el mensaje "Por favor, escanee con su móvil el código QR que aparece en pantalla. Ello provocará que se abra la aplicación Navilens automáticamente. Una vez abierta Navilens, utilícela para escanear códigos y se le guiará hasta su destino".
6. El usuario escanea el código QR con el móvil de pruebas.
7. Se abre la app Navilens en el móvil.
8. El usuario realiza el recorrido hasta los aseos siguiendo las indicaciones de Navilens.
9. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 10:00 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case CM01

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Madrid.
b) Hora y vía de llegada del próximo tren procedente de Granada.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad lector de pantallas, tamaño de letra, contraste, etc.).

**Datos de entrada:**

Se indica al usuario la información que debe obtener de la app móvil.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario lee la hora y vía del próximo tren con destino Madrid.
4. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
5. Tras la nueva navegación, el usuario lee la hora y vía del próximo tren procedente de Granada.
6. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
7. Tras la nueva navegación, el usuario lee la frecuencia de paso del Metro.
8. Fin del test case.







## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 9:45 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case CM02

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para conocer la vía en la que está estacionado su tren utilizando un billete de tren y la app Motional.

**Objetivo**: Averiguar de manera autónoma la Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el acceso a la estación por c/Héroe de Sostoa (para agilizar el Test Case CM04).

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al móvil, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
4. El usuario escanea el billete con el móvil.
5. La app móvil indica la vía en la que está estacionado el tren.
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 10:05 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







# Test Case CM04

## Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para acceder al guiado con móvil (Navilens), y realizar un recorrido hasta la vía en la que está su tren siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (Acceso c/ Héroe de Sostoa Test Case CM02) hasta la cabina de cabecera de andén siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

El usuario se encuentra en la entrada a la estación de la c/ Héroe de Sostoa.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para solicitar guiado con móvil (Navilens), hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y que debe llegar a la cabina de la cabecera del andén de manera autónoma desde su ubicación actual.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case CM02), el usuario selecciona la opción "¿Cómo llegar?" y seguidamente "Guiado por móvil".

El usuario sigue el proceso indicado por la app Motional, y realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. La pantalla del móvil indica la vía en la que está estacionado el tren del billete escaneado (Test Case CM02), el usuario pulsa la opción ¿Cómo llegar?
2. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Guiado por móvil".
4. En la pantalla del móvil aparece un enlace, así como el mensaje "Por favor, pulse el enlace que aparece en pantalla. Ello provocará que se abra la aplicación Navilens automáticamente. Una vez abierta Navilens, utilícela para escanear códigos y se le guiará hasta su destino".
5. Se abre la app Navilens en el móvil de pruebas.
6. El usuario realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 10:30 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

FP1 MOTIONAL
Europe's Rail

## Test Case CM06

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para solicitar un robot asistencial que lo acompañe hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (vía de estacionamiento de su tren tras realizar Test Case CM04), hasta el mostrador de venta de billetes de Cercanías asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad cognitiva.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el encaminamiento podotáctil junto a la cabina de cabecera de andén.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para solicitar un robot que lo acompañe hasta el mostrador de venta de billetes de Cercanías, y asistido por dicho robot, debe llegar a dicho lugar de manera autónoma desde su ubicación actual.

**Resultados esperados:**

El usuario navega de forma autónoma en la app Motional, hasta llegar al botón "Mostrador venta billetes Cercanías", el usuario selecciona la opción "Solicitar robot", sigue el proceso indicado por la app hasta que llega el robot al punto de encuentro en el que se encuentra el usuario.

El usuario localiza el robot y realiza el recorrido hasta el mostrador asistido por el robot asistencial.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario selecciona "Servicios de la Estación".
3. El usuario selecciona la "Mostrador de venta de billetes Cercanías".
4. La app Motional muestra la ruta accesible hacia el mostrador y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
5. El usuario selecciona "Solicitar Robot".
6. La app Motional muestra una pantalla con posibles puntos de encuentro usuario-robot.
7. El usuario selecciona "Vía XX (Test Case CM04)".
8. En la siguiente pantalla, la app ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
9. El usuario selecciona "Siguiendo al robot".
10. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
11. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot para localizarlo por el sonido.

