Deliverable 2.5
Use Cases for project demonstrations

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Report contributors		
Name	*Beneficiary Short Name*	*Details of contribution*
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1. Executive Summary

This document forms Deliverable 2.5 “Use Cases for project demonstrations”” of FP1 MOTIONAL Project. It is designed to present the Use Cases proposed to be demonstrated in the MOTIONAL project.

The deliverable contains 163 Use Cases (UCs) that will be demonstrated through 76 demonstrations. These demonstrations have the goal to demonstrate all technical activities within MOTIONAL Work Packages (WPs). These Use Cases reflect the project tasks, providing clear storyboards for the preparation of the planned demonstrations. The use cases will be used to demonstration preparations and should be later reflected on demonstration reports of each WP. They can be used to validate that the demonstration goals were achieved.

2. Abbreviations and acronyms

Abbreviation / Acronym	Description
ABT	Account Based Ticketing
AI	Artificial Intelligence
API	Application programming interface
ASP	Apportionment and Settlement Platform
ATO	Automatic Train Operation
B2B	Business-to-Business
B2C	Business-to-Customer
BLE	Bluetooth Low Energy
C-DAS	Connected Driver Advisory System
CEN	European Committee for Standardization
CI	Common Interface
CMS	Capacity Management System
DRT	Demand Responsive Transportation
ECMT	European Capacity Management Tool
ERA	European Union Agency for Railways
ERA	European Union Agency for Railways
ERJU	Europe's Rail Joint Undertaking
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
FA	Flagship Area
FCM	Face Capture Module
FP	Flagship Project
FRMCS	Future Rail Mobile Communications System
FRS	Face Recognition Server
FTE	Forum Train Europe
GA	Grant Agreement
GJT	Generalized Journey Time
GoA	Grade of Automation
GPS	Global Positioning System
GTFS	General Transit Feed Specification
HFCS	Hands Free Control System
HL3	Hybrid Level 3
HMI	Human Machine Interface
HST	High Speed Train
HTO	Human, Technology, Organization
IAMS	Intelligent Asset Management System
ID	Identification
IM	Infrastructure Manager
KPI	Key Performance Index
LTP	Long-term Planning
LZB	Linienzugbeeinflussung (Linear Train Control)
MaaS	Mobility as a Service
MAWP	Multi Annual Working Plan

MAWP	Multi Annual Work Program
MMS	Maintenance Management System (railway asset management)
MILP	Mixed-Integer Linear Programming
NeTEx	Network Timetable Exchange
OCC	Operation Control Centre
OJP	Open Journey Planning API
OSDM	Open Sales and Distribution Model
PCS	Path Coordination System
PESP	Periodic Event Scheduling Problem
POT	Passenger-Oriented Timetabling
PRM	Person with Reduced Mobility
RDMP	Research Data Management Plan
RFC	Rail Freight Corridor
RNE	RailNet Europe
RTLS	Real Time Location Service
RU	Railway Undertaker
S2R	Shift2Rail
SERA	Single European Railway Area
SFERA	Smart communications For Efficient Railways Activities
SG	Sub-Group
SIRI	Service Interface for Real Time Information
SP	System Pilar
SP	System Pillar
SPOT	Strategic Passenger-Oriented Timetabling
STP	Short-Term Planning
TAF	Telematics Applications for Freight servicesTPS
TAP	Telematics Applications for Passenger services
TCR	Temporary Capacity Restriction
TE	Technical Enabler
TE	Technical Enabler
TMS	Traffic Management Systems
TOC	Train Operation Company
TPE	Train Path Envelope
TPS	Train Planning System
TRL	Technology Readiness Level
TSI	Technical Specifications for Interoperability
TSP	Transport Service Provider
TTR	Timetable Redesign
UC	Use Case
UWB	Ultra-Wide Band
WP	Work Package
WS	Work Stream
YCS	Yard Coordination System

3. Background

The main objective of the MOTIONAL project is to improve the flexibility, efficiency, resilience, and capacity adaptation of the European rail network to support the development of a Single European Rail Area. This involves the development of functional requirements, specifications, and solutions for future European Traffic Management, including common network management, train planning, operations, automation and mobility management.

The target solution of the project is a dynamic network and traffic management at the European scale built upon a harmonized functional system architecture for agile, borderless, mixed-traffic operations and integration of Rail with other transport modes. The benefits of the project can be numerous and include the extension of capacity planning at the European level, enabling automatic management of cross-border rail traffic, improving service offers, operations, capacity utilization, and the information and distribution of multimodal offers, enhancing the competitiveness of rail-based mobility chains.

To achieve the project objectives, the project is divided into four sub-groups that will work on different areas, namely:

- SG1 Planning systems and processes including cross-border;
- SG2 Integration of TMSs and processes including cross-border traffic management;
- SG3 Integrate Rail with other transport modes;
- SG4 Digital enablers.

In previous deliverables from MOTIONAL:

- D2.3 Use Cases for planned technical developments of the project – was focused on the describing the functionalities to be developed withing the project;
- Some deliverables described the general goal of the demonstrators of each sub-group:
  - D3.1 Mapping against scope, specification of technical enablers, high-level use cases, high-level requirements, high level design for demonstrators in WPs 4-9
  - D10.1 Mapping against scope, specification of technical enablers, high-level use cases, high-level requirements, high level design for demonstrators in WPs 11-18
  - D19.1 Specification Report of Enablers 18 – 27

This deliverable will identify the demonstration Use cases of each sub-group, describing how the technical results from development WPs will be demonstrated.

4. Objective/Aim

The objective of this deliverable is to provide a comprehensive overview of the use cases that will be demonstrated within the MOTIONAL project. The aim is to showcase the practical application of the technical developments achieved in the project's development work packages.

Unlike previous deliverables that primarily focused on describing the functionalities to be developed, this deliverable specifically aims to identify and describe the demonstration use cases for each sub-group within the project. It will outline how the technical results from the development WPs will be presented and validated through demonstrations.

The main goal of this deliverable is to present a clear understanding of the demonstration use cases, including their objectives, requirements, stakeholders involved, and expected outcomes. By doing so, it will facilitate effective communication among project partners and involved stakeholders, enabling them to assess the progress and impact of the developed components and functionalities.

The deliverable will provide a detailed description of each demonstration use case, highlighting the actions and interactions of the stakeholders involved. It will also identify any related tasks or subtasks that may be impacted by the use case, ensuring that the demonstrations align with the overall project objectives and scope.

The expected outcomes or results from each use case demonstration will be clearly stated, emphasizing their link to the exploitation of project results. This will allow project participants and stakeholders to assess the effectiveness and potential of the developed functionalities and components, as well as identify opportunities for further improvement or optimization.

The deliverable aims to provide a comprehensive overview of the demonstration use cases within the MOTIONAL rail research project. It will serve as a valuable resource for project partners, stakeholders, and decision-makers, enabling them to gain insights into the practical application and potential impact of MOTIONAL technical developments.

5. Methodology

The methodology applied to develop this deliverable, "Use Cases for project demonstrations," involves a systematic approach, starting with a collection and analysis of relevant information from previous sub-group deliverables within the MOTIONAL project. The goal is to identify the necessary information to be included in the deliverable, specifically focusing on the demonstrations, related technical enablers, technical use cases, and involved partners. This will provide an overview of the objectives of each demonstration to understand the scope and purpose of the showcased functionalities and components.

Additionally, the analysis of related technical use cases will give a comprehensive understanding of how the technical enablers are utilized and integrated into the demonstrations. This helps establish the context and purpose of each demonstration use case, further enhancing the clarity and effectiveness of the demonstrations.

Furthermore, the methodology involves identifying the partners involved in each demonstration. This includes technical solutions suppliers, infrastructure managers (IMs), railway undertakings (RUs), travellers, agencies, and other possible end users. Understanding the roles and responsibilities of the stakeholders involved is crucial in accurately describing the demonstration and ensuring the successful implementation of the use cases.

To present the collected information in a structured manner, a template table provided in section 5.1 will be utilized. The structured approach ensures that the necessary information is gathered and presented in a clear and concise manner.

By following this methodology, the deliverable will provide a comprehensive overview of the demonstrations use cases. It is important to note that this deliverable will give a first overview of all the demonstrations within the project, and their use cases, by collecting high-level details at the WP2 level (Technical coordination). However, it should be acknowledged that the detailed descriptions of the demonstrations will be fully developed in the demonstration reports of the respective demonstration work packages (WP5, WP7, WP9, WP12, WP14, WP16, WP18, WP21, WP23, WP25). The initial definition of the demonstration use cases is a pre-step to the strategy defined in “D2.4 Demonstrations Strategy”. As the project progresses, the demonstration work packages will further develop and expand upon the descriptions provided in this deliverable. The demonstration reports will provide in-depth information regarding the specific details, actions, interactions, and results of each demonstration use case.

5.1. Demonstration use case description template

This section will present the demonstration Use Case template created at WP2 to have a standardized approach to creating demonstration use cases on the MOTIONAL project. This template was reviewed by several WP2 partners and approved by the Sub-Group leaders from MOTIONAL.

The MOTIONAL project Use Cases are identified following the following scheme, "FP1-DEMO-xx-UC-yy", where *xx* represents demo number where this use case will be demonstrated, and *yy* represent the identification of this Use Case, *yy* shall be consecutively numbered for each demo. The template presented below provides guidelines on how to fill the demonstration use case fields defined at each row.

Name	*Descriptive Name of the Use Case*
ID	*ID of the Use Case "FP1-DEMO-xx-UC-yy"*
Description	*Short description of the Use Case*
Related to task/subtask(s)	*Precise task/subtask that this Use Case relates to*
Technical Enabler(s)	*Indicate TEs involved "Number"*
Stakeholders	*Identify involved stakeholders in the demonstration and* *their role* *(e.g. Technical partners, IMs, RUs, Travellers, Agencies, other end users…)*
Goal	*The main objective or goal of the demonstration use case*
Demonstration Requirements	*Specific physical requirements for the use case demonstration (data, physical items, staff, locations…)* *No development requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*List the newly developed software/hardware/methods components or functionalities that will be demonstrated*
Other involved components	*List other software/hardware components or systems that will be used during the demonstration (not developed by the project)*
Expected Demonstration Location	*Location where the demonstration is scheduled to take place (the location can just be related to the used dataset on a virtual demonstration)*
Demonstration storyboard	*Present a step-by-step high level description of the demonstration, including the actions and interactions of the stakeholders involved. Should allow the reader to understand what will be done on the demonstration. Use bullet points or numbered steps for clarity.* • *[stakeholder] [action] [target of the action]*
Expected Demonstration Date	*Date when the demonstration is estimated to take place (Month Year, time interval)*
Expected evaluation of results	*How will the results be evaluated/assessed and of whom, e.g. end-users, stakeholders, project members etc.*
Exploitation	*Expected outcomes or results from the demonstration use cases (linked to exploitation of results – KER's found in D32.2)*
Responsible partner/person	*Company and Main contact who is responsible to describe this Use Case and guarantee the system design and implementation*
Notes	*Additional notes for the Use Case*

Table 1: Use Case Template

The above template will be used to describe the demonstrations identified in "D2.4 Demonstration Strategy".

6. Demonstrations WS1.1

In chapter 6, all use cases from WS1.1 demonstrations in FP1 MOTIONAL are presented, which gives an overview of the content of the 28 demonstrations expected on this workstream.

6.1. Demonstration 5.1 – Cross-border scheduling

6.1.1. CMS decision support to plan a cross-border path

Name	*CMS decision support to plan a cross-border path*
ID	*FP1-DEMO-5.2-UC-1*
Description	*The CMS operator or an Applicant performs a cross-border path request. All the involved CMSs harmonize the final timetable evaluating their local availability and TCRs.*
Related to task/subtask(s)	*Tasks 4.2, 5.2, 5.2.1*
Technical Enabler(s)	*TE1*
Stakeholders	*IM Operator*
Goal	*Adding a new path into the CMS timetable*
Demonstration Requirements	*The CMS is connected to a PCS. The CMS uses a macro infrastructure configuration compliant to the PCS. New dossier from PCS to CMS is received.*
FP1 Developed components/functions/methods target of demonstration	*An interface between CMS and PCS, a module that insert the new path into CMS plan.*
Other involved components	*Conflict detection and resolution module*
Expected Demonstration Location	*Virtual: Civitanova-Albacina*
Demonstration storyboard	1. *CMS receives a "Path elaboration" request* 1. *CMS integrates the requested path* 2. *CMS Operator resolves conflicts* 3. *CMS produces a path harmonised with its timetable* 4. *If the path request has been integrated a path draft confirmation is sent, otherwise a path rejected is sent.* 2. *CMS receives a Path confirmation request.* 1. *CMS updates and confirms the path* 2. *CMS send a paths confirmation message* 3. *CMS receives a path deletion* 1. *CMS removes the path draft*

	2. CMS sends a path rejected message
Expected Demonstration Date	*April 2026*
Expected evaluation of results	*Evaluated in laboratory with a real plant configuration by end users testing the systems and assessing it.* *The evaluation will be done with attention at the solution quality and user usability experience.*
Exploitation	*KER1*
Responsible partner/person	*Angelo Naselli, MERMEC*
Notes	

6.2. Demonstration 5.2 – Residual capacity for cross-border traffic

6.2.1. Cross-border ad hoc planning with fixed trains

Name	*Cross-border ad hoc planning with fixed trains*
ID	*FP1-DEMO-5.2-UC-1*
Description	*Timetable planners need support to make judgements when processing requests for ad hoc train path insertions or change requests, minor or major, for existing train paths. In this use case, we consider a static scenario in which none of the existing trains can be adjusted or modified while searching for residual capacity for inserting a single train path. The use case will be demonstrated between Malmö and Alnabru freight yards or on a subsection of this line.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2.1*
Technical Enabler(s)	*TE1*
Stakeholders	*Timetable planners at IMs and RUs (as a capacity applicants), as well as yard managers (YM).*
Goal	*Available capacity is visualized in the graphical timetable and a few possible train paths are proposed based on different objectives.*
Demonstration Requirements	*Topology and timetable data for relevant line/network.* *Technical running times for template train configurations.*
FP1 Developed components/functions/methods target of demonstration	*Train path generation, visualization of available capacity.*
Other involved components	*RailSys*
Expected Demonstration Location	*Virtual: Oslo/Alnabru - Malmö, KTH office Stockholm*
Demonstration storyboard	1. *RU/YM requests a new train path or changes in an existing train.*

	2. *The demonstrator computes available capacity and a set of possible train paths.* 3. *One of the possible train paths is selected.* 4. *The timetable is updated.* 5. *Changes are communicated to YMS and RU.*
Expected Demonstration Date	*2026-04-30*
Expected evaluation of results	*Evaluation of quality of the inserted path, both feasibility and robustness, which will be done by people with relevant knowledge and experience at Trafikverket.*
Exploitation	*Contributes to KER1 by introducing a decision support model to cross border planning.*
Responsible partner/person	*Kristian Persson, Trafikverket* *Hans Sipilä, KTH* *Johan Högdahl, KTH*
Notes	-

6.2.2. Cross-border ad hoc planning with adjusted adjacent trains

Name	*Cross-border ad hoc planning with adjusted adjacent trains*
ID	*FP1-DEMO-5.2-UC-2*
Description	*Timetable planners need support to make judgements when processing requests for ad hoc train path insertions or change requests, minor or major, for existing train paths. In this use case, we consider a dynamic scenario in which existing trains can be adjusted or modified when searching for residual capacity for inserting a single train path. Other freight trains may be adjusted to some degree, also passenger trains may get smaller adjustment but subject to any delivery commitments. The use case will be demonstrated between Malmö and Alnabru freight yards or on a subsection of this line.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2.1*
Technical Enabler(s)	*TE1*
Stakeholders	*Timetable planners at IMs and RUs (as a capacity applicants), as well as yard managers (YM).*
Goal	*Available capacity is visualized in the graphical timetable and a few possible train paths are proposed based on different objectives. Necessary changes for other trains are visualized.*
Demonstration Requirements	*Topology and timetable data for relevant line/network.* *Technical running times for template train configurations.*
FP1 Developed	*Train path generation, visualization of available capacity.*

components/functions/methods target of demonstration	
Other involved components	*RailSys with representative setup of infrastructure and timetable for use case.*
Expected Demonstration Location	*Virtual: Oslo/Alnabru - Malmö, KTH Office Stockholm.*
Demonstration storyboard	1. *RU/YM requests a new train path or changes in an existing train.* 2. *The demonstrator computes available capacity and a set of possible train paths.* 3. *One of the possible train paths is selected.* 4. *The timetable is updated.* 5. *Changes are communicated to YMS and RU.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluation of quality of the inserted path, both feasibility and robustness, which will be done by people with relevant knowledge and experience at Trafikverket.*
Exploitation	*Contributes to KER1 by introducing a decision support model to cross border planning.*
Responsible partner/person	*Kristian Persson, Trafikverket* *Hans Sipilä, KTH* *Johan Högdahl, KTH*
Notes	-

6.2.3. Cross-border ad hoc planning and simulation

Name	*Cross-border ad hoc planning and simulation*
ID	*FP1-DEMO-5.2-UC-3*
Description	*Timetable planners need support to make judgements when processing requests for ad hoc train path insertions or change requests, minor or major, for existing train paths. This use case builds on the previous ones, but simulation is added as a tool for assessing the robustness of different train path insertion alternatives. Either a macroscopic or microscopic simulation tool will be used here.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2.1*
Technical Enabler(s)	*TE1*
Stakeholders	*Timetable planners at IMs and RUs (as a capacity applicants), as well as yard managers (YM).*
Goal	*Punctuality and delays are computed, visualization of*

	simulation outcome in graphical timetable
Demonstration Requirements	*Topology and timetable data for relevant line/network.* *Technical running times for template train configurations.* *RailSys software for simulations.*
FP1 Developed components/functions/methods target of demonstration	*Train path generation, visualization of available capacity.*
Other involved components	*RailSys with representative setup of infrastructure and timetable for use case.*
Expected Demonstration Location	*Virtual: Oslo/Alnabru - Malmö, KTH office Stockholm*
Demonstration storyboard	1. *Steps 1 and 2 in use case UC-FP1-WP5-8/9 has been carried out.* 2. *The generated timetables are simulated.* 3. *One of the possible train paths is selected based on the simulation outcome.* 4. *The timetable is updated.* 5. *Changes are communicated to YMS and RU.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*The use case is created to evaluate the quality of the two previous Use cases by performing a simulation. This use case will be evaluated by assessing both resolution time and quality of the evaluation, compared to expert judgement from end users. The evaluation will be done by people with relevant knowledge and experience at Trafikverket.*
Exploitation	*Contributes to KER1 by introducing and evaluating a decision support model to cross border planning.*
Responsible partner/person	*Kristian Persson, Trafikverket* *Hans Sipilä, KTH* *Johan Högdahl, KTH*
Notes	-

6.3. Demonstration 5.3 – Interaction with external national or central planning application

6.3.1. International late path request placed between X-8 and X-2

6.3.1.1. Receipt of an international late path request from Path Coordination System (PCS; RNE)

Name	*Receipt of an international late path request between X-8 and X-2 from Path Coordination System (PCS; RNE)*
ID	*FP1-DEMO-5.3-UC-01*
Description	*An international late (long-term) path request for 4 consecutive weeks on Tuesdays between X-8 and X-2 is received via Path Coordination System (PCS; RNE) and shown in the CMS graphical user interface indicating a capacity conflict in the border/handover location.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2, 5.2.1*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Path request received from PCS shown in the CMS graphical user interface indicating capacity conflicts*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software, hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The CMS receives a Late Path Request for the local national fraction of an international path from PCS*

	2. *The CMS creates a corresponding capacity order in the CMS (LTP) Capacity Plan including the requested path and the Dossier ID of the path in PCS.* 3. *The CMS Operator opens the order and checks the included path for plausibility.* 4. *If plausibility is given, the CMS Operator starts the Path Elaboration; otherwise, the CMS Operator sets the national IM's PCS Acceptance Indicator to 'red' and the process restarts with step 1.* 5. *The CMS automatically initializes the requested path in the (LTP) Capacity Plan as a Path Offer to be processed.* 6. *The CMS detects and shows a conflict between the requested path and another capacity object in the cross-border location in the national (LTP) Capacity Plan.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.3.1.2. Offer preparation and submission of a path offer for an international late path request to the Path Coordination System (PCS; RNE)

Name	*Offer preparation and submission of a path offer for an international late path request between X-8 and X-2 to the Path Coordination System (PCS; RNE).*
ID	*FP1-DEMO-5.3-UC-02*
Description	*The capacity conflict in the border/handover location is resolved by the CMS Operator resulting in a changed path with respect to the original request. The changed path is submitted back to PCS as a path offer corresponding to the request.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2, 5.2.1*

Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*The offered path is shown in a corresponding PCS Dossier for coordination.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*The CMS Operator prepares the path to be offered including resolution of the detected conflict in the (LTP) Capacity Plan considering the national planning rules for LTP.* *When offer preparation has finished, the CMS Operator marks the offer path as 'preparation finished'.* *The CMS Operator decides to send the LTP path offer back to PCS by confirming the offer path being assigned to the corresponding order and changing the path offer status to 'Ready for Sending Update".* *The CMS establishes a write protection for the path in the (LTP) Capacity Plan and sends the elaborated path offer back to PCS.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.*

	KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.3.1.3. Handling of PCS coordination and offer re-submission for an international late path request received from Path Coordination System (PCS; RNE)