12. Cuando el usuario ha localizado la ubicación del robot pulsa "Comenzar acompañamiento" y se acerca al robot.
13. El usuario pulsa el Inicio en la pantalla del robot y comienza el acompañamiento.
14. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
15. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 17/07/2026 11:05 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Cognitive impairment / APROINLA

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case PT01

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Madrid
b) Hora y vía de llegada del próximo tren procedente de Sevilla.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario la información que debe obtener del tótem y se le coloca junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
2. Tras la navegación, el usuario lee (o escucha) la hora y vía del próximo tren con destino Madrid.
3. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
4. Tras la nueva navegación, el usuario lee (o escucha) la hora y vía del próximo tren procedente de Sevilla.
5. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
6. Tras la nueva navegación, el usuario lee (o escucha) la frecuencia de paso del Metro.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 9:30 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case PT02

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la vía en la que está estacionado su tren utilizando un billete de tren y el lector de códigos QR.

**Objetivo**: Averiguar de manera autónoma:

a) Ubicación del lector de códigos QR.
b) Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Tótem

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al lector de códigos QR, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
2. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
3. El tótem indica la situación del lector de códigos QR.
4. El usuario lee (o escucha) la ubicación del lector y coloca el billete frente al lector de códigos QR.
5. El tótem indica la vía en la que está estacionado el tren.
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 9:55 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case PT04

### Descripción del test:

**Breve descripción**: Se indica al sistema que hay un tramo inaccesible y el sistema ofrece una ruta alternativa. El usuario utiliza el tótem para acceder al Guiado con móvil (Navilens) y realizará el recorrido por la ruta alternativa hasta la vía en la que está su tren siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el tótem hasta la cabina de cabecera de andén a través de la ruta alternativa ofrecida por el sistema siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Tótem

El administrador del sistema informa al sistema de que el tramo entre H5 y H4 NO está accesible.

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case PT02)

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para solicitar guiado por móvil hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y que debe llegar a la cabina de la cabecera del andén de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case PT02), el usuario selecciona la opción "¿Cómo llegar?" y seguidamente "Guiado por móvil". El sistema envía a Navilens la ruta alternativa por la que debe guiar al usuario.

El usuario sigue el proceso indicado por el tótem y realiza el recorrido por la ruta alternativa hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. En la pantalla en la que el tótem indica la vía en la que está estacionado el tren del billete escaneado (Test Case PT02), el usuario pulsa la opción ¿Cómo llegar?
2. El tótem muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Guiado por móvil".
4. En la pantalla del tótem aparece un código QR, así como el mensaje "Por favor, escanee con su móvil el código QR que aparece en pantalla. Ello provocará que se abra la aplicación Navilens automáticamente. Una vez abierta Navilens, utilícela para escanear códigos y se le guiará hasta su destino".
5. El usuario escanea el código QR con el móvil de pruebas.

6. Se abre la app Navilens en el móvil.
7. El usuario realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.
8. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 10:15 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case PT05

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la ruta accesible hasta la vía en la que está su tren.

**Objetivo**: Que el voluntario tenga una idea aproximada de cómo llegar a su vía desde el tótem, mostrándole un plano con la ruta accesible. (No es objetivo recorrerla).

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para visualizar la ruta accesible hasta la vía en la que está estacionado su tren.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces, hasta encontrar el botón de la vía solicitada, el usuario pulsa el botón, y el tótem mostrará sobre un plano de la estación la ruta accesible hacia su vía.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
2. Tras la navegación, el usuario llega a la pantalla con el botón "Vía XX (en función de la vía en que se encuentre)".
3. El usuario pulsa el botón de su vía.
4. El tótem muestra la ruta accesible hacia la vía sobre el plano de la estación.
1. El usuario observa el plano, su entorno, se orienta e indica verbalmente qué dirección tomaría.
5. El usuario intenta llegar al destino recordando la ruta accesible que ha visto en el plano (opcional, sólo si el usuario se siente capacitado y quiere intentarlo).
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 10:55 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case PT06

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para solicitar un robot asistencial que lo acompañe hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el tótem hasta la "Cafetería" asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para solicitar un robot que lo acompañe hasta la "Cafetería", y asistido por dicho robot, debe llegar al citado lugar de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces hasta pulsar el botón "Cafetería", el usuario selecciona la opción "Solicitar robot", sigue el proceso indicado por el tótem hasta que llega el robot al punto de encuentro en el tótem.