Name	*Handling of PCS coordination and offer re-submission for an international late path request between X-8 and X-2 received from Path Coordination System (PCS; RNE).*
ID	*FP1-DEMO-5.3-UC-03*
Description	*The CMS Operator (IM) uses the PCS to understand the coordination need indicated by the PCS Dossier and adjusts the offered path in the CMS to be re-submitted. The previous path offer is 'destroyed' by the CMS Operator using the PCS system and the adjusted path offer is re-submitted to the PCS in the CMS system.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2, 5.2.1*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Offered LTP path for international train successfully coordinated via PCS.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka*

	client computer and operation system software
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *The CMS receives from PCS a Path Coordination Update message for an already offered Late Path Request for the local national fraction of an international path.* 2. *The CMS uses the PCS Dossier ID for identifying the already existing capacity order corresponding to the coordination update in the CMS Capacity Plan.* 3. *The CMS includes the updated path request given by the coordination update message of the PCS.* 4. *Goto step 3 of FP1-DEMO-5.3-UC-01 and continue with the steps of FP1-DEMO-5.3-UC-02.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.3.2. International short-term path request placed after X-2 and before X+12)

6.3.2.1. Receipt of an international short-term path request from the Path Coordination System (PCS; RNE)

Name	*Receipt of an international short-term path request between X-2 and X+12 from the Path Coordination System (PCS; RNE) (X is the first date of validity of the next year timetable)*
ID	*FP1-DEMO-5.3-UC-04*
Description	*An international (short-term) path request for one day between X-2 and X+12 is received via the Path Coordination System (PCS; RNE) and shown in the CMS graphical user interface indicating a capacity conflict in the border/handover location.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2, 5.2.1*

Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Path request received from PCS shown in the CMS graphical user interface indicating capacity conflicts*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The CMS receives a short term (STP) Path Request for the local national fraction of an international path from PCS.* *2. The CMS creates a corresponding capacity order in the CMS (STP) Capacity Plan including the requested path and the Dossier ID of the path in PCS.* *3. The CMS Operator opens the order and checks the included path for plausibility.* *4. If plausibility is given, the CMS Operator starts the Path Elaboration; otherwise, the CMS Operator sets the national IM's PCS Acceptance Indicator to 'red' and the process restarts with step 1.* *5. The CMS automatically initializes the requested path in the (STP) Capacity Plan as a Study Path to be processed.* *6. The CMS detects and shows a conflict between the requested path and another capacity object in the cross-border location in the national (STP) Capacity Plan.*
Expected Demonstration Date	*May 2026 – June 2026*

Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.3.2.2. Offer preparation and submission of a path offer for an international short-term path request to the Path Coordination System (PCS; RNE)

Name	*Offer preparation and submission of a path offer for an international short-term path request between X-2 and X+12 to the Path Coordination System (PCS; RNE).*
ID	*FP1-DEMO-5.3-UC-05*
Description	*The capacity conflict in the border/handover location is resolved by the CMS Operator resulting in a changed path with respect to the original request. The changed path is submitted back to the PCS as a path offer corresponding to the request.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2, 5.2.1*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*The offered short-term path is shown in a corresponding PCS Dossier for coordination.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software, hosting system including server hardware*

	server operating system, *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The CMS Operator prepares the Study Path to be offered including resolution of the detected conflict in the (STP) Capacity Plan considering the national planning rules for STP.* *2. When offer preparation has finished, the CMS Operator marks the offer path as 'preparation finished'.* *3. The CMS Operator decides to send the STP path offer back to PCS by confirming the offer path being assigned to the corresponding order and changing the path offer status to 'Ready for Sending Update".* *4. The CMS establishes a write protection for the path in the (STP) Capacity Plan and sends the elaborated path offer back to PCS.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.3.2.3. Handling of the PCS coordination and offer re-submission for an international short-term path request received from the Path Coordination System (PCS; RNE)

Name	*Handling of the PCS coordination and offer re-submission for an international short-term path request between X-2 and X+12 received from the Path Coordination System (PCS; RNE)*
ID	*FP1-DEMO-5.3-UC-06*
Description	*The CMS Operator (IM) uses the PCS to understand the*

	coordination need indicated by the PCS Dossier and adjusts the offered path in the CMS to be re-submitted. The previous path offer is 'destroyed' by the CMS Operator in the PCS system and the adjusted path offer re-submitted to the PCS in the CMS system.
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2, 5.2.1*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Offered path for international STP train successfully coordinated via PCS.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software, hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*The CMS receives from PCS a Path Coordination Update message for an already offered short-term Path Request for the local national fraction of an international path.* *The CMS uses the PCS Dossier ID for identifying the already existing capacity order corresponding to the coordination update in the CMS Capacity Plan.* *The CMS includes the updated path request given by the coordination update message of the PCS.* *Goto step 3 of FP1-DEMO-5.3-UC-04 and continue with the steps of FP1-DEMO-5.3-UC-05.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further*

	enhanced in EU-RAIL wave 2. *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.3.3. Showing and handling of impact of imported TCR

Name	*Showing and handling of the impact of imported Temporary Capacity Restrictions (TCR) on the currently planned paths for international freight trains*
ID	*FP1-DEMO-5.3-UC-07*
Description	*The CMS planning application shows a new or changed imported TCR. The impact of the TCR on paths for international freight trains can be identified and is handled by the CMS Operator.* 1. *Local TCR causes changes to path(s) at/behind the border (handover) location;* 2. *Behind-the-border-TCR causes changes to path(s) in local network.*
Related to task/subtask(s)	*Tasks 4.1, 4.2, 5.2, 5.2.1*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning"*
Stakeholders	*Primary Stakeholder: CMS Operators*
Goal	*Up-to-date and aligned Capacity Plans in both CMSs.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instances representing the two involved national CMSs A and B, covering a region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the two neighbouring IM's Capacity Planners (CMS Operators).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software, hosting system including* *server hardware* *server operating system,* *Oracle database software,*

	Apache Kafka *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. Starting point: Cross-border path for an international freight train planned from IM/CMS A to IM/CMS B without conflicts.* *2. A short-term maintenance need is arising in the CMS A and covered by a TCR received by both CMSs A and B which is affecting the cross-border train.* *3. The CMS A informs CMS B about the need for change in the capacity plan by creating a change scenario ('sandbox') in the capacity plan and sharing it with CMS B.* *4. Pre-alignment of both IMs/CMSs of the required changes to the capacity plan including the affected cross-border train by jointly working on the change scenario.* *5. Pre-alignment concluded by CMS A Operator confirmation of the agreed change in the change scenario making it effective which is leading to the capacity plan updated on both sides of the border.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.4. Demonstration 5.4 – Collaborative yard capacity planning

6.4.1. Update Initial Yard Plan

Name	*YCS - Update the initial A/D-yard plan and make it conflict free for the next few hours.*
ID	*FP1-DEMO-5.4-UC-1*

Description	*The LM, YM and TM update the initial plan for the next few hours.*
Related to task/subtask(s)	*Task 4.5, Task 5.1, 5.2.4 and 5.3*
Technical Enabler(s)	*TE6*
Stakeholders	*Line Manager for the hand-over yard – LM, active* *Yard Manager – YM, active* *Terminal Manager -TM, active* *Locomotive driver, passive* *Line Managers for adjacent lines, passive* *Freight Rail Undertaking, passive*
Goal	*The track allocation plan for the hand-over yard has been updated (replanned), partly based on information from planners of adjacent operations. The track allocation changes have been communicated to planners of adjacent operations (the multi-modal terminal, the marshalling yard, TMS). The track allocation plan matches with the actors' intended work activities.*
Demonstration Requirements	*3 separate rooms, 4 computers with internet connection, 4 phones (or other means of communication), realistic data that can be used to demonstrate the use-cases, end-users from IM, YM and TM, demonstration leaders.*
FP1 Developed components/functions/methods target of demonstration	*YCS - platform for cooperative planning of yard resources.*
Other involved components	*Digital Graph – TMS system.* *Deplide – Data sharing prototype.* *Apache Kafka – open-source distributed event streaming platform* *Kubernetes – open source platform for managing containerized workloads and services* *Docker – used to run YCS in Kubernetes* *Web-browser – used to access YCS.* *Keycloak – used for user access management.* *MySQL – program to store train and yard operation data.* *Node.js – web-server*
Expected Demonstration Location	*Virtual: Malmö freight yard*
Demonstration storyboard	*1. LM, TM and YM opens YCS and log in.* *2. LM extends planning horizon (mental or digital).* *3. LM identifies track allocation conflict or other problem that require the plan to be adjusted.*

	4. LM changes track allocation to remove conflict/problem. Conflicts are resolved one at a time (with decision support). *5. If a departure time needs to be changed, the LM changes this in the TMS and the change is propagated to YCS (via WP11).* *6. LM loops 3. - 5. until they are satisfied.* *7. TM/YM identifies an unmet track allocation need, track allocation requirement conflict or incorrect track allocation requirement.* *8. TM/YM updates the track allocation requirement to account for need or resolve conflict/inaccuracy.* *9. TM/YM loops 6. and 7. until they are satisfied.* *10. LM inspect allocation plan and, if necessary, go back to step 3.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users testing the systems and assessing it. The evaluation will be done from several perspectives: Solution quality, solution time and usability.*
Exploitation	*Knowledge about how interdependent actors from different organisations can cooperate to produce a better capacity plan for, and also usage of, yard resources. Relates to KER 1.* *KER 1: Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Kristian Persson, Trafikverket* *Sara Gestrelius, RISE*
Notes	-

6.4.2. Updated planned arrival times

Name	*YCS - Updated planned arrival times.*
ID	*FP1-DEMO-5.4-UC-2*
Description	*Information regarding updated planned arrival times is received from TMS, replanning is triggered. Information propagated to TM/YM, who make secondary responses to this.*
Related to task/subtask(s)	*Task 4.5, Task 5.1, 5.2.4 and 5.3*
Technical Enabler(s)	*TE6*
Stakeholders	*Line Manager for the hand-over yard – LM, active*

	Yard Manager – YM, active *Terminal Manager -TM, active* *Locomotive driver, passive* *Line Managers for adjacent lines, passive* *Freight Rail Undertaking, passive*
Goal	*The track allocation plan for the hand-over yard has been updated (replanned) to account for the new arrival time. The track allocation changes have been communicated to planners of adjacent operations (the multi-modal terminal, the marshalling yard, TMS). All actors have adapted their planning with respect to the A/D-yard to account for the new arrival time. The track allocation plan matches with the actors' intended work activities.*
Demonstration Requirements	*3 separate rooms, 4 computers with internet connection, 4 phones (or other means of communication), realistic data that can be used to demonstrate the use-cases, end-users from IM, YM and TM, demonstration leaders.*
FP1 Developed components/functions/methods target of demonstration	*YCS - platform for cooperative planning of yard resources.*
Other involved components	*Digital Graph – TMS system.* *Deplide – Data sharing prototype.* *Apache Kafka – open-source distributed event streaming platform* *Kubernetes – open source platform for managing containerized workloads and services* *Docker – used to run YCS in Kubernetes* *Web-browser – used to access YCS.* *Keycloak – used for user access management.* *MySQL – program to store train and yard operation data.* *Node.js – web-server*
Expected Demonstration Location	*Virtual: Malmö freight yard*
Demonstration storyboard	*1. An arrival time is changed in TMS, and the arrival time change is propagated to YCS (via WP11).* *2. YCS automatically extends the track reservation to make it feasible with regards to the new arrival time. This may result in conflicts.* *3. LM identifies any track allocation conflict or other problems that require the plan to be adjusted.* *4. LM changes track allocation to remove conflict/problem. Conflicts are resolved one at a time (with decision support).*

	5. *If a departure time needs to be changed, the LM changes this in the TMS and the change is propagated to YCS (via WP11).* 6. *LM loops 3. - 5. until they are satisfied.* 7. *TM/YM identifies a track allocation requirement conflict, incorrect track allocation requirement or unmet track allocation need.* 8. *TM/YM updates the track allocation requirement to account for need or resolve conflict/inaccuracy.* 9. *TM/YM loops 5. and 6. until they are satisfied.* 10. *LM inspects track allocation plan and, if necessary, go back to step 2.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users testing the systems and assessing it. The evaluation will be done from several perspectives: Solution quality, solution time and usability/user experience.*
Exploitation	*Knowledge about how interdependent actors from different organisations can cooperate to produce a better capacity plan for, and also usage of, yard resources. Relates to KER 1.* *KER 1: Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Kristian Persson, Trafikverket* *Sara Gestrelius, RISE*
Notes	-

6.4.3. Wagons for outbound train not ready for departure on time

Name	*YCS – Wagons for outbound train not ready for departure on time*
ID	*FP1-DEMO-5.4-UC-3*
Description	*Replanning triggered by information from terminal about cars not being ready for departure on time.*
Related to task/subtask(s)	*Task 4.5, Task 5.1, 5.2.4 and 5.3*
Technical Enabler(s)	*TE6*

Stakeholders	*Line Manager for the hand-over yard – LM, active* *Yard Manager – YM, active* *Terminal Manager -TM, active* *Locomotive driver, passive* *Line Managers for adjacent lines, passive (active)* *Freight Rail Undertaking, passive*
Goal	*The track allocation plan for the hand-over yard has been updated (replanned), based on updated information from planners of adjacent operations (the Terminal). The track allocation changes have been communicated to planners of adjacent operations (the multi-modal terminal, the marshalling yard, TMS). The track allocation plan matches with the actors' intended work activities.*
Demonstration Requirements	*3 separate rooms, 4 computers with internet connection, 4 phones (or other means of communication), realistic data that can be used to demonstrate the use-cases, end-users from IM, YM and TM, demonstration leaders.*
FP1 Developed components/functions/methods target of demonstration	*YCS - platform for cooperative planning of yard resources.*
Other involved components	*Digital Graph – TMS system.* *Deplide – Data sharing prototype.* *Apache Kafka – open-source distributed event streaming platform* *Kubernetes – open source platform for managing containerized workloads and services* *Docker – used to run YCS in Kubernetes* *Web-browser – used to access YCS.* *Keycloak – used for user access management.* *MySQL – program to store train and yard operation data.* *Node.js – webserver*
Expected Demonstration Location	*Virtual: Malmö freight yard*
Demonstration storyboard	*1. TM detects that the cars for an outbound train will not be ready for departure at the planned time.* *2. TM change track allocation requirement for A/D-yard in YCS.* *3. LM identifies track allocation conflict or other problem that requires the plan to be adjusted.* *4. LM changes track allocation to remove conflict/problem. Conflicts are resolved one at a time (with decision support).*

	5. *If a departure time needs to be changed, the LM changes this in the TMS and the change is propagated to YCS (via WP11).* 6. *LM loops 3. - 5. until they are satisfied.* 7. *TM/YM identifies a track allocation requirement conflict, incorrect track allocation requirement or unmet track allocation need.* 8. *TM/YM updates the track allocation requirement to account for need or resolve conflict/inaccuracy.* 9. *TM/YM loops 6. and 7. until they are satisfied.* 10. *LM inspects track allocation plan and, if necessary, go back to step 3.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users testing the systems and assessing it. The evaluation will be done from several perspectives: Solution quality, solution time and usability/user experience.*
Exploitation	*Knowledge about how interdependent actors from different organisations can cooperate to produce a better capacity plan for, and also usage of, yard resources. Relates to KER 1.* *KER 1: Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Kristian Persson, Trafikverket* *Sara Gestrelius, RISE*
Notes	*Use case can also be initiated by changes connected to marshalling yard.*

6.4.4. New shunting need

Name	*YCS – New shunting need from YM*
ID	*FP1-DEMO-5.4-UC-4*
Description	*Replanning triggered by new information from Yard Manager regarding shunting operations that requires track capacity on A/D-yard.*
Related to task/subtask(s)	*Task 4.5, Task 5.1, 5.2.4 and 5.3*
Technical Enabler(s)	*TE6*
Stakeholders	*Line Manager for the hand-over yard – LM, active*

	Yard Manager – YM, active *Terminal Manager -TM, active* *Locomotive driver, passive* *Line Managers for adjacent lines, passive (active)* *Freight Rail Undertaking, passive*
Goal	*The track allocation plan for the hand-over yard has been updated (replanned), based on updated information from planners of adjacent operations. The track allocation changes have been communicated to planners of adjacent operations (the multi-modal terminal, the marshalling yard, TMS). The track allocation plan matches with the actors' intended work activities.*
Demonstration Requirements	*3 separate rooms, 4 computers with internet connection, 4 phones (or other means of communication), realistic data that can be used to demonstrate the use-cases, end-users from IM, YM and TM, demonstration leaders.*
FP1 Developed components/functions/methods target of demonstration	*YCS - platform for cooperative planning of yard resources.*
Other involved components	*Digital Graph – TMS system.* *Deplide – Data sharing prototype.* *Apache Kafka – open-source distributed event streaming platform* *Kubernetes – open source platform for managing containerized workloads and services* *Docker – used to run YCS in Kubernetes* *Web-browser – used to access YCS.* *Keycloak – used for user access management.* *MySQL – program to store train and yard operation data.* *Node.js – web-server*
Expected Demonstration Location	*Virtual: Malmö freight yard*
Demonstration storyboard	*1. YM detects need to use A/D-yard for shunting activities.* *2. YM post a track allocation requirement for shunting in YCS.* *3. LM updates track allocation plan and may identify track allocation conflicts or other problems.* *4. LM changes track allocation to remove conflict/problem. Conflicts are resolved one at a time (with decision support).* *5. If a departure time needs to be changed, the LM changes this in the TMS and the change is propagated to YCS (via WP11).* *6. LM loops 3. - 5. until they are satisfied.*

	7. *TM/YM identifies potential secondary track allocation requirement conflict, incorrect track allocation requirement or unmet track allocation need because of the changed track allocation plan.* 8. *TM/YM updates the track allocation requirement to account for need or resolve conflict/inaccuracy.* 9. *TM/YM loops 6. and 7. until they are satisfied.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users testing the systems and assessing it. The evaluation will be done from several perspectives: Solution quality, solution time and usability/user experience.*
Exploitation	*Knowledge about how interdependent actors from different organisations can cooperate to produce a better capacity plan for, and also usage of, yard resources. Relates to KER 1.* *KER 1: Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Kristian Persson, Trafikverket* *Sara Gestrelius, RISE*
Notes	*Use case can also be triggered by new shunting need from TM.*

6.5. Demonstration 5.5 – Improved capacity allocation and new processes. Integration of new planning processes and the production of standard reports

6.5.1. Planning and allocation of capacity for different planning horizons

6.5.1.1. Management of train path envelopes (Slots; RNE) and TCR

Name	*Planning and allocation of capacity for different planning horizons – Management of train path envelopes (Slots; RNE) and TCR*
ID	*FP1-DEMO-5.5-UC-01*
Description	*The CMS Operator creates, changes and deletes a train path envelope (Slot) and a TCR in the CMS.*

Related to task/subtask(s)	*Tasks 4.1, 4.3, 5.2, 5.2.2*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning",* *TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Manage train path envelopes (Slots) and TCRs in the CMS via its graphical user interface.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*Create a new slot / TCR* 1. *The CMS Operator initiates creation of a slot / TCR via the User Interface of the CMS capacity plan editor module.* 2. *The CMS opens an empty form for entering required information about the new slot/TCR.* 3. *The CMS Operator uses the received parameters to enter the data required for a new slot / TCR.* 4. *The data is automatically validated by the CMS. The CMS indicates graphically invalid information.* 5. *If data is invalid, the CMS Operator corrects or adapts the entered data until it is valid.* 6. *The CMS shows the resulting new slot / TCR in the views (capacity graph, tabular views)* 7. *End* *Update an existing slot / TCR*

	1. *The CMS Operator selects an existing slot / TCR via the User Interface of the CMS capacity plan editor module.* 2. *The CMS opens a form including the selected slot/TCR with existing information about it.* 3. *The CMS Operator changes or amends the information about the selected slot/TCR.* 4. *Continue with A4 above.* *Deletion of an existing slot / TCR* 1. *The CMS Operator selects an existing slot / TCR via the User Interface of the CMS capacity plan editor module.* 2. *The CMS opens a form including the selected slot/TCR with existing information about it.* 3. *The CMS Operator deletes selected slot/TCR using e.g., a menu function.* 4. *The CMS updates the views (capacity graph, tabular views) not showing anymore the deleted slot / TCR.* 5. *End*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.5.1.2. Long-term capacity agreements and capacity partitioning

Name	*Planning and allocation of capacity for different planning horizons - Long-term capacity agreements and capacity partitioning*
ID	*FP1-DEMO-5.5-UC-02*
Description	*The CMS Operator creates, changes and deletes a Capacity Band which together with TCR (see FP1-DEMO-5.5-UC-01) are the basic constituents of the Capacity Model used for*

	supporting the long-term capacity agreements and capacity partitioning with the CMS.
Related to task/subtask(s)	*Tasks 4.1, 4.3, 5.2, 5.2.2*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning",* *TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Manage Capacity Bands in the CMS via its graphical user interface.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*Create a new Capacity Band* *1. The CMS Operator initiates creation of a Capacity Band via the User Interface of the CMS capacity plan editor module.* *2. The CMS opens an empty form for entering required information about the new Capacity Band.* *3. The CMS Operator uses the received parameters to enter the data required for a new Capacity Band.* *4. The data is automatically validated by the CMS. The CMS indicates graphically invalid information.* *5. If data is invalid, the CMS Operator corrects or adapts the entered data until it is valid.* *6. The CMS shows the resulting new Capacity Band in the views (capacity graph, tabular views)* *7. End* *Update an existing Capacity Band*

	1. *The CMS Operator selects an existing Capacity Band via the User Interface of the CMS capacity plan editor module.* 2. *The CMS opens a form including the selected Capacity Band with existing information about it.* 3. *The CMS Operator changes or amends the information about the selected Capacity Band.* 4. *Continue with A4 above.* *Deletion of an existing Capacity Band* 1. *The CMS Operator selects an existing Capacity Band via the User Interface of the CMS capacity plan editor module.* 2. *The CMS opens a form including the selected Capacity Band with existing information about it.* 3. *The CMS Operator deletes selected Capacity Band using e.g., a menu function.* 4. *The CMS updates the views (capacity graph, tabular views) not showing anymore the deleted Capacity Band.* 5. *End*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.5.1.3. Rolling Planning process and conjunction to annual allocation