El usuario localiza el robot y realiza el recorrido hasta la cafetería asistido por el robot asistencial.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando el teclado querty, la pantalla táctil o los botones accesibles.
2. Tras la navegación, el usuario llega a la pantalla con el botón "Cafetería" y lo pulsa.
3. El tótem muestra la ruta accesible hacia este mostrador y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
4. El usuario selecciona "Solicitar Robot".
5. El tótem ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
6. El usuario selecciona "Agarrado al asa".
7. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
8. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot.
9. Cuando el usuario ha localizado la ubicación del robot pulsa "Comenzar acompañamiento" y se acerca al robot.
10. El usuario se agarra del asa del robot y comienza el acompañamiento.
11. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
12. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 11:05 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case PM01

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Barcelona.
b) Hora y vía de llegada del próximo tren procedente de Granada.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad lector de pantallas, tamaño de letra, contraste, etc.).

**Datos de entrada:**

Se indica al usuario la información que debe obtener de la app móvil.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario lee la hora y vía del próximo tren con destino Barcelona.
4. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
5. Tras la nueva navegación, el usuario lee la hora y vía del próximo tren procedente de Granada.
6. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
7. Tras la nueva navegación, el usuario lee la frecuencia de paso del Metro.
8. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 11::35 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Easy

Objetive b): Easy

Objetive c): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case PM02

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para conocer la vía en la que está estacionado su tren utilizando un billete de tren y la app Motional.

**Objetivo**: Averiguar de manera autónoma la Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el acceso a la estación por c/Explanada de la estación (para agilizar el Test Case PM03).

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al móvil, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
4. El usuario escanea el billete con el móvil.
5. La app móvil indica la vía en la que está estacionado el tren.
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 11:50 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case PM03

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para solicitar un robot asistencial que lo acompañe hasta la vía en la que está su tren.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (acceso a estación c/ Explanada de la estación), hasta la cabina de cabecera de andén asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case PM02).

Se coloca al usuario en el acceso a la estación por la c/ Explanada de la estación.

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para solicitar un robot que lo acompañe hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y asistido por dicho robot, debe llegar a la cabina de la cabecera del andén de manera autónoma desde su ubicación actual.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case PM02), el usuario selecciona la opción "¿Cómo llegar?", sigue el proceso indicado por la app Motional hasta que llega el robot al punto de encuentro en el que se encuentra el usuario.

El usuario localiza el robot y realiza el recorrido hasta la cabina de la cabecera de su vía asistido por el robot asistencial.

**Secuencia de pasos:**

1. En la pantalla en la que la app Motional indica la vía en la que está estacionado el tren del billete escaneado (Test Case PM02), el usuario pulsa la opción ¿Cómo llegar?
2. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Solicitar Robot".
4. La app Motional muestra una pantalla con posibles puntos de encuentro usuario-robot.
5. El usuario selecciona "Salida estación a c/ Explanada de la estación".
6. En la siguiente pantalla, la app ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
7. El usuario selecciona "Siguiendo al robot".
8. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.

9. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot para localizarlo por el sonido.
10. Cuando el usuario ha localizado la ubicación del robot pulsa "Comenzar acompañamiento" y se acerca al robot.
11. El usuario pulsa el Inicio en la pantalla del robot y comienza el acompañamiento.
12. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
13. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 12:00 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case PM07

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para acceder al Guiado con móvil (Navilens), y realizar un recorrido hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (vía de su tren tras realizar Test Case PM03) hasta la vía 10 de Cercanías siguiendo las indicaciones de Navilens (o en su defecto hasta el ascensor que da acceso a dicha vía).

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el encaminamiento podotáctil junto a cabina de cabecera de andén de la vía en la que se encuentra.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para solicitar guiado con móvil (Navilens), hasta la vía 10 de Cercanías, y que debe llegar de manera autónoma desde su ubicación actual.

**Resultados esperados:**

El usuario navega de forma autónoma en la app Motional utilizando el lector de pantalla, hasta llegar al botón "Vía 11", el usuario selecciona la opción "Guiado por móvil".

El usuario sigue el proceso indicado por la app Motional y realiza el recorrido hasta bajar al andén siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario selecciona "Cercanías".
3. El usuario selecciona "Recorrido Accesible hacia las vías".
4. El usuario selecciona "Vía 10".
5. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
6. El usuario selecciona "Guiado por móvil".
7. En la pantalla del móvil aparece un enlace, así como el mensaje "Por favor, pulse el enlace que aparece en pantalla. Ello provocará que se abra la aplicación Navilens automáticamente. Una vez abierta Navilens, utilícela para escanear códigos y se le guiará hasta su destino".
8. Se abre la app Navilens en el móvil de pruebas.
9. El usuario realiza el recorrido hasta bajar al andén (o en su defecto hasta el ascensor que da acceso), siguiendo las indicaciones de Navilens.
10. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 12:30 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.

## Test Case PM08

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para conocer la ruta accesible hasta un punto de interés de la estación.

**Objetivo**: Que el voluntario tenga una idea aproximada de cómo llegar al mostrador de venta de billetes desde su ubicación, mostrándole un plano con la ruta accesible. (No es objetivo recorrerla).

**Precondiciones:**

Usuario: Discapacidad PMR.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en uno de los puntos de interés de la estación de entre los establecidos en el proyecto. (Junto al ascensor de Vía 10).

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para visualizar la ruta accesible hasta el mostrador de venta de billetes.

**Resultados esperados:**

El usuario navega por las distintas pantallas de la app Motional hasta seleccionar "Mostrador venta de billetes", y la app Motional mostrará un plano de la estación y la ruta accesible hacia su vía.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario selecciona "Servicios Estación".
3. El usuario navega hasta seleccionar "Mostrador venta de billetes".
4. El móvil muestra la ruta accesible hacia el mostrador sobre el plano de la estación.
5. El usuario observa el plano, su entorno, se orienta e indica verbalmente qué dirección tomaría.
6. El usuario intenta llegar al destino observando la ruta accesible que le muestra el móvil (opcional, sólo si el usuario se siente capacitado y quiere intentarlo).
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 13:00 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** PMR impairment / Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case MT01

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Álora.
b) Hora y vía de llegada del próximo tren procedente de Fuengirola.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad Motriz.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario la información que debe obtener del tótem y se le coloca junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando los botones accesibles u otras interfaces.
2. Tras la navegación, el usuario lee (o escucha) la hora y vía del próximo tren con destino Álora.
3. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
4. Tras la nueva navegación, el usuario lee (o escucha) la hora y vía del próximo tren procedente de Fuengirola.
5. El usuario retrocede a pantallas anteriores o vuelve a la página de bienvenida para navegar y obtener nueva información.
6. Tras la nueva navegación, el usuario lee (o escucha) la frecuencia de paso del Metro.
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 11:30 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

Objetive c): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

Objetive c): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case MT02

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la vía en la que está estacionado su tren utilizando un billete de tren y el lector de códigos QR.

**Objetivo**: Averiguar de manera autónoma:

a) Ubicación del lector de códigos QR.
b) Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad Motriz.

Interfaz: Tótem

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al lector de códigos QR, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando los botones accesibles u otras interfaces.
2. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
3. El tótem indica la situación del lector de códigos QR.
4. El usuario lee (o escucha) la ubicación del lector y coloca el billete frente al lector de códigos QR.
5. El tótem indica la vía en la que está estacionado el tren.
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 11:45 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** No Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

**User 2 Results Test (Passed/No passed):** No Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case MT04

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para acceder al Guiado con móvil (Navilens) y realizará el recorrido hasta la vía en la que está su tren siguiendo las indicaciones de Navilens.

**Objetivo**: Llegar desde el tótem hasta la cabina de cabecera de andén siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad Motriz.