Name	*Planning and allocation of capacity for different planning horizons - Rolling Planning process and conjunction to annual allocation*
ID	*FP1-DEMO-5.5-UC-03*
Description	*General rolling planning capability in CMS:* *The CMS Operator creates, changes and deletes a*

	multi-annual Capacity Band, train path and TCR supporting the Rolling Planning process in a multi-annual (rolling) capacity plan. For the next timetable period to be prepared for starting the related LTP path allocation process, the capacity objects are initialized from the multi-annual capacity plan and adapted or converted (slots into paths) for the corresponding LTP timetable period without impacting the multi-annual plan. *Multi-annual (rolling planning) capacity request by RU: The RU timetable planner submits a multi-annual (rolling planning) capacity request with validity of 36 months for being answered by the CMS Operator (IM) with a path offer for the current (STP) timetable period and a capacity commitment (slot) for the upcoming timetable periods.*
Related to task/subtask(s)	*Tasks 4.1, 4.3, 5.2, 5.2.2*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning",* *TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Manage Capacity Objects of the multi-annual capacity plan and the plan for next LTP period in the CMS via its graphical user interface.* *Handling of received multi-annual capacity requests, preparation and provision of a multi-annual capacity offer/commitment to the requesting RU.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*

Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*Based on the received request, the CMS Operator applies required actions in the multi-annual capacity plan and the plan for next LTP period.* 1. *The CMS Operator opens the CMS with the multi-annual capacity plan.* 2. *The CMS Operator selects a subperiod from the CMS User Interface for filtering the capacity objects featuring at least one valid day of the selected period.* 3. *The CMS views are updated showing capacity objects with at least one valid day of the selected period.* 4. *The CMS Operator performs all steps of FP1-DEMO-5.5-UC-1 or FP1-DEMO-5.5-UC-2 respectively, using a multi-annual validity of the capacity objects including valid days of the next LTP period.* 5. *The CMS Operator uses the CMS to initialize the next LTP period from the multi-annual capacity plan.* 6. *The CMS adapts or converts the multi-annual capacity objects (e.g., slots into paths) to initialize the LTP capacity plan.* 7. *The CMS Operator opens the CMS for planning of the next LTP period.* 8. *The new/changed/deleted capacity objects with relevance for the next LTP period are correctly shown in the CMS views.* *Multi-annual (rolling planning) capacity request by RU:* 1. *The RU timetable planner uses a CMS-RU client application to submit a multi-annual (rolling planning) path request with validity of 36 months.* 2. *The CMS Operator sees the received request in the respective CMS view(s) for the rolling capacity plan.* 3. *The CMS Operator uses the CMS to validate the request and if successful, create a corresponding capacity commitment (slot) for the 36 months excluding the current STP period.* 4. *The TMS Operator opens the CMS for planning the current STP period.* 5. *The TMS Operator identifies the requested multi-annual path in the STP period.* 6. *The TMS Operator confirms the request or, If required,*

	a. *the CMS Operator adapts or amends the requested path* b. *the CMS applies all changes to the STP period only.* c. *the CMS Operator offers it to the RU* d. *the RU timetable planner uses the CMS-RU client application to accept the offer or to decline it, possibly repeating the request procedure (for the STP path or the complete multi-annual path).* 7. *End*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.5.1.4. Interface for supporting ECMT (RNE) integration

Name	*Planning and allocation of capacity for different planning horizons - Interface for supporting ECMT (RNE) integration;*
ID	*FP1-DEMO-5.5-UC-4*
Description	*The CMS Operator initiates a transfer of Capacity Bands, train paths and TCRs to the ECMT (RNE) based on filter settings being available to restrict the data to be transferred.*
Related to task/subtask(s)	*Tasks 4.1, 4.3, 5.2, 5.2.2*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning",* *TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Upload of Capacity Bands, train paths and TCRs to the ECMT (RNE) by the CMS.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between*

	Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The CMS Operator decides and selects the filter conditions offered by the CMS to define the set of Capacity Bands, train paths or TCRs to be sent to the ECMT (RNE).* *2. The CMS Operator triggers the transfer of the capacity objects fulfilling the filter conditions to the ECMT.* *3. The CMS logs the preparation of the information to be transferred and the transfer result.* *4. The ECMT shows up with the transferred information.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
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6.5.1.5. Modelling and (capacity-) handling of planned changes of the infrastructure

Name	*Planning and allocation of capacity for different planning horizons - Modelling and (capacity-) handling of planned changes of the infrastructure*

ID	*FP1-DEMO-5.5-UC-5*
Description	*The CMS Operator creates and changes two different infrastructure data baseline versions featuring different, consecutive validity periods. The CMS Operator assigns the different infrastructure data baselines to the multi-annual capacity plan including Capacity Bands, train paths and TCRs and adapts the capacity plan objects being valid for the two baseline periods to the different baselines as needed.*
Related to task/subtask(s)	*Tasks 4.1, 4.3, 5.2, 5.2.2*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning",* *TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Capability of the CMS to model and handle planned changes of the infrastructure in conjunction with multi-annual capacity plans*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The CMS Operator uses the CMS to create and change two different infrastructure data baseline versions featuring different, consecutive validity periods.* *2. The CMS Operator assigns the different infrastructure data baselines to the multi-annual capacity plan including Capacity Bands, train paths and TCRs.*

	3. The CMS Operator adapts the capacity plan objects being valid for the two baseline periods to the different baselines as needed. *4. The CMS shows the multi-annual capacity objects being compliant to the different infrastructure baselines.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.5.1.6. Generation of standard reports

Name	*Planning and allocation of capacity for different planning horizons - Generation of standard reports*
ID	*FP1-DEMO-5.5-UC-6*
Description	*A report can be generated showing the current status of annual and rolling planning volumes on particular line sections for a standard day.*
Related to task/subtask(s)	*Tasks 4.1, 4.3, 5.2, 5.2.2*
Technical Enabler(s)	*TE1 "European cross-border scheduling with international train path planning",* *TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: CMS Operator; RNE*
Goal	*Generation and provision of a report for assessing or documenting the status of annual and rolling planning volumes on particular line sections for a standard day.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved national CMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operator).*
FP1 Developed components/functions/methods	*Enhanced CMS application software; enhanced CMS integration services.*

target of demonstration	
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The CMS Operator uses the CMS to decide and define filter conditions for particular line sections or standard days run patterns.* *2. The CMS Operator uses the CMS to initiate the generation of a filtered report via the CMS User Interface to assess or document the current status of annual and rolling planning volumes.* *3. The CMS applies the filter to identify the respective capacity objects and shows them in a report viewer.* *4. The CMS Operator uses the report viewer controls to manage (save, print etc.) the report.* *5. End*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.6. Demonstration 5.6 – Integration of traffic management system with network capacity planning

6.6.1. Data exchange between TMS and national CMS

6.6.1.1. New or changed plan in national CMS sent to TMS

Name	*Data exchange between TMS and national CMS - New or*

	changed plan in national CMS sent to TMS
ID	*FP1-DEMO-5.6-UC-1*
Description	*A new or changed capacity plan in the national CMS is sent to the TMS including train paths and TCRs.*
Related to task/subtask(s)	*Tasks 4.1, 4.4, 5.2, 5.2.3*
Technical Enabler(s)	*TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: CMS Operator; TMS Operator; SP Task 3*
Goal	*Transfer of the agreed (capacity) plan in the CMS to the TMS for a specific operational day.*
Demonstration Requirements	*HACON demonstrator environment, CMS and TMS application instances representing the involved national CMS and TMS, covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the role of the Capacity Planner (CMS Operator) and a Traffic Controller (TMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services; enhanced TMS application software; enhanced TMS integration services.*
Other involved components	*TPS application servers (CMS and TMS) and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The CMS system scheduler or a CMS/TMS Operator initiates a transfer of the capacity plan valid for a selected day.* *2. The CMS transfer function uses the specific day for filtering train timetables and TCRs valid on that day.* *3. The CMS transfer function generates the agreed plan including train timetables and TCRs for the specific day in a defined format and transfers it to the TMS.* *4. The TMS receives the agreed plan transferred by the CMS and stores it as initial Operational Plan for the specific operational day.* *5. End*
Expected Demonstration Date	*May 2026 – June 2026*

Expected evaluation of results	*End users (CMS Operator/Capacity Planner, TMS Operator/Traffic Controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.6.1.2. New or changed local plan of yard-based local CMS sent to TMS

Name	*Data exchange between TMS and national CMS - New or changed local plan of yard based local CMS sent to TMS*
ID	*FP1-DEMO-5.6-UC-2*
Description	*A new or changed local plan of yard-based local CMS is sent to TMS, a) train consist b) later arrival in departure track c) earlier arrival in departure track d) track assignment change e) changed or new track reservation f) changed or new shunting activities with impact on lines.*
Related to task/subtask(s)	*Tasks 4.1, 4.4, 5.2, 5.2.3*
Technical Enabler(s)	*TE2 "Improved capacity allocation using rolling planning and TTR"*
Stakeholders	*Primary Stakeholder: local CMS Operator; TMS Operator; SP Task 3*
Goal	*Transfer of the agreed local (capacity) plan in the yard-based local CMS to the TMS for a specific operational day.*
Demonstration Requirements	*HACON demonstrator environment, local CMS and TMS application instances representing the involved national local CMS and TMS, covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the role of the local Capacity Planner (local CMS Operator) and a Traffic Controller (TMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced local CMS application software; enhanced local CMS integration services; enhanced TMS application software; enhanced TMS integration services.*

Other involved components	*TPS application servers (local CMS and TMS) and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The local CMS system scheduler or a local CMS/TMS Operator initiates a transfer of the local capacity plan valid for a selected day.* *2. The local CMS transfer function uses the specific day for filtering capacity objects and assigned information about train consist, later arrival in departure track, earlier arrival in departure track, track assignment change, changed or new track reservation, changed or new shunting activities valid on that day.* *3. The local CMS transfer function generates the agreed local plan for the specific day in a defined format and transfers it to the TMS.* *4. The TMS receives the agreed local plan transferred by the local CMS and stores it as part of the initial Operational Plan for the specific operational day.* *5. End*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (local CMS Operator/Capacity Planner, TMS Operator/Traffic Controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
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6.6.1.3. New or changed operational TCR in TMS sent to national and local yard-based CMS

Name	*Data exchange between TMS and national CMS - New or changed operational TCR in TMS sent to national and local yard-based CMS*
ID	*FP1-DEMO-5.6-UC-3*
Description	*A new or changed operational TCR in TMS is sent to national and local yard-based CMS.*
Related to task/subtask(s)	*Tasks 4.1, 4.4, 5.2, 5.2.3*
Technical Enabler(s)	*TE2 "Improved capacity allocation using rolling planning and TTR"* *TE6 "Integration of TMS with yard /station planning"*
Stakeholders	*Primary Stakeholder: National CMS and local CMS Operator; TMS Operator; SP Task 3*
Goal	*Transfer of operational TCRs in the TMS to the national CMS and to the yard- based local CMS.*
Demonstration Requirements	*HACON demonstrator environment, national / local CMS and TMS application instances representing the involved national and local CMS and TMS, covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the role of the national and local Capacity Planner (national and local CMS Operator) and a Traffic Controller (TMS Operator).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced national and local CMS application software; enhanced national and local CMS integration services; enhanced TMS application software; enhanced TMS integration services.*
Other involved components	*TPS application servers (national and local CMS and TMS) and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *The TMS system scheduler initiates an extract of the Operational Plan.* 2. *The TMS/CMS interface identifies the operational TCRs and transfers them in a defined format to the national and local CMS.*

	3. *The national and local CMS receive the TCRs transferred by the TMS and stores them as part of the national or local Capacity Plan.* 4. *End*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (national and local CMS Operator/Capacity Planner, TMS Operator/Traffic Controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.6.1.4. Up-to-date train position feed-back from TMS to national CMS for deviation detection (track/time)

Name	*Data exchange between TMS and national CMS - Up-to-date train position feed-back from TMS to CMS for deviation detection (track/time)*
ID	*FP1-DEMO-5.6-UC-4*
Description	*An up-to-date train position feed-back from TMS is sent to the CMS for deviation detection (track/time) to support the decision making for larger re-planning scenarios.*
Related to task/subtask(s)	*Tasks 4.1, 4.4, 5.2, 5.2.3*
Technical Enabler(s)	*TE2 "Improved capacity allocation using rolling planning and TTR"* *TE6 "Integration of TMS with yard /station planning"*
Stakeholders	*Primary Stakeholder: National CMS Operator; TMS Operator; SP Task 3*
Goal	*Transfer of Up-to-date train positions in the TMS to the CMS for deviation detection (track/time) to support the decision making for larger re-planning scenarios.*
Demonstration Requirements	*HACON demonstrator environment, CMS and TMS application instances representing the involved CMS and TMS, covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the role of the Capacity Planner (CMS*

	Operator) and a Traffic Controller (TMS Operator).
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software; enhanced CMS integration services; enhanced TMS application software; enhanced TMS integration services.*
Other involved components	*TPS application servers (CMS and TMS) and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The TMS sends the real-time arrival time and track of the train at the reported location to the CMS.* *2. The CMS receives the real-time arrival time and track of the train.* *3. The CMS validates the information and, if successful, indicates it in the GUI of the CMS.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (CMS Operator/Capacity Planner, TMS Operator/Traffic Controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	*-*

6.7. Demonstration 5.7 – Integration of network capacity planning with yard and station capacity planning

6.7.1. Data exchange between CMS and local CMS

Name	*Data exchange between national capacity management/planning system (national CMS) and local, yard-based capacity management/planning system (local CMS)*
ID	*FP1-DEMO-5.7-UC-1*

Description	*The national CMS planning application demonstrates the exchange of data with local (yard) based CMS showing new planning process capabilities. The following sub-Use Cases are covered:* 1. *New or changed plan in national CMS sent to yard based local CMS a) train path b) TCR;* 2. *New or changed local plan of yard based local CMS sent to national CMS, a) train consist b) later arrival in departure track c) earlier arrival in departure track d) track assignment change e) changed or new track reservation f) changed or new shunting activities with impact on lines;*
Related to task/subtask(s)	*Tasks 4.1, 4.5, 5.2, 5.2.4*
Technical Enabler(s)	*TE6 "Integration of TMS with yard /station planning"*
Stakeholders	*Primary Stakeholder: National CMS Operator; local CMS Operator*
Goal	*Synchronized national ad local capacity plans as managed by national and local CMS.*
Demonstration Requirements	*HACON demonstrator environment, local and national CMS application instances representing the involved local and national CMS and TMS, covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the role of the national and local Capacity Planners (local and national CMS Operators).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced national / local CMS application software; enhanced national / local CMS integration services;*
Other involved components	*TPS application servers (CMS and TMS) and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *National plan in the CMS is changed local CMS area.* *1.1 The CMS Operator performs the creation of a new or the change of an existing planned train path /TCR impacting the area of the local CMS.* *1.2 The CMS sends the capacity plan change to the local*

	CMS. 1.3 The local CMS receives the capacity plan change, applies related change to the local capacity plan and indicates it in the GUI of the local CMS 2. Local plan in the local CMS is changed impacting a line planned by the CMS. 2.1 The local CMS Operator performs a change of train consist, late arrival in departure track, earlier arrival in departure track, track assignment change, changed or new track reservation, or changes or create new shunting activities with impact on lines planned by the CMS. 2.2 The local CMS sends the change to the CMS. 2.3 The CMS receives the change and indicates it in the GUI of the CMS
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (local and national CMS Operator/Capacity Planner assessed functionality and usability aspects.)*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 1, Interfaces and decision support modules enabling Integrated capacity planning of European infrastructure managers with external national and central planning applications and yard and station capacity management; European-wide capacity allocation enriched with new processes such as TTR.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

6.8. Demonstration 7.1 – Use of algorithms for generating strategic timetables

6.8.1. Decision support for strategic station routing

Name	*Decision support for strategic station routing*
ID	*FP1-DEMO-7.1-UC-1*
Description	*Network-level planning algorithms cannot guarantee that their generated timetables are viable when taking the microscopic station infrastructure into account. A timetable planner may, therefore, want to validate the feasibility on important station nodes before proceeding to the next stages of the timetabling process.* *For a given macroscopic timetable, we will demonstrate*

	an algorithm that finds a robust station routing or reports its inability to do so. The optimization takes robustness against small everyday delays into account.
Related to task/subtask(s)	*Task 6.2, 7.3*
Technical Enabler(s)	*TE 4*
Stakeholders	*Timetable designers (at RU and IM)*
Goal	*Demonstrate the usability of the algorithm for realistic instances and obtain feedback from timetable designers*
Demonstration Requirements	*The demonstration will take place during a physical meeting with all involved scientific researchers and the expert timetable designers to directly exchange feedback and answer questions.*
FP1 Developed components/functions/methods target of demonstration	*Algorithm to construct an optimized robust station routing*
Other involved components	*Microscopic infrastructure data of relevant stations provided by NSR and ProRail* *Network timetables provided by NSR and NRD using algorithms for network timetable optimization*
Expected Demonstration Location	*Virtual demonstration – test on data from Dutch railway stations*
Demonstration storyboard	1. *NSR algorithm developers provide optimized network timetable(s)* 2. *NSR and DLR determine interesting stations in collaboration* 3. *DLR optimizes the station routing using the station routing algorithm for the selected stations* 4. *DLR computes robustness metrics for timetable and infrastructure and provides a static visualization* 5. *Timetable planners from NSR and/or ProRail analyze the results and evaluate the quality of the station routing* 6. *DLR collects the results and produces a report*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The local station routing will be evaluated by experienced timetable planners from NSR and/or ProRail.*
Exploitation	*KER 2: Improve delay robustness of the local station routing*
Responsible partner/person	*Philipp Widmann, DLR*
Notes	-

6.8.2. Decision support for strategic timetabling

Name	*Decision support for strategic timetabling*
ID	*FP1-DEMO-7.1-UC-2*
Description	*For strategic timetabling, decision support algorithms that can optimize the trade-off between service quality and operational cost of a timetable need to be developed.* *In this use case, we focus on cyclic timetables with a cycle time of 1 hour. In addition, we want to minimize the total generalized travel time for all passengers together. This includes waiting time, in-train time and transfer time.*
Related to task/subtask(s)	*Task 6.2, 7.3*
Technical Enabler(s)	*TE 4*
Stakeholders	*Timetable designers and experts (at RU and IM)*
Goal	*Show that an algorithm can support planners in designing a strategic timetable*
Demonstration Requirements	*The demonstration will take place in a meeting room with the involved developer(s) and timetable designer and expert(s)*
FP1 Developed components/functions/methods target of demonstration	*Algorithm to construct a strategic timetable*
Other involved components	*Algorithm from DLR to construct robust station routing* *Algorithm from NRD to construct timetable from scratch* *Visualisation of the produced timetable in the form of a time-space and track occupation diagrams, and evaluation of the timetable on a given set of KPIs*
Expected Demonstration Location	*Virtual demonstration – test on Dutch railway network*
Demonstration storyboard	1. *Algorithms will produce several different outputs for a given instance resulting in several timetables* 2. *Each output will be visualized in the form of a static time-space and track occupation diagram and a set of KPIs will be computed* 3. *Timetable designers and experts (NSR and/or ProRail) will judge the different outputs and provide feedback on the quality of each produced timetable* 4. *The feedback of the planners will be documented in a report*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The timetable will be evaluated by experienced timetable designers and experts of NSR and/or ProRail*

Exploitation	*KER 2: Improved and more robust timetables*
Responsible partner/person	*D. Huisman, NSR*
Notes	-

6.9. Demonstration 7.2 – Planner interaction with an optimisation-based timetable planning tool to resolve conflicts in the long-term planning process

6.9.1. Usability of an optimization-based decision support system for long term timetabling

Name	*Usability of an optimization-based decision support system for long term timetabling*
ID	*FP1-DEMO-7.2-UC-1*
Description	*When constructing the annual timetable, planners have to modify train paths to resolve conflicts. There are many ways that the train paths can be modified to obtain a conflict-free timetable, but planners rarely have time to explore different solutions as there are strict deadlines. There are optimization algorithms that could be used to support the planners, and this use case focuses on how to make an interactive usable optimization-based decision support system. Specifically, the use case considers a planner who wants to solve the conflicts for a train, or a set of trains, in the long-term planning process.*
Related to task/subtask(s)	*Tasks 6.2, 7.3*
Technical Enabler(s)	*TE4*
Stakeholders	*IMs timetable planners*
Goal	*To learn more about the usability aspects that come into play when a timetable planner uses an optimization-based support tool.*
Demonstration Requirements	*Computer with prototype installed, data for running the use-case, end-users that can test the prototype, demonstration leader.*
FP1 Developed components/functions/methods target of demonstration	*Prototype for testing usability aspects of an optimization-based decision support tool for planning the annual timetable.*
Other involved components	*M2 – a research prototype for generating a timetable with optimization.* *Prototyping tool – to be defined on demonstration phase*
Expected Demonstration	*Virtual*

Location	
Demonstration storyboard	1. *IM timetable planner "cleans up" a timetable by using the support tool to solve "easy conflicts".* 2. *IM timetable planner selects a conflict to resolve.* 3. *IM timetable planner resolves conflict using the decision support tool, which may include:* a. *Forcing certain decisions.* b. *Allowing certain planning rules to be broken.* c. *Influencing which solution the tool generates.* d. *Analysis of different solutions.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users who are testing the procedure*
Exploitation	*Knowledge of usability aspects that come into play when timetable planners use optimization-based support tools.* *KER2 - Decision support modules and demonstrators for optimised capacity considering train paths and infrastructure maintenance restrictions and rolling stock planning.*
Responsible partner/person	*Emma Solinen, TRV* *Sara Gestrelius, RISE* *Jonas Andersson, RISE*
Notes	-

6.10. Demonstration 7.3 – Timetable optimiser and decision support system for adjusting the annual timetable on a line or network level

Name	*Producing optimized STP timetables*
ID	*FP1-DEMO-7.3-UC-1*
Description	*The CMS Operator uses a built-in CMS feature to optimize and adjusting the annual capacity plan/ timetable on a line or network level in the Short-Term Planning period. This is invoked by the TMS Operators to react efficiently on incurred capacity plan changes with respect to TCRs resulting from planned construction works or predictive maintenance as well as train paths / changes in (forecasted) transport demand or changes of the network characteristics.*
Related to task/subtask(s)	*Tasks 6.3.1*
Technical Enabler(s)	*TE3 "Decision support for short term planning"*

Stakeholders	*Capacity or timetable planners at RU and IM*
Goal	*To produce optimized STP timetables in the case of TCRs, changes of the network characteristics, or insertion of a new train. In all this cases, short perturbations of the planned train routes will also be considered.*
Demonstration Requirements	*HACON demonstrator environment, CMS application instance representing the involved CMS, covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the Capacity Planner (CMS Operators).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced CMS application software.*
Other involved components	*TPS application server (CMS) and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *client computer and operation system software*
Expected Demonstration Location	*A virtual line generated on the base of different realistic instances*
Demonstration storyboard	1. *The system is initialized with respect with the current planned timetable.* 2. *Triggered by manual request of CMS Operator (Capacity Planner).* 3. *The best solution obtained within the given time limit will be displayed, emphasizing the changes between the old and the new plan.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*Evaluated by end users who are testing the procedure and the result quality.*
Exploitation	*Minimizing as much as possible conflicts and reaching the best result according with rules and KPIs* *KER 2: Decision support modules and demonstrators for optimised capacity considering train paths and infrastructure maintenance restrictions and rolling stock planning.*
Responsible partner/person	*Paolo Ventura, SMO IT* *Rolf Gooßmann, Hacon*
Notes	-

6.11. Demonstration 7.4 – Decision support for constructing adjusted hourly timetables

Name	*Decision support for constructing adjusted hourly timetables*
ID	*FP1-DEMO-7.4-UC-1*
Description	*Demonstration of algorithms for planning of planned maintenance work for the entire Dutch network. Cancellations and alternative routes will be considered.*
Related to task/subtask(s)	*Task 6.3, 7.4*
Technical Enabler(s)	*TE 3*
Stakeholders	*Timetable planners (at RU and IM)*
Goal	*Show that an algorithm can support planners in constructing an adjusted hourly timetable*
Demonstration Requirements	*The demonstration will take place in a meeting room with the involved developer(s) and planner(s)*
FP1 Developed components/functions/methods target of demonstration	*Algorithm to construct an adjusted hourly timetable*
Other involved components	*Visualisation of the produced timetable in the form of a time-space and track occupation diagrams, and evaluation of the timetable on a given set of KPIs*
Expected Demonstration Location	*Virtual demonstration – test on Dutch railway network*
Demonstration storyboard	1. *Algorithm will produce several different outputs for a given instance resulting in several adjusted hourly timetables* 2. *Each output will be visualized in the form of a static time-space and track occupation diagrams and a set of KPIs will be computed* 3. *Timetable planners (NSR and/or ProRail) will judge the different outputs and provide feedback on the quality of each produced timetable* 4. *The feedback of the planners will be documented in a report*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The timetable will be evaluated by experienced timetable planners of NSR and/or ProRail*
Exploitation	*KER 2: Reduce impact on the quality of the timetable due to infrastructure maintenance restrictions.*
Responsible partner/person	*D. Huisman, NSR*

Notes	-

6.12. Demonstration 7.5 – Use of short-term planning algorithms for re-scheduling trains in case of TCRs

6.12.1. Decision support for timetable planning with a temporary single-track section

Name	*Decision support for timetable planning with a temporary single-track section*
ID	*FP1-DEMO-7.5-UC-1*
Description	*A timetable planner needs support to make good decisions in case of a TCR. The TCR is of such magnitude that it has a significant impact on the traffic and will lead to large delays if we don't make a new plan. It is time-consuming to make temporary timetables which in practice often results in the trains running according to the original timetable, with delays. With an algorithm that returns a new timetable given the new prerequisites, the timetable planner could get input to which decisions to make according to some KPIs.* *Two TCRs of different characters will be analysed: 1) A TCR that is located on a double-track line where one of the tracks is closed, and 2) A TCR that is located on a single-track line where some part of the line has a speed reduction for all trains.*
Related to task/subtask(s)	*Tasks 6.3, 7.4*
Technical Enabler(s)	*TE3*
Stakeholders	*IMs timetable planners*
Goal	*To get a new re-planned timetable in case of a TCR*
Demonstration Requirements	*No demonstration requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*Developed algorithm for short-term timetable re-scheduling*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual, The line between Göteborg-Alnabru.*
Demonstration storyboard	• *IM get knowledge of a TCR and start the process with making a temporary timetable* • *We model the problem for the specific line/area* • *We test if it is possible to find a feasible solution*

	We decide if and which trains need to be cancelled (interaction with IM) *We re-schedule trains* *We evaluate KPIs* *If needed: Change settings and re-schedule/evaluate again (iterative process)*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users (timetable planners) who are testing the algorithm for feasibility, calculation speed, accuracy, robustness, usability, etc.*
Exploitation	*KER2 - Decision support modules and demonstrators for optimised capacity considering train paths and infrastructure maintenance restrictions and rolling stock planning*
Responsible partner/person	*Emma Solinen, TRV* *Carl Henrik Häll, LiU* *Mikael Fredriksson, LiU*
Notes	-

6.13. Demonstration 7.6 – Use of algorithms for inserting short-term train paths in a planned timetable

6.13.1. Optimized insertion of short-term trains into an existing timetable

Name	*Optimized insertion of short-term trains into an existing timetable*
ID	*FP1-DEMO-7.6-UC-1*
Description	*The use case consists in validating the algorithms proposed for inserting one or more short-term trains into an existing timetable. The validation will be performed using the OSRD simulator (Oen Source Railway Designer by SNCF Réseau, French IM)*
Related to task/subtask(s)	*6.3, T7.4*
Technical Enabler(s)	*TE3*
Stakeholders	*SNCF SA, SNCF Réseau (IM) and Mines Saint-Etienne*
Goal	*The goal is to provide SNCF Réseau and other IMs the ability to insert short-term trains, in particular freight trains which have last—minute operational constraints.*
Demonstration Requirements	*Data related to timetable, infrastructure and rolling stock.* *Trajectory calculation implemented in OSRD.*

FP1 Developed components/functions/methods target of demonstration	*Method and software to support planners in inserting short-term trains into a predefined timetable.*
Other involved components	*OSRD simulator*
Expected Demonstration Location	*No specific location.*
Demonstration storyboard	*1. [SNCF SA, SNCF Réseau] [select one short-term train to insert] [NA]* *2. [SNCF SA, SNCF Réseau] [analyse the alternatives proposed by the optimization algorithm] [Choose the best alternative]* *3. [SNCF SA, SNCF Réseau] [select several short-term trains to insert] [NA]* *4. [SNCF SA, SNCF Réseau] [analyse the alternatives proposed by the optimization algorithm] [Choose the best alternative]*
Expected Demonstration Date	*June 2026*
Expected evaluation of results	*Results assessed by SNCF Réseau's experts: local and regional planners in coordination with the OSRD team.*
Exploitation	*KER2 – Decision support module*
Responsible partner/person	*Christelle Lérin and Rémy Chevrier, SNCF SA*
Notes	

6.14. Demonstration 7.7 – Use of short-term planning algorithms that identify and solve conflicts by different means

6.14.1. Decision support for timetabling by conflict detection and resolution (CDR) algorithms.

Name	*Decision support for timetabling by conflict detection and resolution (CDR) algorithms.*
ID	*FP1-DEMO-7.7-UC-1*
Description	*The aim is to develop a decision support tool that identifies conflicts in train schedules caused by disruptions and generates a conflict-free timetable without altering commercial schedules. The tool uses genetic algorithms, iteratively improving the timetable by resolving conflicts and optimizing based on KPIs.* *The conflict detection and resolution (CDR) software solves several conflicts simultaneously allowing the planner to adjust the timetable minimising user intervention.*
Related to task/subtask(s)	*Tasks 6.3.1, 7.4.1, 7.4.3*
Technical	*TE3*

Enabler(s)	
Stakeholders	*-INDRA staff (timetable planner role)*
Goal	*The main goal is to demonstrate the effectiveness of the CDR algorithms in resolving conflicts and achieving the best possible schedule based on a set of KPIs.*
Demonstration Requirements	*-Network topology data and timetable data* *-KPIs setup for evaluation* *-Staff for analysis and support*
FP1 Developed components/functions/methods target of demonstration	*INDRA's CDR software for conflict detection and resolution, utilizing genetic algorithms to provide optimized timetables based on predefined KPIs.*
Other involved components	*-Traffic Management System (planning functionality) for timetable creation.*
Expected Demonstration Location	*Virtual (INDRA laboratory)*
Demonstration storyboard	*[Timetable planner] [creates a temporary speed restriction (TSR), adjust train paths or add new train path] [affecting current timetable and provoking conflicts]* *[CDR software] [detects conflicts] [caused by the introduced changes in the modified timetable].* *[CDR software/Timetable Optimization module] [processes timetable and conflicts] [by evaluating various resolution methods iteratively].* *[CDR software/Timetable Optimization module] [applies selected resolutions] [to update the timetable].* *[CDR software/ Timetable Optimization module] [provides KPIs values] [to assess the new timetable].* *[Timetable planner and stakeholders] [review final timetable] [to assess improvements in the conflict resolution].*
Expected Demonstration Date	*March 2026*
Expected evaluation of results	*Results will be evaluated by project members based on the effectiveness of the CDR algorithms in resolving conflicts, impact on train-paths and new conflicts generated.*
Exploitation	*Expected outcomes include better timetable management processes by enhancing the conflict detection and resolution, leading to more efficient train scheduling.* *This can contribute to the exploitation of results in improved planning tools and resolution methods (KER 2).*
Responsible partner/person	*INDRA* *Enrique Gómez González* *Carmen Ramos Prieto*
Notes	*The conflict resolution process leverages genetic algorithms to optimize timetables while minimizing user intervention.*

6.15. Demonstration 7.8 – Functionalities for short-term planning for rescheduling timetables in case of TCR and managing additions or modifications of new tracks on request

6.15.1. Use of timetable optimizer and decision support for STP

Name	*Use of timetable optimizer and decision support for STP*
ID	*FP1-DEMO-7.8-UC-1*
Description	*Optimizing timetables in the Shor t Term Period*
Related to task/subtask(s)	*Tasks 6.3.1, 7.4.3*
Technical Enabler(s)	*TE3 "Decision support for short term planning"*
Stakeholders	*Timetable planners at RU and IM*
Goal	*The software component developed by Hitachi/SINTEF will demonstrate functionalities for optimizing timetables in the Short-Term Period (from one day to one year ahead) taking into account TCRs, new trains requests and network characteristics.* *It will be configured in the Genoa SCCM area, a plant currently in operation with a variety of cases including single and double track lines, the presence of route alternatives, and stations of significant complexity.* *The following sub-Use Cases are covered:* *A scheduled work that completely interrupts a stretch of line or puts a station out of service for a period* *An accidental event such as flooding of a station or derailment of a train. The trains must be redirected to an alternative route for a period of time that cannot be determined in advance* *Interruption due to works on only one track of a double-track line* *Changes to station layout, e.g. platform not available for a period* *Add a new train to the timetable schedule, given specific constraints*
Demonstration Requirements	*Network data of the Genoa TMS Area* *Annual timetable*
FP1 Developed components/functions/methods target of demonstration	*SINTEF Solver* *Hitachi Train Planner*
Other involved components	*A subset of Hitachi TMS system will be used*
Expected Demonstration	*Genoa, Italy*

Location	
Demonstration storyboard	1. *System initialization of a chosen timeslot: the system displays the trains involved* 2. *Insert perturbations in the system such as possession and speed restrictions* 3. *Request optimization of the scenario* 4. *Display the results (optimized trains) and figures (e.g. total delays, residual conflicts, total modified trains)* 5. *Result evaluation* 6. *Optionally reiterate from 2 changing optimizer parameters or introducing manual changes (e.g. trains suppressions)*
Expected Demonstration Date	*Q2 2026*
Expected evaluation of results	*The RFI Team will check for feasibility of the new timetables and will provide a subjective opinion on their quality.*
Exploitation	*Minimizing as much as possible conflicts and reaching the best result according with RFI rules and KPIs* *This can contribute to the exploitation of results in improved planning tools and resolution methods (KER 2).*
Responsible partner/person	*Hitachi: Gruosso/Bianchi* *SINTEF: Sartor*
Notes	-

6.16. Demonstration 7.9 – Use of algorithms for rolling stock rotation

Name	*Rolling stock rotation on a Norwegian line*
ID	*FP1-DEMO-7.9-UC-1*
Description	*We consider one busy line in Norway, and derive an optimal rolling stock rotation plan from a given timetable*
Related to task/subtask(s)	*Task 6, Subtask 4*
Technical Enabler(s)	*TE4a*
Stakeholders	*The Norwegian Railway Directorate (NRD), generating the instances, assessing the results.* *SINTEF DIGITAL, developing models and solution methods*
Goal	*The main objective or goal of the demonstration use case*
Demonstration Requirements	
FP1 Developed components/functions/method	*A Mixed Integer Linear Programming formulation, based on an integer flow model of the rolling stock*

s target of demonstration	*rotation problem in Norway*
Other involved components	*A mixed integer linear programming solver*
Expected Demonstration Location	*Probably (but not certainly) the Norwegian line Jærbanen from Stavanger to Egersund, otherwise another line TBD*
Demonstration storyboard	*1. The NRD generates a timetable* *2. SINTEF runs the rolling stock algorithm and generates a rolling stock plan* *3. The plan is assessed by the NRD* *4. NRD possibly proposes potential alternatives* *5. SINTE modifies some parameters to take into account NRD's comments and we restart from Step 2.*
Expected Demonstration Date	*Q2 2026*
Expected evaluation of results	*NRD planners assess the quality of the rolling stock plans*
Exploitation	*KER 2: Efficient rolling stock planning*
Responsible partner/person	*Carlo Mannino, SINTEF DIGITAL*
Notes	

6.17. Demonstration 7.10 – Decision support for rolling stock stabling

Name	*Decision support for rolling stock stabling*
ID	*FP1-DEMO-7.10-UC-1*
Description	*Demonstration of algorithms for rolling stock stabling*
Related to task/subtask(s)	*Task 6.4, 7.5*
Technical Enabler(s)	*TE 6*
Stakeholders	*Node planners (at RU)*
Goal	*Show that an algorithm can support planners in constructing a rolling stock stabling plan on a large station with multiple yards*
Demonstration Requirements	*The demonstration will take place in a meeting room with the involved developer(s) and planner(s)*
FP1 Developed components/functions/methods target of demonstration	*Algorithm to construct rolling stock stabling plan with multiple yards*
Other involved components	*Visualisation of the produced plan in the form of a track occupation diagram, a location overview showing the time evolution, and evaluation of the timetable on a given set of KPIs (i.e. number of conflicts and number of total shunt movements)*

Expected Demonstration Location	*Virtual demonstration – test on Utrecht Central station with 3 yards (Landstraat, Cartesiusweg and OZ)*
Demonstration storyboard	*1. Algorithm will produce several different outputs for a given instance resulting in several rolling stock stabling plans* *2. Each output will be visualized in the form of a static track occupation diagram, a location overview showing the time evolution, and a set of KPIs will be computed* *3. RU node planners (NSR) will judge the different outputs and provide feedback on the quality of each produced timetable* *4. The feedback of the planners will be documented in a report*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The timetable will be evaluated by experienced node planners of NSR*
Exploitation	*KER 2: Efficient rolling stock planning*
Responsible partner/person	*D. Huisman, NSR*
Notes	-

6.18. Demonstration 9.1 – Simulate large networks, calibration and validation methodology of simulation model

6.18.1. Feedback loop from simulation to planning for large scale networks

Name	*Feedback loop from simulation to planning for large scale networks*
ID	*FP1-DEMO-9.1-UC-1*
Description	*Railway traffic creates dependencies between trains running for long times and at different lines. To get a complete evaluation of the traffic, IMs need to be able to capture all these dependencies and perform stochastic traffic simulations in large networks. Microscopic models are at a high level-of-detail, which makes it complicated and time consuming to simulate traffic in large networks. There is a need for model with lower level-of-detail, that can handle large datasets but still give reliable results.*
Related to task/subtask(s)	*Tasks 8.3.1, 9.1*
Technical Enabler(s)	*TE5*
Stakeholders	*IMs (that want to evaluate current or future traffic)*

Goal	*To be able to demonstrate the existing simulation tool PROTON in a Swedish use case and simulate a large network.*
Demonstration Requirements	*No development requirement should be considered. Timetable, macro infrastructure description and train technical driving times are required.*
FP1 Developed components/functions/methods target of demonstration	*Proton*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*
Demonstration storyboard	1. *We collect and process infrastructure and timetable data for multiple control area networks in Sweden* 2. *We collect and process historical performance data to calibrate primary delay distributions in collaboration with FP1-DEMO-12.1-UC-2.* 3. *We simulate several disturbed traffic scenarios for one or multiple control area networks* 4. *We evaluate the output to validate the simulation tool*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users (capacity analysts) who are testing the simulation tool to validate the results against real-world data.*
Exploitation	*This demonstration will improve the planning of robust timetables by improving the feedback loops between operation and planning (KER 3).*
Responsible partner/person	*Emma Solinen, TRV* *Hans Sipilä, KTH*
Notes	-

6.18.2. Historical data analysis to improve traffic simulations and traffic planning

Name	*Historical data analysis to improve traffic simulations and traffic planning*
ID	*FP1-DEMO-9.2-UC-2*
Description	*In stochastic simulations, primary delays are inserted to capture timetable performance indexes such as punctuality and arrival delay. To get accurate output from the simulations, it is important that the input is correct and corresponds to real world historical data. Therefore, we 1)*

	need to perform analyses of historical data and 2) calibrate primary delay distributions, to turn the data into realistic disturbance distributions which can be used in operational railway simulations. *In the use case, there are of two datasets, one Swedish and one French, that can be assessed in respective demonstrations.*
Related to task/subtask(s)	*Tasks 8.3.2, 9.1*
Technical Enabler(s)	*TE5*
Stakeholders	*IMs (that want to evaluate current or future traffic)*
Goal	*To create realistic primary delay distributions*
Demonstration Requirements	*No development requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*Method to process historical performance data and calibrate primary delay distributions as input to simulation tools*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual, large part of the Swedish network*
Demonstration storyboard	1. *We collect and process infrastructure and timetable data for multiple control area networks in Sweden* 2. *We collect and process historical performance data to calibrate primary delay distributions to be used in FP1-DEMO-12.1-UC-1.* 3. *We simulate several disturbed traffic scenarios for one or multiple control area networks* 4. *We evaluate the output to validate the simulation tool*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by end users who are testing the distributions in a simulation tool (FP1-DEMO-9.2-UC-1)*
Exploitation	*This demonstration will improve the planning of robust timetables by improving the feedback loops between operation and planning (KER 3).*
Responsible partner/person	*Emma Solinen, TRV* *Carl-William Palmqvist, LU*
Notes	*This is the same use case as FP1-DEMO-9.3-UC-1 but this is the case with Swedish data.*

6.19. Demonstration 9.2 – Feedback loops between crew plan and operation

Name	*Feedback loops between crew plan and operation*
ID	*FP1-DEMO-9.2-UC-1*

Description	*In this use case we aim at improving the robustness of a crew plan with the use of an optimiser, a simulator and a feedback loop between both components. The goal is to produce a crew plan that increases train punctuality because the crew plan is less prone to delay propagation. The feedback loop converts statistical information about delays provided by the simulator into guidelines for the optimiser to produce crew plans with increased robustness. The simulator generates realistic incidents based on historical data from the operation and simulates also in a realistic way the effect of these incidents in the execution of the operational plans. After subjecting an operational plan to multiple disruption scenarios, it produces a robustness evaluation report and useful statistics that can be used to improve the robustness of a crew plan.* *We aim at obtaining a crew plan with higher robustness, i.e. less prone to delay propagation, with a comparable number of duties.*
Related to task/subtask(s)	*Task 8.3*
Technical Enabler(s)	*TE5*
Stakeholders	*Crew duty planners and dispatcher at RU*
Goal	*Evaluate the robustness of a crew plan*
Demonstration Requirements	*The demonstration will take place in a meeting room with the developers and representatives from crew planning and dispatching.*
FP1 Developed components/functions/methods target of demonstration	*Simulation model for a crew duty plan* *Feedback loop between the simulator and crew optimising software* *Plug-in for enabling robust scheduling in the crew optimising software from SISCOG*
Other involved components	*Crew optimising software from SISCOG* *Timetables and crew plans at NS as made by our timetable production*
Expected Demonstration Location	*Virtual demonstration – test on Dutch railway network*
Demonstration storyboard	*1. Developers from SISCOG and/or crew planners from NS will provide an initial crew plan* *2. Simulation researchers from NS simulate the plan and provide an evaluation of the crew plan* *3. This feedback is used by developers from SISCOG to run a second iteration of the optimiser* *4. The second iteration is simulated again and will be judged on whether the robustness has improved*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The second iteration of the crew plan will be judged on the*

	balance between the number of duties obtained and robustness outcome from the simulation.
Exploitation	*KER 3 – New methods and models for improved feedback loops between planning and operations including TMS – C-DAS/ATO*
Responsible partner/person	*Camiel Simons, NSR* *Ricardo Saldanha, SISCOG*
Notes	*A new simulation software will be developed for this purpose. Existing crew planning tool will be modified and linking interfaces are built.*

6.20. Demonstration 9.3 – Method for processing the historical data and implement the delay distribution into RailSys for stochastic models