Interfaz: Tótem

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case MT02)

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar el tótem para solicitar guiado por móvil hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y que debe llegar a la cabina de la cabecera del andén de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case MT02), el usuario selecciona la opción "¿Cómo llegar?" y seguidamente "Guiado por móvil", sigue el proceso indicado por el tótem y realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. En la pantalla en la que el tótem indica la vía en la que está estacionado el tren del billete escaneado (Test Case MT02), el usuario pulsa la opción ¿Cómo llegar?
2. El tótem muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Guiado por móvil".
4. En la pantalla del tótem aparece un código QR, así como el mensaje "Por favor, escanee con su móvil el código QR que aparece en pantalla. Ello provocará que se abra la aplicación Navilens automáticamente. Una vez abierta Navilens, utilícela para escanear códigos y se le guiará hasta su destino".
5. El usuario escanea el código QR con el móvil de pruebas.
6. Se abre la app Navilens en el móvil.
7. El usuario realiza el recorrido hasta la cabina de la cabecera de su vía siguiendo las indicaciones de Navilens.
8. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 12:05 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case MT05

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para conocer la ruta accesible hasta la vía en la que está su tren.

**Objetivo**: Que el voluntario tenga una idea aproximada de cómo llegar a su vía desde el tótem, mostrándole un plano con la ruta accesible. (No es objetivo recorrerla).

**Precondiciones:**

Usuario: Discapacidad motriz.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para visualizar la ruta accesible hasta la vía en la que está estacionado su tren.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces, hasta encontrar el botón de la vía solicitada, el usuario pulsa el botón, y el tótem mostrará sobre un plano de la estación la ruta accesible hacia su vía.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando los botones accesibles u otras interfaces.
2. Tras la navegación, el usuario llega a la pantalla con el botón "Vía XX (en función de la vía en que se encuentre)".
3. El usuario pulsa el botón de su vía.
4. El tótem muestra la ruta accesible hacia la vía sobre el plano de la estación.
1. El usuario observa el plano, su entorno, se orienta e indica verbalmente qué dirección tomaría.
5. El usuario intenta llegar al destino recordando la ruta accesible que ha visto en el plano (opcional, sólo si el usuario se siente capacitado y quiere intentarlo).
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 12:30 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case MT06

### Descripción del test:

**Breve descripción**: El usuario utiliza el tótem para solicitar un robot asistencial que lo acompañe hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el tótem hasta el "Mostrador de atención Acerca" asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad motriz.

Interfaz: Tótem

**Datos de entrada:**

Se indica al usuario que debe usar el tótem para solicitar un robot que lo acompañe hasta el "Mostrador de atención Acerca", y asistido por dicho robot, debe llegar al citado lugar de manera autónoma.

Se coloca al usuario junto al tótem.

**Resultados esperados:**

El usuario navega de forma autónoma por la por la pantalla táctil del tótem utilizando los botones accesibles u otras interfaces hasta pulsar el botón "Mostrador de atención Acerca", el usuario selecciona la opción "Solicitar robot", sigue el proceso indicado por el tótem hasta que llega el robot al punto de encuentro en el tótem.

El usuario localiza el robot y realiza el recorrido hasta el servicio Acerca asistido por el robot asistencial.

**Secuencia de pasos:**

1. El usuario se mueve por las pantallas y selecciona opciones utilizando los botones accesibles u otras interfaces.
2. Tras la navegación, el usuario llega a la pantalla con el botón "Mostrador de atención Acerca" y lo pulsa.
3. El tótem muestra la ruta accesible hacia este mostrador y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
4. El usuario selecciona "Solicitar Robot".
5. El tótem ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".
6. El usuario selecciona "Siguiendo al robot".
7. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
8. El usuario puede pulsar "Localizar a mi robot" para volver a oír el sonido emitido por el robot.
9. Cuando el usuario ha localizado la ubicación del robot pulsa "Comenzar acompañamiento" y se acerca al robot.
10. El usuario pulsa el Inicio en la pantalla del robot y comienza el acompañamiento.

11. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
12. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 12:35 h

**Tester (Name/Company):** Alba Rodríguez/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







## Test Case MM01

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para obtener información sobre horarios de trenes y frecuencia de paso del Metro.

**Objetivo**: Averiguar de manera autónoma:

a) Hora y vía de salida del próximo tren con destino Barcelona.
b) Hora y vía de llegada del próximo tren procedente de Granada.
c) Frecuencia de paso del Metro en esos momentos.

**Precondiciones:**

Usuario: Discapacidad motriz.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad lector de pantallas, tamaño de letra, contraste, etc.).

**Datos de entrada:**

Se indica al usuario la información que debe obtener de la app móvil.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional hasta obtener la información solicitada.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario lee la hora y vía del próximo tren con destino Barcelona.
4. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
5. Tras la nueva navegación, el usuario lee la hora y vía del próximo tren procedente de Granada.
6. El usuario retrocede a pantallas anteriores o vuelve a la pantalla inicial para navegar y obtener nueva información.
7. Tras la nueva navegación, el usuario lee la frecuencia de paso del Metro.
8. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 9:35 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

Objetive c): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetives (Easy/Difficult to find)

Objetive a): Difficult

Objetive b): Difficult

Objetive c): Difficult

Evidence: Motional demonstrator evaluation form.







## Test Case MM02

### Descripción del test:

**Breve descripción**: El usuario utiliza la app móvil para conocer la vía en la que está estacionado su tren utilizando un billete de tren y la app Motional.

**Objetivo**: Averiguar de manera autónoma la Vía en la que está estacionado el tren del billete.

**Precondiciones:**

Usuario: Discapacidad motriz.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el acceso a la estación por esquina Héroe de Sostoa con Explanada (para agilizar el Test Case MM03).

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para averiguar la vía en la que está estacionado el tren del billete que se le ha entregado.

**Resultados esperados:**

El usuario navega de forma autónoma por la app Motional, llega hasta la opción "Comprobación Datos Billete", coloca el billete frente al móvil, y se informa sobre la vía de estacionamiento.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario se mueve por las pantallas para acceder a la información.
3. Tras la navegación, el usuario llega hasta la opción "Comprobación Datos Billete".
4. El usuario escanea el billete con el móvil.
5. La app móvil indica la vía en la que está estacionado el tren.
6. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 9:55 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** No Passed

Objetive (Easy/Difficult to find): Difficult

**User 2 Results Test (Passed/No passed):** No Passed

Objetive (Easy/Difficult to find): Difficult

Evidence: Motional demonstrator evaluation form.

## Test Case MM03

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para solicitar un robot asistencial que lo acompañe hasta la vía en la que está su tren.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (Salida estación esquina Héroe de Sostoa con Explanada), hasta la cabina de cabecera de andén en la que está su tren asistido por robot asistencial.

**Precondiciones:**

Usuario: Discapacidad motriz.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

El usuario ha escaneado su billete y está en la pantalla en la que se le ofrece la información del mismo. (Test Case MM02).

Se coloca al usuario en el acceso a la estación por la esquina Héroe de Sostoa con Explanada de la estación.

**Datos de entrada:**

Billete de tren que se entrega al usuario.

Se indica al usuario que debe usar la app Motional para solicitar un robot que lo acompañe hasta la vía en la que está estacionado el tren del billete que se le ha entregado, y asistido por dicho robot, debe llegar a la cabina de la cabecera del andén de manera autónoma desde su ubicación actual.

**Resultados esperados:**

Tras conocer la vía a la que debe dirigirse (Test Case MM02), el usuario selecciona la opción "¿Cómo llegar?", sigue el proceso indicado por la app Motional hasta que llega el robot al punto de encuentro en el que se encuentra el usuario.

El usuario localiza el robot y realiza el recorrido hasta la cabina de la cabecera de su vía asistido por el robot asistencial.

**Secuencia de pasos:**

1. En la pantalla en la que la app Motional indica la vía en la que está estacionado el tren del billete escaneado (Test Case MM02), el usuario pulsa la opción ¿Cómo llegar?
2. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
3. El usuario selecciona "Solicitar Robot".
4. La app Motional muestra una pantalla con posibles puntos de encuentro usuario-robot.
5. El usuario selecciona "Salida estación esquina Héroe de Sostoa con Explanada".
6. En la siguiente pantalla, la app ofrece las opciones de acompañamiento "Agarrado al asa" y "Siguiendo al robot".

7. El usuario selecciona “Siguiendo al robot”.
8. El usuario espera hasta que el robot anuncie su llegada mediante un sonido.
9. El usuario puede pulsar “Localizar a mi robot” para volver a oír el sonido emitido por el robot para localizarlo por el sonido.
10. Cuando el usuario ha localizado la ubicación del robot pulsa “Comenzar acompañamiento” y se acerca al robot.
11. El usuario pulsa el Inicio en la pantalla del robot y comienza el acompañamiento.
12. El robot llega al destino seleccionado e indica al usuario que ha finalizado el acompañamiento.
13. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 10:10 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Easy

Evidence: Motional demonstrator evaluation form.