Name	*Demonstrate a method for processing the historical data and implement the delay distribution into RailSys for stochastic models*
ID	*FP1-DEMO-9.3-UC-1*
Description	*In stochastic simulations, primary delays are inserted to capture timetable performance indexes such as punctuality and arrival delay. To get accurate output from the simulations, it is important that the input is correct and corresponds to real world historical data. Therefore, we 1) need to perform analyses of historical data and 2) calibrate primary delay distributions, to turn the data into realistic disturbance distributions which can be used in operational railway simulations.* *In the use case, there are two datasets, one Swedish and one French, that can be assessed in respective demonstrations.*
Related to task/subtask(s)	*Tasks 8.3.1, 9.1*
Technical Enabler(s)	*TE5*
Stakeholders	*IMs (that want to evaluate current or future traffic)*
Goal	*To create realistic primary delay distributions*
Demonstration Requirements	*No development requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*RailSys*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*

Demonstration storyboard	1. *Identify and retrieve available data (ATESS, Bréhat, GPS, Mistral, …). Retrieve the data on the EOLE perimeter. Contributors: SNCF D2D ICODEV & DGEX INCA EEx* 2. *Interpret the input data to display regularity curves by line. Deliverable: application or Power Bi to process the data and display the results. Contributors: SNCF D2D ICODEV & DGEX INCA EEx.* 3. *Distinguish between Origin Incidents (OI) and Induced Incidents (II). Deliverable: algorithm that analyses the data and isolates unit disturbances according to certain criteria. Academical partnership: Lund University (Sweden). Contributors: SNCF D2D ICODEV & DGEX INCA EEx* 4. *Inject the primary perturbations into the background noise and calibrate it under RailSys/Denfert. Use of Denfert scripts to inject disturbances automatically. Need to develop the RailSys/Denfert software to make it easier to change parameters. Contributors: TRV (collaboration on the RailSys scripts) & SNCF DGEX INCA EEx* 5. *Faster reading of results and improved iterations to converge on a calibration model. Internal evaluation module, looking for academic collaboration for data analysis*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*This enhanced methodology will be evaluated by end users who are testing the simulation tool*
Exploitation	*This demonstration will improve the planning of robust timetables by improving the feedback loops between operation and planning (KER 3).*
Responsible partner/person	*Axel Valentin, SNCF Réseau* *Augustin Arachtingi, SNCF Réseau*
Notes	*This is the same use case as FP1-DEMO-9.1-UC-2 but this is the case with French data.*

6.21. Demonstration 9.4 – Simulate how the timetable behaves with different topology networks

6.21.1. Assess the feasibility of a change in the network topology.

Name	*Assess the feasibility of a change in the network topology.*

ID	*FP1-DEMO-9.4-UC-1*
Description	*This use case demonstrates the performance of a capacity analysis tool with various topologies and timetables. The tool identifies bottlenecks, facilitating iterative simulations with new topologies for improved timetabling.*
Related to task/subtask(s)	*Tasks 8.3.1, Task 9.1*
Technical Enabler(s)	*TE5*
Stakeholders	*INDRA staff:* *- Technical expert partners: Collaborate on the adjustment of the capacity analysis tool.* *- Responsible for operating the traffic management system during the simulations, assessing the impact of the results, and contributing to the optimization of timetable efficiency.* *- Simulation Operator provides scenarios to the simulation environment (e.g. new situations such as track circuit occupied, etc)*
Goal	*The main goal is to evaluate the performance and capacity of railway networks by simulating different topologies with different signalling systems.*
Demonstration Requirements	*- Network topology data - Data from various ATP systems (ETCS Level 1 and ETCS Level 2)* *- Simulated train movement data (timetable data)* *- Locations for simulation of virtual environments (laboratory)* *- Staff for analysis and support*
FP1 Developed components/functions/methods target of demonstration	*- Enhanced capacity analysis tool with new functionalities software (Support for ETCS Level 1 and ETCS Level 2 ATP systems)*
Other involved components	*- Simulation environment software* *- Traffic management system*
Expected Demonstration Location	*Virtual (INDRA laboratory)*
Demonstration storyboard	*1. [INDRA staff] [Set up and run an initial simulation with a specific network topology and timetable.] [Identify performance issues or poor planning behaviour.]* *2. [INDRA staff] [Apply the capacity analysis tool to the identified network topology.] [Detect bottlenecks and discuss potential changes, including modifications to signalling systems (e.g., ETCS Level 1 to Level 2).]*

	3. *[Capacity Analysis Tool] [executes topology analysis] [providing capacity output regarding the new topology]* 4. *[INDRA staff] [Implement the proposed changes in the topology and re-run the simulation] [Evaluate the impact of changes on network performance.]* 5. *[INDRA staff] [Analyse and compare the results of the revised simulation with the initial performance data.] [determine if the changes improved or worsened the network performance.]*
Expected Demonstration Date	*March 2026*
Expected evaluation of results	*Results will be evaluated by project members to determine the effectiveness of topology changes in resolving bottlenecks and improving timetable efficiency.*
Exploitation	*The expected outcome of the demonstration is to showcase the improved capacity analysis tool, now enhanced with ETCS L1 and L2 functionalities leading to better operational decision-making.* *The results will contribute to business benefits by enabling improved network performance and supporting future infrastructure planning (KER 3).*
Responsible partner/person	*Enrique Gómez González, INDRA* *Carmen Ramos Prieto, INDRA*
Notes	*The demonstration leverages advanced simulation and analysis capabilities to model various ATP systems. The tool's results aim to enhance the efficiency and capacity of railway networks.*

6.22. Demonstration 9.5 – System effects of DATO concepts

Name	*System effects of DATO concepts*
ID	*FP1-DEMO-9.5-UC-1*
Description	*Demonstrate by use cases the system effects of different DATO concepts, such as HL3 and ATO GoA2 or higher, on a corridor of the national railway network with a micro simulation tool.*
Related to task/subtask(s)	*Tasks 8.4, 9.2*
Technical Enabler(s)	*TE5, TE7*
Stakeholders	*IMs and TOCs: provide data and apply new methods*
Goal	*Evaluation of the developed methods and data delivery for several WPs of FP2.*
Demonstration Requirements	*Data of infrastructure, timetable and rolling stock available for the base scenario and scenario where one or more DATO-concepts are in place for all different locations as described in D8.3.*

FP1 Developed components/functions/methods target of demonstration	*Methods for capacity calculation and simulation of different DATO-concepts, e.g. ERTMS HTD, ATO, TMS, based on the method for capacity calculation of ERTMS L2*
Other involved components	*The methods will be evaluated with several capacity simulators, dependent of data availability and method requirements: CAF-tool, HESE, PROTON, RailSys, railVOS, VTI-simulator.*
Expected Demonstration Location	*Different calculation and simulation environments*
Demonstration storyboard	*1. There are several methods to be implemented and scenarios to be simulated and milestones to be met with other WPs. Based on the number of scenarios and milestones within FP2 the timeline is tighter or looser.* *2. WP8/9-partners and software makers: implement method for evaluating DATO-concepts* *3. WP8/9-partners: implement scenarios in new simulation environment* *4. WP8/9-partners: run scenarios, evaluate results and adapt methods and scenarios* *5. WP8/9-partners: send results to FP2-partners, evaluate and adapt based on their findings.*
Expected Demonstration Date	*Feb-2025 --> Apr-2026*
Expected evaluation of results	*Results will first be evaluated and compared within the WP (comparison of effect between different DATO-concepts and comparison of different implementations / scenarios of the same method). Thereafter the results will be shared with experts from FP2 WP17, WP32 and WP37.*
Exploitation	*Evaluation and comparison of the outcomes within the WP. Thereafter sharing the resulting data with other WPs:* • *FP2 WP17: Next Generation Brake Systems with adhesion management functions – Phase 1: Demonstrator preparation and pre-validation* • *FP2 WP32: DATO Assessment and Potential identification* • *FP2 WP37: ETCS HL3 Deployment Strategies* *This demonstration will improve the planning of robust timetables by developing new simulation methods and models for capacity evaluation of ETCS and C-DAS/ATO (KER 4).*
Responsible partner/person	*Alwin Pot, ProRail*
Notes	-

6.23. Demonstration 9.6 – Methods to determine the capacity effect of ETCS HTD

Name	*Methods to determine the capacity effect of ETCS HL3*
ID	*FP1-DEMO-9.6-UC-1*
Description	*•Demonstration of a method for implementing ETCS HTD into RailSys and determining the capacity effect of ETCS HTD.* *•Demonstration of the capacity effect of ETCS HTD on different use cases. We will demonstrate the capacity effect of ETCS HTD for headways and infrastructure occupation with 2 different use cases.*
Related to task/subtask(s)	*Tasks 8.4.1, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*IMs (that want to evaluate current or future traffic)*
Goal	*Demonstrate the capacity effect of ETCS HTD for headways and infrastructure occupation with 2 different use cases*
Demonstration Requirements	*No development requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*RailSys*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*
Demonstration storyboard	*SNCF Réseau will do the demonstration on RailSys by:* 1. *Defined a methodology for the modelling of ETCS HTD in RailSys (task 8.4).* 2. *Using the methodology defined in task 8.4 for the modelling of ETCS HTD in RailSys.* 3. *Modelling infrastructure and timetable in RailSys for the 2 different use cases* 4. *Define scenarios for each use cases (reference scenario with ETCS L2 and several scenarios for ETCS HTD). Possible interaction with WP37* 5. *Demonstrate the capacity effect of ETCS HTD for the different use cases and scenarios* 6. *The objective is to get KPI for headways and infrastructure occupation for all scenarios and compare the results.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*This enhanced methodology defined in task 8.3 will be evaluated by end users who are using it.*

Exploitation	*This demonstration will develop new simulation methods and models for capacity evaluation of ETCS (and C-DAS/ATO): KER 4*
Responsible partner/person	*Augustin Arachtingi, SNCF Réseau* *Axel Valentin, SNCF Réseau*
Notes	-

6.24. Demonstration 9.7 – Update timetable considering C-DAS driver mode

6.24.1. Effects of C-DAS in capacity

Name	*Effects of C-DAS in capacity*
ID	*FP1-DEMO-9.7-UC-1*
Description	*INDRA will evaluate the capacity of the infrastructure with new elements such as C-DAS testing with "C-DAS driving modes" in the simulation environment. The objective is to analyse the changes in capacity with C-DAS.*
Related to task/subtask(s)	*Tasks 8.4.2, Task 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*INDRA staff:* *- Responsible for operating the traffic management system during the simulations, assessing the impact of the results, and contributing to the optimization of timetable efficiency.* *- Simulation Operator provides scenarios to the simulation environment (e.g. new situations such as track circuit occupied, etc)*
Goal	*The main goal is to analyse how the inclusion of C-DAS in the simulation environment impacts the capacity and to demonstrate improvements in route calculation and timetable optimization.*
Demonstration Requirements	*- Network topology data and timetable data* *- Simulation environment setup (TMS, train and driver simulator)* *- Staff to operate the simulator, run simulations and analyse results.* *- Locations for simulation of virtual environments (laboratory)*
FP1 Developed components/functions/methods target of demonstration	*- TMS Simulator with new capabilities (new C-DAS driving modes) software*
Other involved components	*- Simulation environment software* *- Traffic management system*
Expected Demonstration	*Virtual simulation environment with C-DAS integration (INDRA*

Location	*laboratory)*
Demonstration storyboard	1. *[INDRA staff] [Configure the TMS simulator with the C-DAS functionality and driving modes] [Ensure the simulator processes C-DAS commands in the driver/train simulator]* 2. *[INDRA staff] [executes the simulation with C-DAS with different driving modes] [to characterize the different driving modes]* 3. *[TMS dispatcher] [monitor real-time recommendations from C-DAS integrated with the TMS simulation environment] [to assess the new operation mode]* 4. *[TMS dispatcher] [operates the railway network without C-DAS recommendations] [to assess the baseline situation]* 5. *[TMS dispatcher] [operates the railway network with C-DAS recommendations and different driving modes] [to assess how C-DAS integration helps to improve route calculation]*
Expected Demonstration Date	*March 2026*
Expected evaluation of results	*Results will be evaluated by project members to assess the impact of C-DAS on network capacity and timetable efficiency.*
Exploitation	*The demonstration is expected to provide insights into how C-DAS can improve capacity. (KER 3)*
Responsible partner/person	*Enrique Gómez González, INDRA* *Carmen Ramos Prieto, INDRA*
Notes	

6.25. Demonstration 9.8 – Mixed operational plans

6.25.1. Generating plans through different inputs

Name	*Generate planification through different inputs*
ID	*FP1-DEMO-9.8-UC-1*
Description	*Through this use case, we want to be able to generate a planning taking into account different parameters.* *One of the most important to take into account is the time of day or the space in which the track runs in order to define through one or the other if the planning is done as a headway or as a timetable.* *This would be done as follows:* • *If we take into account the time of day, if it is an off-peak time the planning will be by timetable and if it is a rush hour it will be done by headway.* • *If we take into account the space through which the track runs, the planning will be done in the*

	following way: if it is an urban area, the planning will be by headway; if on the contrary it runs through an area of branch lines, the planning will be by timetable.
Related to task/subtask(s)	*Tasks 8.4, 8.3.2, 9.1, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*The end user will be the people working in Traffic Control Centre. The data is own by CAF*
Goal	*Demonstrate the ability to generate exploitation plans based on the results of the capacity simulation tool.* *This will help us achieving the KER3 and KER4*
Demonstration Requirements	*Location: CAF laboratory* *Data: infrastructure and rolling stock*
FP1 Developed components/functions/methods target of demonstration	*SW: mixed planner and improved functionality of our simulation tool (focus on ATO)*
Other involved components	*No other components are involved*
Expected Demonstration Location	*The demonstration will take place in CAF Laboratory*
Demonstration storyboard	*By having an infrastructure file and a rolling stock file available and valid, the traffic control operator:* *1. Generate / create a new standard service in which the stops at the stations and the stop times at them are defined. One standard per branch.* *This standard will be performed by the people working in Traffic Control Centre.* *2. Define the operation calendar where the days of operation will be included according to interest.* *3. Once the previous two points have been achieved, add the necessary commercial services to meet the needs imposed by the operator.* *When defining these commercial services, it will be taken into account whether you want to plan by headway or timetable.*
Expected Demonstration Date	*April – May, 2026*
Expected evaluation of results	*Project members and end users will evaluate the quality of the planning*
Exploitation	*The results obtained in this demonstrator without being used in the regulator presented in demo 16.8 are meaningless.* *Present the approach to the other FPs and FA7 projects, especially to FP6.* *KER 3 and KER 4*
Responsible partner/person	*Isabel Meseguer Hijós, CAF Signalling*

Notes	

6.25.2. Validation of planning

Name	*Validation of planning*
ID	*FP1-DEMO-9.8-UC-2*
Description	*The objective of this use case is to validate the planning generated within the simulation environment to see if it meets the needs presented.*
Related to task/subtask(s)	*Tasks 8.4, 8.3.2, 9.1, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*The end user will be the people working in Traffic Control Centre. The data is own by CAF.*
Goal	*Validate the planning generated in the use case FP1-DEMO-9.8-UC-1*
Demonstration Requirements	*Location: CAF laboratory* *Data: plan generated in FP1-DEMO-9.8-UC-1*
FP1 Developed components/functions/methods target of demonstration	*SW: mixed planner and improved functionality of our simulation tool (focus on ATO)*
Other involved components	*No other components are involved*
Expected Demonstration Location	*The demonstration will take place in CAF Laboratory*
Demonstration storyboard	*Having a standardised operating plan, the people working in Traffic Control Centre will:* *1. Upload the exploitation plan to our tool.* *2. Activate the option to validate the exploitation plan.* *3. If there is no conflict, the exploitation plan could be used to operate. If, on the other hand, a conflict is detected, it should be returned to the FP1-DEMO-13.5-UC-1 use case, where the exploitation plan would be redefined. The conflicts that can be detected are:* • *Link in header* • *Non-compliance with inter-service restrictions* • *Non-compliance with minimum interval restrictions* • *Multiple platform occupancy* • *Reach* • *Crossing*
Expected Demonstration Date	*April – May, 2026*
Expected evaluation of results	*Project members and end users will validate the validity*

	of the planning
Exploitation	*The results obtained in this demonstrator without being used in the regulator presented in demo 16.8 are meaningless.* *Present the approach to the other FPs and FA7 projects, especially to FP6.* *KER 3 and KER 4*
Responsible partner/person	*Isabel Meseguer Hijós, CAF Signalling*
Notes	

6.25.3. Planning simulation and acceptance

Name	*Planning simulation and acceptance*
ID	*FP1-DEMO-9.8-UC-3*
Description	*The objective of this use case is to be able to compare between different plans that have been generated and validated in steps before. Then the TMS operator will choose the one that best fits the needs and implement it.*
Related to task/subtask(s)	*Tasks 8.4, 8.3.2, 9.1, 9.2, 16.5*
Technical Enabler(s)	*TE7*
Stakeholders	*No other stakeholders are involved in this phase of the project* *The end user will be the people working in Traffic Control Centre. The data is own by CAF*
Goal	*The main objective to be able to accept an operational plan that meets the operator's needs.*
Demonstration Requirements	*Location: CAF laboratory* *Data: plan generated in FP1-DEMO-9.8-UC-2*
FP1 Developed components/functions/methods target of demonstration	*SW: mixed planner and improved functionality of our simulation tool (focus on ATO)*
Other involved components	*No other components are involved*
Expected Demonstration Location	*The demonstration will take place in CAF Laboratory*
Demonstration storyboard	1. *The operator shall load the operational plan into the controller and start the traffic simulation.* 2. *The operator shall decide whether the conflict-free operational plan is working properly or whether it needs to be improved.*
Expected Demonstration Date	*April – May 2026*
Expected evaluation of results	*Project members and end users will validate if it satisfies the requirements for the planning.*
Exploitation	*The results obtained in this demonstrator without being used in the regulator presented in demo 16.8 are*

	meaningless. *Present the approach to the other FPs and FA7 projects, especially to FP6.* *KER 3 and KER 4*
Responsible partner/person	*Isabel Meseguer Hijós, CAF Signalling*
Notes	

6.25.4. Planning changes based on data analytics

Name	*Planning changes based on data analytics*
ID	*FP1-DEMO-9.8-UC-4*
Description	*The objective of this use case is to be able to make changes in the planning, generating a new one, based on the results obtained from the analysis of historical data that we have carried out through big data.*
Related to task/subtask(s)	*Tasks 8.4, 8.3.2, 9.1, 9.2, 16.5*
Technical Enabler(s)	*TE7*
Stakeholders	*The end user will be the people working in Traffic Control Centre. The data is own by CAF*
Goal	*Improving the quality of the business plans we generate*
Demonstration Requirements	*Location: CAF laboratory* *Data: plan generated in different executions and reports from the real application*
FP1 Developed components/functions/methods target of demonstration	*SW: mixed planner and improved functionality of our simulation tool (focus on ATO)*
Other involved components	*No other components are involved*
Expected Demonstration Location	*The demonstration will take place in CAF Laboratory*
Demonstration storyboard	*The people working in Traffic Control Centre:* 1. *Planning is generated* 2. *It is taken to operation, in this case to the laboratory simulator.* 3. *The results of the operation are obtained* 4. *The discordance of data between what was planned and what actually happened is obtained.* 5. *A new planning is proposed, adapting it to the new needs. It is in this step where the operator must accept the proposal made by the planner.*
Expected Demonstration Date	*April – May 2026*
Expected evaluation of results	*Project members and end users*
Exploitation	*The results obtained in this demonstrator without being used in the regulator presented in demo 16.8 are meaningless.*

	Present the approach to the other FPs and FA7 projects, especially to FP6. *KER 3 and KER 4*
Responsible partner/person	*Isabel Meseguer Hijós, CAF Signalling*
Notes	

6.26. Demonstration 9.9 – Effects of C-DAS on capacity and energy consumption

Name	*Effects of C-DAS on capacity and energy consumption*
ID	*FP1-DEMO-9.9-UC-1*
Description	*Demonstration of the capacity effects of C-DAS*
Related to task/subtask(s)	*T8.4.2 and T9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*IMs to study capacity effects of C-DAS*
Goal	*To create more realistic simulations of C-DAS for capacity and energy analysis*
Demonstration Requirements	*Input data (track layout, rolling stock information and timetable)*
FP1 Developed components/functions/methods target of demonstration	*Capacity tool developed and C-DAS efficient-driving algorithms*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual (CEIT offices)*
Demonstration storyboard	1. *Operator loads the input data* 2. *Operation is simulated with all trains equipped with C-DAS systems* 3. *New scenario is simulated with partial share of C-DAS devices disabled.* 4. *The results of the simulations are obtained* 5. *Capacity is analysed and evaluated in both cases. Utilization rates and conclusions are extracted (critical points).*
Expected Demonstration Date	*April-May 2026*
Expected evaluation of results	*Evaluate capacity impact of C-DAS within WP9 members evaluation and end user*
Exploitation	*This demo will contribute to KER3 and specially KER4. The developments are expected to be further developed in the next waves to study other kinds of traffic and lines and eventually extended to the simulation and analysis of ATO.*
Responsible partner/person	*Pablo Ciáurriz, CEIT*
Notes	

6.27. Demonstration 9.10 – Modelling of system effects of different GoA

6.27.1. System effects of different grades of automation

Name	*System effects of different grades of automation*
ID	*FP1-DEMO-9.10-UC-1*
Description	*Analyse system effects of ATO with different grades of automation on selected lines on the Swedish and Norwegian national railway network with macro and micro simulation tools. Preliminary RailSys and PROTON will be used as tools. The lines will be of different types: single track/double track, mixed traffic/only passenger/mainly freight and urban/rural environments.*
Related to task/subtask(s)	*Tasks 8.4.2, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*IMs and RUs*
Goal	*To study the capacity effects of different grades of automation*
Demonstration Requirements	*Simulation tools RailSys and PROTON, timetable, and ATO specific parameters*
FP1 Developed components/functions/methods target of demonstration	*ATO specific parameters from WP8 will be used for the demo such as delay distributions, driver variation, and driving strategies.*
Other involved components	*Previous studies about ATO specific parameter*
Expected Demonstration Location	*Virtual (KTH office Stockholm)*
Demonstration storyboard	1. *Setting up the four different lines that will be simulated with timetables and specific parameters for different GoA scenarios* 2. *Running simulations in macroscopic and microscopic tools* a. *Calibration of the simulation tools* 3. *Validation of the simulation results* 4. *Presentation of the simulation results*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluate capacity effects of different grades of automation done by end-users within WP9 and KTH*
Exploitation	*Contributing to KER 4, New simulation methods and models for capacity evaluation of ETCS and C-DAS/ATO.*

	The outcomes from the demonstration will also be used in FP2 WP32 as input the business case for different GoA. The results could also be used in the next phase of ER in simulation of ATO.
Responsible partner/person	*Emil Jansson, KTH*
Notes	

6.27.2. Effects of introducing ETCS Hybrid Level 3 on lines with dense traffic

Name	*Effects of introducing ETCS Hybrid Level 3 on lines with dense traffic*
ID	*FP1-DEMO-9.10-UC-2*
Description	*Analyse and compare the effect on capacity and operations on selected lines on the Swedish network by moving from ETCS L2 to a ETCS HL3 setup. The selected lines will be a subset of those used in UC-FP1-WP3-40. Deterministic simulation is first used to compute the effect on technical headways with varying combinations of virtual (HL3) block lengths. Further, stochastic simulation is used for assessing the effects on, e.g., capacity/robustness and punctuality.*
Related to task/subtask(s)	*Tasks 8.4.2, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*IMs and RUs*
Goal	*Demonstrate the capacity effect of ETCS HTD for headways and assess the effect on operational measures of performance, such as punctuality, by simulating selected setup(s).*
Demonstration Requirements	*HESE tool and RailSys*
FP1 Developed components/functions/methods target of demonstration	*TBD*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*
Demonstration storyboard	1. *Use case setup* 2. *HESE tool* 3. *Impact on technical headways for selected HTD setups with comparisons to underlying ETCS L2 setup* 4. *Effect on operational measure of performance, punctuality.*
Expected Demonstration Date	*2026-04*

Expected evaluation of results	*End users within WP9 and KTH*
Exploitation	*Contributing to KER 4 New simulation methods and models for capacity evaluation of ETCS and CDAS/ATO*
Responsible partner/person	*KTH*
Notes	

6.27.3. Effects from varying adhesion conditions and introducing new generation braking system

Name	*Effects from varying adhesion conditions and introducing new generation braking system*
ID	*FP1-DEMO-9.10-UC-3*
Description	*Analyse the effects on capacity and operations (e.g., punctuality, robustness) under varying adhesion conditions and from introducing new generation braking system with improved adhesion management. The idea is to use a representative and suitable line for this use case, preferably one from the set of lines that will be used in UC-FP1-WP3-40. Deterministic simulation is used first to compute the effect on technical headways under conditions both with and without new generation braking system. Further, stochastic simulation, is used for assessing the effects on, e.g., capacity/robustness and punctuality. Input on brake parameter modelling comes from FP2.*
Related to task/subtask(s)	*Tasks 8.4.2, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*IMs and RUs*
Goal	*Demonstrate the capacity effect in reduced adhesion conditions for headways and assess the effect on operational measures of performance, such as punctuality, by simulating selected setup(s) with and without NG brake technology.*
Demonstration Requirements	*HESE + RailSys*
FP1 Developed components/functions/methods target of demonstration	*HESE and methodology for modelling the relevant setups in RailSys simulations.*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*
Demonstration storyboard	*1. Use case setup* *2. HESE tool*

	3. *Impact on technical headways in reduced adhesion conditions for trains with and without NG brake technology* 4. *Effect on operational measure of performance, punctuality, in reduced adhesion conditions and comparisons between case where trains have NG brake technology and where trains don't.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*End users within WP9 and KTH*
Exploitation	*Contributing to KER 4 New simulation methods and models for capacity evaluation of ETCS and CDAS/ATO*
Responsible partner/person	*KTH*
Notes	

6.28. Demonstration 9.11 – Effect of ETCS level 2 roll-out strategy

6.28.1. Demonstrate effect of ETCS level 2 roll-out strategy in terms of drivability, capacity and safety – co-existence

Name	*Demonstrate effect of ETCS level 2 roll-out strategy in terms of drivability, capacity and safety – co-existence*
ID	*FP1-DEMO-9.11-UC-1*
Description	*Develop a demonstrator in a train-driver simulator where the effects of a new ERTMS roll-out strategy can be studied. A method called co-existence (ERTMS marker boards and lineside signalling co-exist) will be implemented in the simulator, which includes parts of the Scandinavian Mediterranean corridor*
Related to task/subtask(s)	*Tasks 8.4.1, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*Trafikverket and operators in Sweden*
Goal	*Study the capacity and safety aspects of the new implementation strategy*
Demonstration Requirements	*No development requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*Simulator experiments; implementation of ERTMS interface in the simulation software*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*

Demonstration storyboard	1. *VTI will study the effect of the new ETCS strategy in a simulated environment with Swedish train drivers* 2. *The effects are demonstrated in terms of capacity (run-time and braking behaviour) and safety (eye-tracking data)*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by VTI and stakeholders*
Exploitation	*KER 4*
Responsible partner/person	*Björn Lidestam, VTI* *Tomas Rosberg,VTI*
Notes	-

6.28.2. Demonstrate effect of ETCS level 2 roll-out strategy in terms of drivability, capacity and safety – normal ERTMS implementation strategy

Name	*Demonstrate effect of ETCS level 2 roll-out strategy in terms of drivability, capacity and safety – normal ERTMS implementation strategy*
ID	*FP1-DEMO-13.7-UC-2*
Description	*Develop a demonstrator in a train-driver simulator where the effects of a standard ERTMS roll-out-strategy can be studied. In this strategy, lines are equipped with either lineside signalling or ERTMS marker boards (and in-cab signalling).*
Related to task/subtask(s)	*Tasks 8.4.1, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*Trafikverket and operators in Sweden*
Goal	*Study the capacity and safety aspects of the new implementation strategy*
Demonstration Requirements	*No development requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*Simulator experiments; implementation of ERTMS interface in the simulation software*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*
Demonstration storyboard	1. *VTI will study the effect of the new ETCS strategy in a simulated environment with Swedish train drivers*

	2. *The effects are demonstrated in terms of capacity (run-time and braking behaviour) and safety (eye-tracking data)*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by VTI and stakeholders*
Exploitation	*KER 4*
Responsible partner/person	*Björn Lidestam, VTI* *Tomas Rosberg,VTI*
Notes	-

6.28.3. Demonstrate effect of ETCS level 2 roll-out strategy in terms of drivability, capacity and safety – special case

Name	*Demonstrate effect of ETCS level 2 roll-out strategy in terms of drivability, capacity and safety – special case*
ID	*FP1-DEMO-13.7-UC-3*
Description	*Develop a demonstrator in a train-driver simulator where the effects of a new ERTMS roll-out strategy can be studied. A method called co-existence (ERTMS marker boards and lineside signalling co-exist) will be implemented in the simulator, which includes parts of the Scandinavian Mediterranean corridor. Scenarios that include special cases are developed in order to be studied.*
Related to task/subtask(s)	*Tasks 8.4.1, 9.2*
Technical Enabler(s)	*TE7*
Stakeholders	*Trafikverket and operators in Sweden*
Goal	*Study the capacity and safety aspects of the new implementation strategy*
Demonstration Requirements	*No development requirement should be considered.*
FP1 Developed components/functions/methods target of demonstration	*Simulator experiments; implementation of ERTMS interface in the simulation software*
Other involved components	*N/A*
Expected Demonstration Location	*Virtual*
Demonstration storyboard	1. *VTI will study the effect of the new ETCS strategy in a simulated environment with Swedish train drivers* 2. *The effects are demonstrated in terms of capacity (run-time and braking behaviour) and safety (eye-tracking data)*

Expected Demonstration Date	*2026-04*
Expected evaluation of results	*Evaluated by VTI and stakeholders*
Exploitation	*KER 4*
Responsible partner/person	*Björn Lidestam, VTI* *Tomas Rosberg,VTI*
Notes	-

7. Demonstrations WS1.2

In chapter 7, all use cases from WS1.2 demonstrations in FP1 MOTIONAL are presented, which gives an overview of the content of the 30 demonstrations expected on this workstream.

7.1. Demonstration 12.1 – Interfaces from the communication Platform to the Timetable Management Applications and to the Traffic Control (RBC, Interlocking)

7.1.1. Information exchange for Automatic Route Setting (ARS)

Name	*Information exchange for Automatic Route Setting (ARS)*
ID	*FP1-DEMO-12.1-UC-1*
Description	*Communication between TMS providing the trip info via Integration Layer (Communication Platform (COM-P)) and the CTC System to set the route in the automatic way (ARS).* *The TMS constantly updates the operational Timetable (TT) on the COM-P adopting it to the changing traffic situation. CTC System uses it to set routes for individual trains in the automatic way based on the trip info out of operational TT taking it from COM-P.*
Related to task/subtask(s)	*Tasks 11.3.1, 12.2.1*
Technical Enabler(s)	*TE8*
Stakeholders	*ATSA staff to operate TMS and CTC and monitor communication over COM-P.*
Goal	*Demonstration of TMS – CTC communication over Communication Platform with generic API*
Demonstration Requirements	*ATSA virtual test environment(s) to run COM-P, CTC and TMS* *Network communication between connected systems* *Staff for analysis and support*
FP1 Developed components/functions/methods target of demonstration	*Based on Integration layer (COM-P: Communication Platform) developed by ATSA in Shift2Rail program additional features have been developed including:* *COM-P generic API,* *Additional COM-P functions,* *dedicated adaptors to COM-P for TMS and CTC.*
Other involved components	*TMS – ATSA TMS system,* *CTC – ATSA CTC system*
Expected Demonstration Location	*ATSA virtual environment*
Demonstration storyboard	*All actions will be performed by ATSA staff*

	1. *The operational timetable including trips of many trains is being published by the TMS on Communication Platform* 2. *All registered subscribers (including CTC System) of timetable information are notified about timetable change.* 3. *The CTC System takes decision if the change is important from its perspective and specify filter criteria to indicate which part of the whole timetable needs to be taken from COM-P.* 4. *CTC System continues operation (in particular ARS) according to new / modified timetable.*
Expected Demonstration Date	*March - April 2026*
Expected evaluation of results	*Results will be evaluated by project members and ATSA TMS & CTC experts to determine correctness, effectiveness and robustness of developed communication solution.*
Exploitation	*The expected outcome of the demonstration is to showcase the possibility to connect TMS and CTC systems via a generic API of Integration Layer (COM-P). Contributes to KER 5.*
Responsible partner/person	*Hakan Palm, ATSA* *Zbigniew Dyksy, ATSA*
Notes	-

7.1.2. Information exchange for Monitor & Control Train

Name	*Information exchange for Monitor & Control Train*
ID	*FP1-DEMO-12.1-UC-2*
Description	*Communication between CTC System providing interlocking / RBC info about train to the TMS system via Integration Layer (Communication Platform (COM-P)).* *CTC System publishes constantly train status information originated from Interlocking / RBC on Communication Platform. TMS accesses Communication Platform and uses this information to optimize operational timetable.*
Related to task/subtask(s)	*Tasks 11.3.1, 12.2.1*
Technical Enabler(s)	*TE8*
Stakeholders	*ATSA staff to operate TMS and CTC and monitor communication over COM-P.*
Goal	*Demonstration of TMS – CTC communication over Communication Platform with generic API*

Demonstration Requirements	*ATSA virtual test environment(s) to run COM-P, CTC and TMS* *Network communication between connected systems* *Staff for analysis and support*
FP1 Developed components/functions/methods target of demonstration	*Based on Integration layer (COM-P: Communication Platform) developed by ATSA in Shift2Rail program additional features have been developed including:* *COM-P generic API,* *Additional COM-P functions,* *dedicated adaptors to COM-P for TMS and CTC.*
Other involved components	*TMS – ATSA TMS system,* *CTC – ATSA CTC system*
Expected Demonstration Location	*ATSA virtual environment*
Demonstration storyboard	*All actions will be performed by ATSA staff* 1. *CTC System periodically while the train moves publish train status information on Communication Platform (COM-P).* 2. *Information is stored on COM-P.* 3. *Registered subscribers are notified about updated train status by COM-P.* 4. *The information is processed and operational timetable is updated if applicable by the TMS.* 5. *CTC System continues operation (in particular ARS) according to new / modified timetable.*
Expected Demonstration Date	*March - April 2026*
Expected evaluation of results	*Results will be evaluated by project members and ATSA TMS & CTC experts to determine correctness, effectiveness and robustness of developed communication solution.*
Exploitation	*The expected outcome of the demonstration is to showcase the possibility to connect TMS and CTC systems via a generic API of Integration Layer (COM-P). Contributes to KER 5.*
Responsible partner/person	*Hakan Palm, ATSA* *Zbigniew Dyksy, ATSA*
Notes	-

7.1.3. Monitor & Control the field elements

Name	*Monitor & Control the field elements*
ID	*FP1-DEMO-12.1-UC-3*
Description	*Information about limitations available on Integration Layer*

	(Communication Platform (COM-P)) are provided to TMS system. *The CTC System publishes unplanned unavailability information of the railway infrastructure element on COM-P. The unavailability information is delivered by COM-P to the TMS which is able to take it and perform proper actions (example: change the route of one or more trains affected by the unavailability of the infrastructure element).*
Related to task/subtask(s)	*Tasks 11.3.1, 12.2.1*
Technical Enabler(s)	*TE8, TE10*
Stakeholders	*ATSA staff to operate TMS and CTC and monitor communication over COM-P.*
Goal	*Demonstration of TMS – CTC communication over Communication Platform with generic API*
Demonstration Requirements	*ATSA virtual test environment(s) to run COM-P, CTC and TMS* *Network communication between connected systems* *Staff for analysis and support*
FP1 Developed components/functions/methods target of demonstration	*Based on Integration layer (COM-P: Communication Platform) developed by ATSA in Shift2Rail program additional features have been developed including:* *COM-P generic API,* *Additional COM-P functions,* *dedicated adaptors to COM-P for TMS and CTC.*
Other involved components	*TMS – ATSA TMS system,* *CTC – ATSA CTC system*
Expected Demonstration Location	*ATSA virtual environment*
Demonstration storyboard	*All actions will be performed by ATSA staff* *1. CTC System publishes on Communication Platform information about unavailability of the infrastructure element. It can be a switch, track circuit, semaphore or other.* *2. All registered subscribers are notified about new limitation defined and take proper actions.* *3. TMS can use the information and change the route of one or more trains affected by the unavailability of the infrastructure element.*
Expected Demonstration Date	*March - April 2026*
Expected evaluation of results	*Results will be evaluated by project members and ATSA TMS & CTC experts to determine correctness, effectiveness and robustness of developed communication solution.*

Exploitation	*The expected outcome of the demonstration is to showcase the possibility to connect TMS and CTC systems via a generic API of Integration Layer (COM-P). Contributes to KER 5.*
Responsible partner/person	*Hakan Palm, ATSA* *Zbigniew Dyksy, ATSA*
Notes	-

7.2. Demonstration 12.2 – Integration solution for the data exchange and storage system

Name	*Integration solution for the data exchange and storage system*
ID	*FP1-DEMO-12.2-UC-01*
Description	*Demonstrate the validity of data centralization through data lake by providing decision support for station operator regarding availability of trans border travel.*
Related to task/subtask(s)	*Development 11.3.2* *Demonstration 12.2.2*
Technical Enabler(s)	*TE9*
Stakeholders	*PKP S.A.*
Goal	*The demonstration aims to illustrate how centralized data, managed through a data lake, can empower station operators to enhance the commercialization potential of their stations. By leveraging Power BI dashboards, the demonstration will provide actionable insights and visualizations that enable operators to efficiently exploit trans-border travel availability of the station as a method to increase attractiveness.*
Demonstration Requirements	*Access to MERITS data.*
FP1 Developed components/functions/methods target of demonstration	*Data lake service, DSS dashboard*
Other involved components	*MERITS database, MS Power BI*
Expected Demonstration Location	*Lodz, Poland*
Demonstration storyboard	*Accessing DSS* *Selection of appropriate station to analyse* *Setting how many target stations being analysed* *Setting parameters (geographical distance, maximum number of connections)* *DSS generates dashboard with indicated accessibility network*
Expected Demonstration Date	*Q4 2026*
Expected evaluation of results	*Assessment by project team based on surveys among*

	selected users. Survey will consider response time, stability and realization of functionalities.
Exploitation	*Knowledge about how information about trans-border capabilities can be used in business decision making and how data centralization facilitates that. Linked to KER5* *KER 5 Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management*
Responsible partner/person	*Jerzy Baranowski, PKP S.A.*
Notes	-

7.3. Demonstration 12.3 – Maximise the energy efficiency of the train operation in a short-term action

Name	*Maximise the energy efficiency of the train operation in a short-term action*
ID	*FP1-DEMO-12.3-UC-05*
Description	*STS develops an interface from TMS Planning system to ATO-TS control module to maximise the energy efficiency of the train operation in a short-term action.*
Related to task/subtask(s)	*11.3.3 and 12.3.3*
Technical Enabler(s)	*TE8*
Stakeholders	*STS*
Goal	*The main objective of the demonstration is to produce a new detailed timetable data to be sent to ATO-TS to optimize traffic conditions and to reduce the energy consumption during train operations.*
Demonstration Requirements	*Geometrical characteristics of the considered railway lines. Characteristics (mass, energy consumption at different conditions, etc.) of the considered passengers trains.*
FP1 Developed components/functions/methods target of demonstration	***ECO-DRIVE**: A module for the TMS that generates a detailed timetable to be sent to the ATO-TS to minimise energy consumption.*
Other involved components	*TMS and ATO-TS*
Expected Demonstration Location	*Virtual demonstration based on the Empoli Pisa Italian railway line*
Demonstration storyboard	1. *TMS generates a timetable and send it to the ECO-DRIVE module* 2. *ECO-DRIVE generates a detailed timetable starting from the received timetable* 3. *The detailed timetable is sent to the ATO-TS for implementation*
Expected Demonstration Date	*From 10/2025 to 03/2026*

Expected evaluation of results	*Comparison of the results with and without developed ECO-DRIVE module by STS.*
Exploitation	*Integrate the ECO-DRIVE module into the new TMS developments.* *It will contribute to KER5*
Responsible partner/person	*Carmelo Lofiego, STS*
Notes	-

7.4. Demonstration 12.4 – Interface from the communication Platform to wayside C-DAS operation system, focusing on speed profiles functionalities

7.4.1. Information exchange between TMS and C-DAS TS

Name	*Information exchange between TMS and C-DAS TS*
ID	*FP1-DEMO-12.4-UC-06*
Description	*Communication between TMS and C-DAS TS focused on RTTP and status report that includes estimated time to arrival to the next timing point.*
Related to task/subtask(s)	*Tasks 11.3.4, 12.2.4*
Technical Enabler(s)	*TE 8*
Stakeholders	*INDRA staff (to check and monitor the communications)*
Goal	*Test the communication between TMS and C-DAS TS making use of standardized communication and Integration Layer.*
Demonstration Requirements	*- Network topology data and timetable data* *- Simulated train movement data* *- Locations for simulation or virtual environments* *- Staff for analysis and support*
FP1 Developed components/functions/methods target of demonstration	*-TMS Interfaces software* *-C-DAS TS interfaces software* *-IL (Integration Layer) software*
Other involved components	*- Simulation environment software* *- Traffic management system*
Expected Demonstration Location	*Virtual simulation environment with C-DAS integration (INDRA laboratory)*
Demonstration storyboard	*1. [TMS] [create the RTTPs and send them to the C-DAS TS through IL] [to provide updated information to the C-DAS TS]* *2. [C-DAS TS] [process the information received and send it to the C-DAS OBs] [to provide specific information to C-DAS OB]* *3. [C-DAS TS] [receives and processes information from C-DAS OB] [to obtain real time information]*

	4. *[TMS] [receives the information from C-DAS TS] [to get status info]*
Expected Demonstration Date	*March 2026*
Expected evaluation of results	*Results will be evaluated by project members to assess the correct communication of the messages between TMS and C-DAS TS.*
Exploitation	*KER 5*
Responsible partner/person	*Enrique Gómez González, INDRA* *Carmen Ramos Prieto, INDRA*
Notes	

7.5. Demonstration 12.5 – Demonstrator based on the interfaces coming from subtask 11.3.5 (implementing interfaces between neighbouring TMSs and IMs) to provide a TMS and IM real-time connection of rail networks focused on cross border traffic management.