# Test Case MM07

## Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para acceder al Guiado con móvil (Navilens), y realizar un recorrido hasta un punto de interés de la estación.

**Objetivo**: Llegar desde el punto en el que se encuentra el usuario (vía de su tren tras realizar Test Case MM03) hasta la venta de billetes siguiendo las indicaciones de Navilens.

**Precondiciones:**

Usuario: Discapacidad motriz.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

Se coloca al usuario en el encaminamiento podotáctil junto a cabina de cabecera de andén de la vía en la que se encuentra.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para solicitar guiado con móvil (Navilens), hasta el punto de venta de billetes, y que debe llegar de manera autónoma desde su ubicación actual.

**Resultados esperados:**

El usuario navega de forma autónoma en la app Motional hasta llegar al botón "Venta de billetes", el usuario selecciona la opción "Guiado por móvil".

El usuario sigue el proceso indicado por la app Motional y realiza el recorrido hasta llegar a la oficina de venta de billetes siguiendo las indicaciones de Navilens.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario selecciona "Servicios Estación".
3. El usuario selecciona "Siguiente" hasta llegar al botón "Venta de billetes".
4. El usuario selecciona "Venta de billetes".
5. La app Motional muestra la ruta accesible hacia la vía y ofrece las opciones "Solicitar Robot" y "Guiado por móvil".
6. El usuario selecciona "Guiado por móvil".
7. En la pantalla del móvil aparece un enlace, así como el mensaje "Por favor, pulse el enlace que aparece en pantalla. Ello provocará que se abra la aplicación Navilens automáticamente. Una vez abierta Navilens, utilícela para escanear códigos y se le guiará hasta su destino".
8. Se abre la app Navilens en el móvil de pruebas.
9. El usuario realiza el recorrido hasta llegar al punto de venta de billetes siguiendo las indicaciones de Navilens.
10. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 10:45 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

Evidence: Motional demonstrator evaluation form.







## Test Case MM08

### Descripción del test:

**Breve descripción**: El usuario utiliza la app Motional para conocer la ruta accesible hasta un punto de interés de la estación.

**Objetivo**: Que el voluntario tenga una idea aproximada de cómo llegar al acceso a Cercanías desde su ubicación, mostrándole un plano con la ruta accesible. (No es objetivo recorrerla).

**Precondiciones:**

Usuario: Discapacidad motriz.

Interfaz: Móvil. Se configura el móvil de pruebas según las preferencias del usuario (velocidad del lector de pantallas, tamaño de letra, contraste, etc.).

El usuario se encuentra en el punto de venta de billetes tras el Test Case MM07.

**Datos de entrada:**

Se indica al usuario que debe usar la app Motional para visualizar la ruta accesible hasta la zona de acceso a Cercanías.

**Resultados esperados:**

El usuario navega por las distintas pantallas de la app Motional hasta seleccionar "Acceso a Cercanías", y la app Motional mostrará un plano de la estación y la ruta accesible hacia su vía.

**Secuencia de pasos:**

1. El usuario inicia app Motional.
2. El usuario selecciona "Cercanías".
3. El usuario navega hasta seleccionar "Acceso a Cercanías".
4. El móvil muestra la ruta accesible hacia la zona de acceso a Cercanías sobre el plano de la estación.
5. El usuario observa el plano, su entorno, se orienta e indica verbalmente qué dirección tomaría.
6. El usuario intenta llegar al destino observando la ruta accesible que le muestra el móvil (opcional, sólo si el usuario se siente capacitado y quiere intentarlo).
7. Fin del test case.

## Ejecución del test:

**Place of performance:** Estación de ferrocarril María Zambrano de Málaga

**Test timestamp:** 25/06/2025 11:20 h

**Tester (Name/Company):** David Oliver/Ineco

**User (Type of disability/Association):** Motor disability/ Agruprupación de Desarrollo Málaga Accesible

**User 1 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

**User 2 Results Test (Passed/No passed):** Passed

Objetive (Easy/Difficult to find): Difficult

Evidence: Motional demonstrator evaluation form.