7.5.1. Cooperative conflict resolution (Two TMSs)

Name	*Cooperative conflict resolution (Two TMSs)*
ID	*FP1-DEMO-12.5-UC-01*
Description	*A train conflict solution shall consider also the possible choices taken by the TMS behind the border.*
Related to task/subtask(s)	*Tasks 11.3.5, 12.2.5*
Technical Enabler(s)	*TE8, TE9*
Stakeholders	*Two border TMS Operators*
Goal	*An operational plan with conflict solved for both TMSs*
Demonstration Requirements	*Two TMSs up and running controlling their lines with at least one common track sections, i.e. the cross-border track. The current plans are loaded, and two trains need to go through the track at the same time.*
FP1 Developed components/functions/methods target of demonstration	*Cooperative Interface*
Other involved components	*Conflict detection and resolution module*
Expected Demonstration Location	*Virtual: Civitanova-Albacina; Fabriano-Albacina*
Demonstration storyboard	1. *TMS-1 Operator chooses a conflict solution.* 2. *Conflict solution is sent to TMS-2.* 3. *TMS-2 Operator accepts or rejects the proposal solution (and eventually adds a note).* 4. *When accepted the conflict is solved in both TMSs.*
Expected Demonstration Date	*May 2026*

Expected evaluation of results	*Evaluated in laboratory with a real plant configuration by end users testing the systems and assessing it.* *The evaluation will be done with attention at the solution quality and user usability experience.*
Exploitation	*Mermec aims to exploit the cooperative interface module in their new products.* *KER5*
Responsible partner/person	*Angelo Naselli, MERMEC*
Notes	

7.5.2. Exchanging real time train data regarding the border stations.

Name	*Exchanging real time train data regarding the border stations.*
ID	*FP1-DEMO-12.5-UC-02*
Description	*The TMS shall be able to exchange train characteristic, issues, and forecast information with neighbour TMSs.*
Related to task/subtask(s)	*Tasks 11.3.5, 12.2.5*
Technical Enabler(s)	*TE8, TE9*
Stakeholders	*Two border TMS Operators*
Goal	*Shared train forecast.*
Demonstration Requirements	*Two TMSs up and running controlling their lines with at least one common track sections, i.e. the cross-border track. Current plans are loaded, a train needs to go through the common track and it is delayed.*
FP1 Developed components/functions/methods target of demonstration	*Cooperative Interface*
Other involved components	*Forecast calculation module*
Expected Demonstration Location	*Virtual: Civitanova-Albacina; Fabriano-Albacina*
Demonstration storyboard	*1. A deviation for a cross border/area train is detected by the related module.* *2. Forecast is updated for the above train.* *3. Train information is sent to the neighbouring TMS by Cooperative module.* *4. The neighbouring TMS updates its operational plan accordingly.*
Expected Demonstration Date	*May 2026*
Expected evaluation of results	*Evaluated in laboratory with a real plant configuration by end users testing the systems and assessing it.* *The evaluation will be done with attention at the solution quality and user usability experience.*
Exploitation	*MERMEC aims to exploit the cooperative interface module in their new products.*

	KER5
Responsible partner/person	*Angelo Naselli, MERMEC*
Notes	

7.6. Demonstration 12.6 – TRL 6 interfaces and TRL 5 decision support module for integration and traffic management of two neighbouring TMSs and IMs including cross-border operations (supporting Destination 5 activities).

7.6.1. Short-term maintenance needs or accidental situation which requires a pre-alignment of the train journey parts

Name	*Short-term maintenance needs or accidental situation which requires a pre-alignment of the train journey parts*
ID	*FP1-DEMO-12.6-UC-01*
Description	*Short-term maintenance needs or accidental situation detected. Exchange of information between TMSs. Pre-alignment between the parts of a journey including a border. Decision/alignment done before crossing the border.*
Related to task/subtask(s)	*Tasks 11.3.6, 12.2.6*
Technical Enabler(s)	*TE8 - "Real-time connection of rail networks as managed by TMSs and involved actors"* *TE9 - "Modelling and decision support for cross-border traffic management"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM*
Goal	*Pre-aligned and updated Operational Plans.*
Demonstration Requirements	*HACON demonstrator environment, TMS application instances representing the two involved national TMSs covering a region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two TMS demo operators taking the roles of the two neighbouring IM's Traffic Controllers.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka*

	• *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *Starting point: Cross-border train operating from IM/TMS A to IM/TMS B without incidents.* 2. *Short-term maintenance needs or accidental situation detected arising in the TMS A and covered by a TCR received by the TMSs which is affecting the cross-border train being delayed.* 3. *The TMS A informs TMS B about the change in the operation.* 4. *Pre-alignment of both IMs/TMSs of the changes to the Operational Plan including the affected cross-border train.* 5. *Alignment done and Operational Plan updated before crossing the border.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.6.2. Sending and Receiving train running forecast information

Name	*Sending and Receiving train running forecast information*
ID	*FP1-DEMO-12.6-UC-02*
Description	*The TMS shall be able to receive forecast information from other sources, e.g., a neighbouring TMS.*
Related to task/subtask(s)	*Tasks 11.3.6, 12.2.6*
Technical Enabler(s)	*TE8 - "Real-time connection of rail networks as managed by TMSs and involved actors"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM*
Goal	*Updated forecast taking estimated time of arrival at handling point into account*
Demonstration Requirements	*HACON demonstrator environment, TMS application instances representing the two involved national TMSs covering a region around the cross-border section between*

	Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two TMS demo operators taking the roles of the two neighbouring IM's Traffic Controllers.
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *Train related to path started in foreign network.* 2. *Forecasted arrival time at handover point with local network received via TAF/TSI (e.g., by RNE/TIS or foreign TMS).* 3. *Forecast calculation in local TMS is triggered for the local fraction of the journey in accordance with the planned path (where possible).* 4. *Forecast result validated.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.6.3. Pre-aligned decisions cross-border

Name	*Pre-aligned decisions cross-border*
ID	*FP1-DEMO-12.6-UC-03*
Description	*Aligning decisions by knowing capacity restrictions behind the border (until next node behind the border).*
Related to task/subtask(s)	*Tasks 11.3.6, 12.2.6*
Technical Enabler(s)	*TE8 - "Real-time connection of rail networks as managed by*

	TMSs and involved actors" *TE9 - "Modelling and decision support for cross-border traffic management"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM*
Goal	*Up-to-date Operational Plan coping with TCR behind the border.*
Demonstration Requirements	*HACON demonstrator environment, TMS application instances representing the two involved national TMSs covering a region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two TMS demo operators taking the roles of the two neighbouring IM's Traffic Controllers.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. Train related to path started in local network.* *2. Forecast calculation from current position to next node behind the border triggered (according to planned path).* *3. Conflict with TCR behind the border is detected and shown.* *4. Local dispatcher holds back the train on local network to maintain capacity in area towards the border until TCR is gone.* *5. Forecast result validated.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*

Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7. Demonstration 12.7 – Interfaces for integration of TMS with other services such as station and yard management systems (supporting Destination 5 activities), digital maintenance systems (supporting Destination 3 activities), Passenger Information Services (supporting Destination 6) as well as electric traction systems and crew/ rolling stock management systems.

7.7.1. Import and handling of a TCR

Name	*Import and handling of a TCR*
ID	*FP1-DEMO-12.7-UC-01*
Description	*Provide forecast / updated operational plan considering digital maintenance planning*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM*
Goal	*Updated Operational Plan (TCRs) synchronized with connected DMPS.*
Demonstration Requirements	*HACON demonstrator environment, TMS and DMPS application instances representing the two involved systems covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and Maintenance Planner/Manager using the DMPS.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration	*Virtual demonstration using a region around the Scan-Med*

Location	*corridor section Malmö-Oslo.*
Demonstration storyboard	1. *Train related to path started in local network.* 2. *A TCR is imported/updated from track maintenance planning system DMPS (IAMS, FP3).* 3. *Forecast calculation from current position shows up with conflict(s) with the imported TCR.* 4. *TMS Operator adapts Operational Plan to solve the conflict(s).*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.2. Provision and handling of TMS Operational Plan changes in the Yard Management System

Name	*Provision and handling of TMS Operational Plan changes in the Yard Management System*
ID	*FP1-DEMO-12.7-UC-02*
Description	*The TMS provides an update of the Operational Plan to the Yard Management System requiring an adaptation of the yard capacity plan.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; Yard Manager at a local yard of the IM's territory s (FP5-TRANS4M-R - integration of yard capacity production)*
Goal	*Updated Operational Plan synchronized with connected Yard Management System.*
Demonstration Requirements	*HACON demonstrator environment, TMS and YMS application instances representing the involved national TMS and local YMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo*

	operators taking the roles of the IM's Traffic Controller and Yard Manager.
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *The TMS sends an updated Operational Plan and train running forecast for a train to the Yard Management System.* 2. *The change of the Operational Plan for the train causes one or more conflicts with the planned yard track, track reservation, consist information or shunt moves for handling the train.* 3. *The conflict is solved by the Yard Operator by adapting the conflicting tracks, track reservations or shunt moves in the yard capacity plan, taking the updated consist and train running forecast into account.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.3. Receipt and handling of Yard Capacity Plan changes in the TMS

Name	*Receipt and handling of Yard Capacity Plan changes in the TMS*
ID	*FP1-DEMO-12.7-UC-03*
Description	*The Yard Management System provides an update of the Yard Capacity Plan to the TMS requiring an adaptation of*

	the Operational Plan.
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; Yard Manager at a local yard of the IM's territory s (FP5-TRANS4M-R - integration of yard capacity production)*
Goal	*Updated Operational Plan synchronized with connected Yard Management System.*
Demonstration Requirements	*HACON demonstrator environment, TMS and YMS application instances representing the involved national TMS and local YMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and Yard Manager.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The Yard Management System sends to the TMS an update of* *a) the departure track in the yard / handling location for a train and/or,* *b) the arrival time of a shunting move to make the consist available in the departure track and/or,* *c) the consist information of the departing train.* *2. The change(s) cause one or more conflicts with the current Operational Plan.* *3. The conflict(s) is (are) solved by the TMS Operator by adapting the train's routing and timing information in the Operational Plan.*
Expected Demonstration Date	*May 2026 – June 2026*

Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.4. Train running forecast of the TMS improved by integration of TMS with systems and processes related to yard or station management

Name	*Train running forecast of the TMS improved by integration of TMS with systems and processes related to yard or station management.*
ID	*FP1-DEMO-12.7-UC-04*
Description	*Input received from yard/station planning systems by the TMS. Calculation of the train running forecast by the TMS considering this information.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; Local Manager at a local yard or station area of the IM's territory; ADIF as UC contributor*
Goal	*Updated train running forecast improved considering their constraints and needs of yard/station management systems.*
Demonstration Requirements	*HACON demonstrator environment, TMS and YMS application instances representing the involved national TMS and local YMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and Yard Manager.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including*

	○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *The local system (Yard Management system or Station Management System) sets an operation with impact on the track assignment for the train of the TMS.* 2. *Local system informs to the TMS of the change of track assignment.* 3. *The TMS adjusts the track assigned considering the information received from the local system.* 4. *Forecast shows up with the new track assigned.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.5. Planning and/or management of systems and processes related to yard or station management, taking into account the information received from the TMS

Name	*Planning and/or management of systems and processes related to yard or station management, taking into account the information received from the TMS*
ID	*FP1-DEMO-12.7-UC-05*
Description	*The TMS sends to the other planning/management local system (yard, stations) info of updated train running forecast and/or updated operational plan. The local system uses this information.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at*

	IM; Local Manager at a local yard or station area of the IM's territory s; ADIF as UC contributor
Goal	*The local system receives the updated information from the TMS and takes it into account to implement its actions.*
Demonstration Requirements	*HACON demonstrator environment, TMS and local Management System application instances representing the involved national TMS and local MS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and Yard Manager.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *There is an update in the train's operational plan due to updated train running forecast.* 2. *The TMS informs the local system on the update.* 3. *The local system takes into account the updated information received from the TMS to implement its actions.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.6. Provision and handling of TMS Operational Plan changes in the Station (Depot) Management System

Name	*Provision and handling of TMS Operational Plan changes in the Station (Depot) Management System*
ID	*FP1-DEMO-12.7-UC-06*
Description	*The TMS provides an update of the Operational Plan and the train running forecast to the Station (Depot) Management System requiring an adaptation of the station capacity plan.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; Station Manager at a local station (depot) of the IM's territory.*
Goal	*Updated Operational Plan synchronized with connected Station (Depot) Management System (SMS).*
Demonstration Requirements	*HACON demonstrator environment, TMS and SMS application instances representing the involved national TMS and local SMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and Station Manager.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *The TMS sends an updated Operational Plan and train running forecast for a train to the Station (Depot) Management System.* 2. *The change of the Operational Plan for the train causes one or more conflicts with the planned station track,*

	track reservation, consist information or shunt moves for handling the train. 3. *The conflict is solved by the Station (Depot) Operator by adapting the conflicting tracks, track reservations or shunt moves in the station capacity plan, taking the updated consist and train running forecast into account.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.7. Receipt and handling of Station (Depot) Capacity Plan changes in the TMS

Name	*Receipt and handling of Station (Depot) Capacity Plan changes in the TMS*
ID	*FP1-DEMO-12.7-UC-07*
Description	*The Station (Depot) Management System provides an update of the Station (Depot) Capacity Plan to the TMS requiring an adaptation of the Operational Plan.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; Station Manager at a local station (depot) of the IM's territory.*
Goal	*Updated Operational Plan synchronized with connected Station (Depot) Management System (SMS).*
Demonstration Requirements	*HACON demonstrator environment, TMS and SMS application instances representing the involved national TMS and local SMS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and Station Manager.*
FP1 Developed	*Enhanced TMS application software; enhanced TMS*

components/functions/methods target of demonstration	*integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The Station (Depot) Management System sends to the TMS an update of* *a. the departure track in the station area/ handling location for a train and/or,* *b. the arrival time of a shunting move to make the consist available in the departure track and/or,* *c. the consist information of the departing train.* *2. The change(s) cause one or more conflicts with the current Operational Plan.* *3. The conflict(s) is (are) solved by the TMS Operator by adapting the train's routing and timing information in the Operational Plan.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.8. Provision and handling of TMS Operational Plan changes in the Electric Traction System (ETS) performing the trackside Energy Management

Name	*Provision and handling of TMS Operational Plan changes in the Electric Traction System (ETS) performing the trackside Energy Management.*
ID	*FP1-DEMO-12.7-UC-08*
Description	*The TMS provides an update of the Operational Plan to the Electric Traction System (ETS) performing a forecast of energy consumption and detection of energy conflicts.*

<table>
<tr><td>Related to task/subtask(s)</td><td>Tasks 11.3.7, 12.2.7</td></tr>
<tr><td>Technical Enabler(s)</td><td>TE10 - “Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching”</td></tr>
<tr><td>Stakeholders</td><td>Primary stakeholder: Traffic Controller (TMS Operator) at IM;</td></tr>
<tr><td>Goal</td><td>Updated Operational Plan synchronized with connected Electric Traction System (simulator).</td></tr>
<tr><td>Demonstration Requirements</td><td>HACON demonstrator environment, TMS and Electric Traction System (ETS) simulator application instances representing the involved national TMS and local ETS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the IM’s Traffic Controller.</td></tr>
<tr><td>FP1 Developed components/functions/methods target of demonstration</td><td>Enhanced TMS application software; enhanced TMS integration services. Enhanced ETS simulator software (HACON/AE SMO).</td></tr>
<tr><td>Other involved components</td><td>TPS application server and system software,
Sidytrac ETS simulator server and system software
hosting system including
server hardware
server operating system,
Oracle database software,
Apache Kafka
client computer and operation system software</td></tr>
<tr><td>Expected Demonstration Location</td><td>Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.</td></tr>
<tr><td>Demonstration storyboard</td><td>The TMS sends an updated Operational Plan to the ETS.
In the ETS, the change of the Operational Plan causes one or more energy conflicts for trains operating in the different substation areas which lead to one or more energy restrictions for certain trains.
The train related energy restrictions are transferred back to the TMS.</td></tr>
<tr><td>Expected Demonstration Date</td><td>May 2026 – June 2026</td></tr>
<tr><td>Expected evaluation of results</td><td>End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.</td></tr>
<tr><td>Exploitation</td><td>The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.
KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.</td></tr>
</table>

Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.9. Receipt and handling of train related energy restrictions in the TMS

Name	*Receipt and handling of train related energy restrictions in the TMS*
ID	*FP1-DEMO-12.7-UC-09*
Description	*The Electric Traction System (ETS) simulator provides forecasted energy restrictions for trains to the TMS requiring an adaptation of the train running forecast or Operational Plan.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM;*
Goal	*Updated Operational Plan considering the energy restrictions synchronized with connected Electric Traction System (simulator).*
Demonstration Requirements	*HACON demonstrator environment, TMS and Electric Traction System (ETS) simulator application instances representing the involved national TMS and local ETS covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One demo operator taking the role of the IM's Traffic Controller.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services. Enhanced ETS simulator software (HACON/AE SMO).*
Other involved components	• *TPS application server and system software,* • *Sidytrac ETS simulator server and system software* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*

Demonstration storyboard	1. *The Electric Traction System (ETS) sends energy restrictions in relation to the train running information to the TMS.* 2. *The TMS receives the energy restrictions and using them for the next cycle of calculating the train running forecast.* 3. *The forecast indicates the need for adapting the Operational Plan.* 4. *The Operational Plan is adapted by the TMS or Traffic Controller.* 5. *Next calculation cycle of train running forecast makes use of the adapted Operational Plan.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.10. Consideration of crew links reflecting train crew exchanges between trains at stations

Name	*Consideration of crew links reflecting train crew exchanges between trains at stations*
ID	*FP1-DEMO-12.7-UC-10*
Description	*Provide forecast / updated operational plan considering crew links which reflect train crew exchanges between trains at stations.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; RU crew manager*
Goal	*Updated Operational Plan synchronized with connected Crew Management System.*
Demonstration Requirements	*HACON demonstrator environment, TMS and integration service instances representing the involved national TMS and RU system (interface only) covering a national region*

	around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and RU crew manager.
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *The message including the train link (provided by crew dispatching system or simulation of it) reflecting a Driver exchange is received.* 2. *The Operational Plan is updated including a Control Rule reflecting the train link and controlling the train running forecast.* 3. *Because of adequate train position reports for the first train assigned to the Control Rule, the train running forecast shows up with a delayed arrival of the first train at the crew exchange location.* 4. *The delayed arrival does not allow anymore to maintain the minimum activity time required for the exchange of the driver at the station, leading to a knock-on delay of the second train.* 5. *The TMS forecast calculation reflects the delayed train running of the second train.* 6. *The first train is further delayed leading to exceeding the maximum delay threshold of the Control Rule and triggering automated de-activation of the Control Rule.* 7. *The TMS automatically updates the Operational Plan based on the already incurred delay of the second train.* 8. *The TMS sends the updated Operational Plan and train running forecast to the crew dispatching system (or simulation of it).*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller, RU crew*

	manager) assessed functionality and usability aspects.
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	*-*

7.7.11. Consideration of crew information

Name	*Consideration of crew information*
ID	*FP1-DEMO-12.7-UC-11*
Description	*Provide updated operational plan considering crew information.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; RU crew manager*
Goal	*Updated Operational Plan including the crew information for the relevant train.*
Demonstration Requirements	*HACON demonstrator environment, TMS and integration service instances representing the involved national TMS and RU system (interface only) covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and RU crew manager.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*

Demonstration storyboard	1. *The message including the crew information (provided by crew dispatching system or simulation of it) is received.* 2. *The train Id assigned to the crew information is used to identify and update the respective train information in the Operational Plan.* 3. *The TMS shows the assigned crew information in its User Interface.* 4. *The TMS sends the updated Operational Plan to the crew dispatching system (or simulation of it).*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller, RU crew manager) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	*Crew information includes ID and further qualitative information.*

7.7.12. Consideration of rolling stock links reflecting rolling stock exchanges between trains at stations

Name	*Consideration of rolling stock links reflecting rolling stock exchanges between trains at stations*
ID	*FP1-DEMO-12.7-UC-12*
Description	*Provide forecast / updated operational plan considering rolling stock links which reflect rolling stock exchanges between trains at stations.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; RU rolling stock manager*
Goal	*Updated Operational Plan synchronized with connected Rolling Stock Management System.*
Demonstration Requirements	*HACON demonstrator environment, TMS and integration service instances representing the involved national TMS and RU system (interface only) covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable*

	including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and RU rolling stock manager.
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	1. *The message including the train link (provided by rolling stock dispatching system or simulation of it) reflecting a rolling stock exchange is received.* 2. *The Operational Plan is updated including a Control Rule reflecting the train link and controlling the train running forecast.* 3. *Because of adequate train position reports for the first train assigned to the Control Rule, the train running forecast shows up with a delayed arrival of the first train at the rolling stock exchange location.* 4. *The delayed arrival does not allow anymore to maintain the minimum activity time required for the exchange of the rolling stock at the station, leading to a knock-on delay of the second train.* 5. *The TMS forecast calculation reflects the delayed train running of the second train.* 6. *The first train is further delayed leading to exceeding the maximum delay threshold of the Control Rule and triggering automated de-activation of the Control Rule.* 7. *The TMS automatically updates the Operational Plan based on the already incurred delay of the second train.* 8. *The TMS sends the updated Operational Plan and train running forecast to the rolling stock management system (or simulation of it).*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller, RU rolling stock) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further*

	enhanced in EU-RAIL wave 2. *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.7.13. Consideration of rolling stock information

Name	*Consideration of rolling stock information*
ID	*FP1-DEMO-12.7-UC-13*
Description	*Provide updated operational plan considering rolling stock information.*
Related to task/subtask(s)	*Tasks 11.3.7, 12.2.7*
Technical Enabler(s)	*TE10 - "Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching"*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM; RU rolling stock manager*
Goal	*Updated Operational Plan including the rolling stock information for the relevant train.*
Demonstration Requirements	*HACON demonstrator environment, TMS and integration service instances representing the involved national TMS and RU system (interface only) covering a national region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the IM's Traffic Controller and RU rolling stock manager.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	• *TPS application server and system software,* • *hosting system including* ○ *server hardware* ○ *server operating system,* ○ *Oracle database software,* ○ *Apache Kafka* • *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. The message including the rolling stock information (provided by rolling stock management system or simulation of it) is received.*

	2. The train Id assigned to the rolling stock information is used to identify and update the respective train information in the Operational Plan. 3. The TMS shows the assigned rolling stock information in its User Interface. 4. The TMS sends the updated Operational Plan to the rolling stock dispatching system (or simulation of it).
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller, RU rolling stock manager) assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	*rolling stock information includes ID and further qualitative information.*

7.8. Demonstration 12.8 – Interface of TMS to Yard Coordination System 2.0 in Malmö node. Work connects to WP 4

Name	*Sending and Receiving track allocation information between TMS and YCS.*
ID	*FP1-DEMO-12.8-UC-01*
Description	*Trigger: ETA of a freight train is changed to a yard planned with YCS (Yard Coordination System).* *Results: The TMS Operator has an updated view on track allocation that has impact on interaction with neighbouring area supervised and controlled by an YCS.* *The YCS Operator has an updated view on track allocation that has impact on interaction with neighbouring TMS area.*
Related to task/subtask(s)	*Tasks 11.3.8, 12.2.8*
Technical Enabler(s)	*TE 10*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM and YCS Operator.*
Goal	*The goal of the demonstration is to show how information exchange between TMS and YCS environment will contribute to less workload for involved users and make efficient processes.*
Demonstration Requirements	*TRV IT environment, TRV TMS (Digital graf test environment) for Malmö region including its data, communication between TRV and RISE environment.* *TMS operator (Traffic controller) for Malmö and YCS*

	Operator.
FP1 Developed components/functions/methods target of demonstration	*YCS (Yard Coordination System)*
Other involved components	*TRV's railway API (for external data communication)* *Deplide (RISE communication platform)*
Expected Demonstration Location	*TRV office in Malmö*
Demonstration storyboard	1. *Exchange track allocation information between TMS and YCS* 2. *Notifying TMS and YCS operators about disruptions and requests*
Expected Demonstration Date	*Mars 2026 – May 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller, Yard Managers, YCS Operator) assess usability aspects and functionality.*
Exploitation	*The developed modules could be further enhanced in EU-RAIL wave 2.* *KER 5, Processes, modules and interfaces for Integration of functions and decision processes facilitating cross-border traffic management.*
Responsible partner/person	*Martin Joborn, RISE* *Jan Byström, TRV*
Notes	-

7.9. Demonstration 12.9 – Interface in view of the future autonomous inspection vehicle for the infrastructure (Destination 3) and its integration with the Intelligent Asset Management System (IAMS). To receive information about asset status and planned interventions and deliver allocated paths to execute inspections and interventions.

Name	*IAMS-TMS-AIV interfaces*
ID	*FP1-DEMO-12.9-UC-01*
Description	*Interface in view of the future autonomous inspection vehicle for the infrastructure (FP3) and its integration with the Intelligent Asset Management System (IAMS). To receive information about asset status and planned interventions and deliver allocated paths to execute inspections and interventions.*
Related to task/subtask(s)	*Tasks 11.3.9, 12.2.9*
Technical Enabler(s)	*TE10*
Stakeholders	• *TMS: Traffic Management System, for managing the railway traffic.*

	• *IAMS: Intelligent Asset Management System, to send alert messages to TMS or inspection vehicle about required inspection intervention status of assets.* • *IV: Inspection Vehicle, to receive the allocated path for inspection.*
Goal	*To test and demonstrate integrations and communication requirements between TMS, IAMS and inspection vehicle.*
Demonstration Requirements	*Required inputs:* • *Required inspection intervention.* • *Infrastructure asset alerts with warnings or recommendations (e.g. apply temporary speed restrictions, alerts about assets reaching critical status, etc…).*
FP1 Developed components/functions/methods target of demonstration	*IAMS to TMS interface.* *TMS to Inspection vehicle interface.*
Other involved components	-
Expected Demonstration Location	*CEIT Laboratory*
Demonstration storyboard	*1. [TMS] [send the route to the AIV] [to provide route to the AIV]* *2. [IAMS] [send the interventions to AIV] [to provide interventions to AIV]* *3. [AIV] [receives and processes information from TMS and IAMS] [to obtain the route and the interventions to be done]*
Expected Demonstration Date	*May 2026*
Expected evaluation of results	*Results will be evaluated by project members to assess the correct communication of the messages between TMS, IAMS and AIV.*
Exploitation	*KER 5*
Responsible partner/person	*Jaizki Mendizabal*
Notes	-

7.10. Demonstration 14.1 – Collaborative DSS for efficient and effective disruption management

7.10.1. Critical alarm management

Name	*Critical alarm management*
ID	*FP1-DEMO-14.1-UC-01*
Description	*The CTC System Operator is supported to reduce the effort and stress required to manage critical events, by providing*

	through the HMI different type of help (suggestion, useful info...) and supporting the critical event resolution.
Related to task/subtask(s)	*Tasks 13.2, 13.5*
Technical Enabler(s)	*TE 11, 13, 14*
Stakeholders	*STS*
Goal	*To show how the DSS support the operator in the management of an alarm coming from a failure/malfunctioning of an asset*
Demonstration Requirements	*Real disruption data* *Machine dedicated to TMS* *Machine dedicated to Integration Layer* *Machine dedicated to DSS*
FP1 Developed components/functions/methods target of demonstration	*DSS for the management of alarm*
Other involved components	*IL, TMS*
Expected Demonstration Location	*Virtual demonstration*
Demonstration storyboard	1. *Technical operator simulates the HABD alarm* 2. *DSS evaluates if the received alarm is included in the subset of alarm managed by the DSS* 3. *If so, DSS identifies the procedure associated to the alarm received* 4. *DSS, through the HMI, shows the list of tasks that have to be performed and relative task details window to help the operator in performing the related actions* 5. *In executing tasks and commands, DSS provides to the other subsystems involved (TMS mainly) the decisions made by the operator*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The STS referents, together with the development team, will measure the KPI identified by INDRA and TRV to measure the MWL of the operators involved in the procedure, in order to show how the DSS can help the operator in reducing his/her effort, when managing procedures related to critical alarm.*
Exploitation	*Decision support system for disruption management (KER 6)*
Responsible partner/person	*Daniela Pietranera, STS*
Notes	-

7.10.2. Short-term management of a possible asset failure

Name	*Short-term management of a possible asset failure*
ID	*FP1-DEMO-14.1-UC-02*

Description	*The DSS receives a warning coming from IAMS, about a specific asset of the infrastructure that has a high probability of failure. the DSS helps the operator in determine if the warning is a symptom of an upcoming failure of the asset. If so, to help the operator in the planning of the short term of the possible failure, calculates and provides a set of preferable time windows in which to plan intervention.* *The DSS helps also the operator in the management of the related procedure of maintenance.*
Related to task/subtask(s)	*Tasks 13.2, 13.5*
Technical Enabler(s)	*TE 11, 13, 14*
Stakeholders	*STS*
Goal	*To show how the DSS support the operator in the management of an alarm coming from a failure/malfunctioning of an asset*
Demonstration Requirements	*Real disruption data* *Machine dedicated to TMS* *Machine dedicated to Integration Layer* *Machine dedicated to DSS*
FP1 Developed components/functions/methods target of demonstration	*DSS for the short-term management of a possible failure*
Other involved components	*IL, TMS, IAMS, Maintenance Subsystem*
Expected Demonstration Location	*Virtual demonstration*
Demonstration storyboard	1. *IAMS send a warning to the DSS* 2. *DSS evaluates if the received warning is included in the subset of warnings managed by the DSS* 3. *If so, DSS identifies the procedure associated to the warning received* 4. *DSS, through the HMI, shows the list of tasks that have to be performed and relative task details window to help the operator in evaluating if the warning is symptomatic of a real failure* 5. *If so, the DSS calculates and shows to the operator a set of preferable timeslots in which is possible to plan the maintenance information, on the basis of different information coming from other subsystems* 6. *The operator, by selecting the preferred timeslot among the possible ones, perform a reservation of the line and of the needed maintenance personnel* 7. *DSS, through the HMI, at the selected time, shows the list of tasks that have to be performed and relative task details window to help the operator in performing the tasks and the command of the associated maintenance procedure*

	8. *DSS provides to the other subsystems involved (TMS, maintenance subsystem, IAMS mainly) the decisions made by the operator*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The STS referents, together with the development team, will measure the KPI identified by INDRA and TRV to measure the MWL of the operators involved in the procedure, in order to show how the DSS can help the operator in reducing his/her effort, when managing procedures related to the short-term management of a possible failure*
Exploitation	*Decision support system for disruption management (KER 6)*
Responsible partner/person	*Daniela Pietraner, STS*
Notes	-

7.10.3. Preventive functional assessment (PFA)

Name	*Preventive functional assessment (PFA)*
ID	*FP1-DEMO-14.1-UC-03*
Description	*To cope with a lack of monitoring data for assets that are not used for a long period, preventive functional assessment needs to be conducted. The system continuously monitors the assets and support the CTC System Operator in identifying such assets and suggesting when the PFA needs to be done according to the planned railway traffic.*
Related to task/subtask(s)	*Tasks 13.2, 13.5*
Technical Enabler(s)	*TE 11, 13, 14*
Stakeholders	*STS*
Goal	*To show how the DSS support the operator in the management of a preventive functional assessment procedure*
Demonstration Requirements	*Real disruption data* *Machine dedicated to TMS* *Machine dedicated to Integration Layer* *Machine dedicated to DSS*
FP1 Developed components/functions/methods target of demonstration	*DSS for the management of procedure of preventive functional assessment*
Other involved components	*IL, TMS, IAMS, Maintenance Subsystem*
Expected Demonstration Location	*Virtual demonstration*
Demonstration storyboard	1. *IAMS from the sensing data on assets to the system and TMS-related data determines which asset has been*

	not monitored for a long period and a PFA is needed and sends this information to the DSS 2. DSS evaluates if the received warning is included in the subset of warnings managed by the DSS 3. If so, DSS identifies the procedure associated to the alarm received 4. DSS, through the HMI, shows the list of tasks that have to be performed and relative task details window to help the operator in evaluating if the warning is symptomatic of a real failure 5. If so, the DSS calculates and shows to the operator a set of preferable timeslots in which is possible to plan the maintenance information, on the basis of different information coming from other subsystems 6. The operator, by selecting the preferred timeslot among the possible ones, perform a reservation of the line and of the needed maintenance personnel 7. DSS, through the HMI, at the selected time, shows the list of tasks that have to be performed and relative task details window to help the operator in performing the tasks and the command of the associated maintenance procedure 8. DSS provides to the other subsystems involved (TMS, maintenance subsystem, IAMS mainly) the decisions made by the operator
Expected Demonstration Date	*2026*
Expected evaluation of results	*The STS referents, together with the development team, will measure the KPI identified by INDRA and TRV to measure the MWL of the operators involved in the procedure, in order to show how the DSS can help the operator in reducing his/her effort, when managing procedures related to the short-term management of a possible failure*
Exploitation	*Decision support system for disruption management (KER 6)*
Responsible partner/person	*Daniela Pietranera, STS*
Notes	-

7.10.4. Disruption management and activation of emergency services

Name	*Disruption management and activation of emergency services.*
ID	*FP1-DEMO-14.1-UC-04*
Description	*When a failure in the train or the trackside is detected, the*

	system shows on the IM Operator's HMI information about the failure occurred, which is leading to the traffic disruption. Such information is acquired from TMS and/or sensors deployed at the assets. It is also indicated that an intervention is required, in particular, the need to activate emergency services/organisation.
Related to task/subtask(s)	*Tasks 13.2, 13.5*
Technical Enabler(s)	*13, 14*
Stakeholders	*STS*
Goal	*To show how the DSS support the operator in the management of a disruption and in particular in the activation of emergency services.*
Demonstration Requirements	*Real disruption data* *Machine dedicated to TMS* *Machine dedicated to Integration Layer* *Machine dedicated to DSS*
FP1 Developed components/functions/methods target of demonstration	*DSS for the management of alarm and related activation of emergency services*
Other involved components	*IL, TMS*
Expected Demonstration Location	*Virtual demonstration*
Demonstration storyboard	1. *From the monitoring of the state of trackside assets, the system receives information about a disruption due to an asset failure (train or infra failure). As a consequence of this, the traffic is interrupted in the line. The information is received/collected from different subsystems.* 2. *Alarm indication received by the operator.* 3. *System shows through the HMI to the IM Operator info about failure type.* 4. *System shows through the HMI info about the disruption if known (duration, train affected, section of the network affected).* 5. *To help in the making decision of the operator, System displays through the HMI suggestions/proposal of steps to follow to mitigate/resolve the situation as soon as possible.* 6. *The decision of activation of emergency services is made by the responsible managing the incident (alternative transport to transport passengers, shuttle service, trailer train to help the train).*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The STS referents, together with the development team, will measure the KPI identified by INDRA and TRV to measure the MWL of the operators involved in the*

	procedure, in order to show how the DSS can help the operator in reducing his/her effort, when managing he indicated procedures.
Exploitation	*Decision support system for disruption management (KER 6)*
Responsible partner/person	*Daniela Pietranera, STS*
Notes	*-*

7.10.5. Disruption management and activation of a maintenance intervention

Name	*Disruption management and activation of a maintenance intervention*
ID	*FP1-DEMO-14.1-UC-05*
Description	*When a failure in the train or the trackside is detected, the IM system shows on the HMI information about the failure occurred which is leading to the traffic disruption. It is also indicated that an intervention is required, specifically a maintenance intervention (needed resources (people), expected duration, impact on traffic…).*
Related to task/subtask(s)	*Tasks 13.2, 13.5*
Technical Enabler(s)	*TE 11, 13, 14*
Stakeholders	*STS*
Goal	*To show how the DSS support the operator in the management of a disruption and in particular in the activation of maintenance intervention.*
Demonstration Requirements	*Real disruption data* *Machine dedicated to TMS* *Machine dedicated to Integration Layer* *Machine dedicated to DSS*
FP1 Developed components/functions/methods target of demonstration	*DSS for the management of alarm and related activation of maintenance intervention*
Other involved components	*IL, TMS*
Expected Demonstration Location	*Virtual demonstration*
Demonstration storyboard	*1. From the monitoring of the state of trackside assets, the system receives information about a disruption due to an asset failure (train or infra failure). As a consequence of this, the traffic is interrupted in the line. The information is received/collected from different subsystems.* *2. Alarm indication received by the operator.* *3. System shows through the HMI to the IM Operator info about failure type.*

	4. *System shows through the HMI info about the disruption if known (duration, train affected, section of the network affected).* 5. *To help in the making decision of the operator, System displays through the HMI suggestions/proposal of steps to follow to mitigate/resolve the situation as soon as possible.* 6. *DSS provides info of necessary maintenance tasks to mitigate the failure, including required resources (people, assets, ...), expected duration, impact on traffic.*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The STS referents, together with the development team, will measure the KPI identified by INDRA and TRV to measure the MWL of the operators involved in the procedure, in order to show how the DSS can help the operator in reducing his/her effort, when managing procedures related to critical alarm.*
Exploitation	*Decision support system for disruption management (KER 6)*
Responsible partner/person	*Daniela Pietranera, STS*
Notes	-

7.11. Demonstration 14.2 – Decision support for rolling stock dispatching

7.11.1. Solving of Rolling stock dispatching conflicts using reserves and swaps

Name	*Solving of Rolling stock dispatching conflicts using reserves and swaps*
ID	*FP1-DEMO-14.2-UC-01*
Description	*Rolling stock dispatching is a crucial aspect in real-time operation at a RU. In case of disruption decision support algorithms are limited available. Improved support is needed in order to better guarantee smooth operation for the RU and good service for passengers.*
Related to task/subtask(s)	*Task 14.3*
Technical Enabler(s)	*TE 13,14*
Stakeholders	*Rolling stock dispatchers at RU*

Goal	*The goal is to demonstrate how decision support to solve rolling stock conflicts would work.*
Demonstration Requirements	*The demonstration will take place in a meeting room in an offline setting with the involved developer(s) and domain experts from RU.*
FP1 Developed components/functions/methods target of demonstration	*DSS model to solve individual rolling stock conflicts*
Other involved components	*Visualisation of the modified rolling stock schedule and evaluation of the new schedule on a given set of KPIs*
Expected Demonstration Location	*Virtual demonstration – test on Dutch railway network*
Demonstration storyboard	*1. Algorithm will produce output for a given disruption.* *2. Each output will be visualized and a set of KPIs will be computed* *3. Domain experts (NSR) will judge the different outputs and provide feedback on the quality of the solution* *4. The feedback of the experts will be documented in a report*
Expected Demonstration Date	*2026*
Expected evaluation of results	*The proposed updates on the rolling stock schedule will be evaluated by experienced rolling stock dispatchers of NSR*
Exploitation	*The main outcome is a working DSS algorithm that can propose solutions for conflicts that occur in real-time operation.* *Decision support system for disruption management (KER 6)*
Responsible partner/person	*Pieter-Jan Fioole, NSR*
Notes	-

7.12. Demonstration 14.3 – Collaborative DSS for efficient and effective disruption management

7.12.1. Multi-actor coordination and decision support for implementation of aligned decisions

Name	*Multi-actor coordination and decision support for implementation of aligned decisions*
ID	*FP1-DEMO-14.3-UC-01*
Description	*The TMS Operator (Traffic Controller) coordinates with the RU Dispatcher (RUD) the initial implementation and required updating of a resource link reflecting the re-use of crew or rolling stock due to disruption. The update has an impact on the forecast result, triggering the re-planning of the Operational Plan in the TMS;*
Related to task/subtask(s)	*Tasks 13.2.3, 14.1.2*
Technical Enabler(s)	*TE13 - "Cooperative planning multi-actors within rail".* *TE14 - "Integration of incident management and customer information, with IM and RU interaction and Decision Support for Disruption management"*
Stakeholders	*Primary stakeholder: TMS Operator (Traffic Controller) at IM; RU (resource) dispatcher*
Goal	*The goal is to, based on an IM-RU actor scenario,* *optimize cost/benefit ratio of effective train operations resulting from aligned and fast decisions; and* *improve the forecast calculation quality due to considered (collaborative) decisions based on constraints or needs of integrated processes/systems.*
Demonstration Requirements	*HACON demonstrator environment, TMS application instance representing a national TMS covering a region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the TMS Operator (Traffic Controller) and RU Dispatcher (RUD).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*

Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. Via the interface, the RUD introduces a new resource link (Crew or Rolling Stock) between two trains stopping at the exact location A, reflecting the re-use of the resource swapping the trains at that location.* *2. TMS generates a Control Rule matching the new resource link with given parameters/conditions.* *3. The first train faces a disruption, causing a major delay at station A.* *4. TMS updates the train running forecast, showing major delays for the first train and, as a knock-on effect, also for the second train when departing from A. The delayed second train caused issues with other trains not affected so far.* *5. The TMS Operator requests the RUD to improve the situation by reconsidering re-planning options on RU-side.* *6. Via the interface, the RUD updates the resource link to let the second train go after a maximum waiting time threshold has elapsed.* *7. TMS updates the related Control Rule, reflecting the update of the resource link with updated parameters/conditions.* *8. The first train is further delayed.* *9. TMS updates the train running forecast indicating that the second train will depart at A without waiting for the first train since the maximum waiting time threshold of the Control Rule has been exceeded.* *10. The other trains are not impacted anymore.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 6: A cooperative multi-actor optimisation and decision support system for incidents and disruption management with human in the loop, an advanced multi-media web-based HMI for the DSS.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.12.2. Show interaction of TMS with the Maintenance Planning System for improved and cooperative traffic optimisation and regulation

Name	*Show interaction of TMS with the Maintenance Planning System for improved and cooperative traffic optimisation and regulation*

ID	*FP1-DEMO-14.3-UC-02*
Description	*The TMS Operator (Traffic Controller) coordinates with the CMS Operator (STP capacity planner) and MMS Operator (Maintenance Manager) the planning and implementation of an accidental maintenance possession on the tracks affected by an incident which caused an operational track blockage. The resulting train regulations and capacity restrictions are considered for updating and dissemination of the Operational Plan managed by the TMS.*
Related to task/subtask(s)	*Tasks 13.2.3, 14.1.2*
Technical Enabler(s)	*TE13* **-** *"Cooperative planning multi-actors within rail".* *TE14 - "Integration of incident management and customer information, with IM and RU interaction and Decision Support for Disruption management"*
Stakeholders	*Primary stakeholder: TMS Operator (Traffic Controller) at IM; CMS Operator (STP capacity planner), MMS Operator (Maintenance Manager); FA3-IAM4RAIL WP8 (Task 8.4: Digital Maintenance Planning System)*
Goal	*The goal is to, based on an IM-RU actor scenario,* - *optimize cost/benefit ratio of effective train operations resulting from aligned and fast decisions; and* - *Show interaction of TMS with the CMS and the Maintenance Planning System for improved and cooperative traffic optimization and regulation; joint demonstrations with FA3-IAM4RAIL WP8, Task 8.4.*
Demonstration Requirements	*HACON demonstrator environment, TMS, CMS, MMS application instances representing national systems covering a region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the TMS Operator (Traffic Controller), RUD, CMS Operator and MMS Operator.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	- *TPS application server and system software,* - *hosting system including* - *server hardware* - *server operating system,* - *Oracle database software,* - *Apache Kafka* - *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*

Demonstration storyboard	*1. The MMS receives an accidental possession request initiated by the TMS Operator.* *2. The MMS Operator implements the new maintenance/repair activity in the maintenance plan managed by the MMS.* *3. The MMS sends the related temporary capacity restrictions (TCRs) including track blockages and temporary speed restrictions for the next 4 days to the TMS/CMS.* *4. The TMS/CMS receives the TCRs and introduces them into the operational/capacity plan.* *5. The TMS updates the train running forecast, indicating the impacted traffic to the TMS Operator in real-time.* *6. Due to the current delays already reflected in the operational plan, the TMS Operator asks for a slight shift in the activity's time by one hour to address most of the issues caused by the TCR in the operational plan on the actual day.* *7. The TMS communicates the request back to the MMS.* *8. After checking with the maintenance team, the MMS Operator shifts the maintenance activity by one hour for the actual day.* *9. The MMS sends the updated TCR to the TMS/CMS.* *10. For the remaining days, the CMS adapts the impacted planned train paths in the capacity plan based on the original TCRs, involving the RUs who have requested the paths.* *11. The TMS/CMS receives the updated TCR and introduces the update to the operational plan.* *12. The TMS updates the train running forecast, indicating that the traffic impact has been mitigated.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 6: A cooperative multi-actor optimisation and decision support system for incidents and disruption management with human in the loop, an advanced multi-media web-based HMI for the DSS.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.12.3. Give operational feedback to planning services to allow for improved timetable planning, as complementary activities to WP4/5

Name	*Give operational feedback to planning services to allow for improved timetable planning, as complementary activities to WP4/5*
ID	*FP1-DEMO-14.3-UC-03*
Description	*The TMS sends feed-back data to the CMS and the related capacity planning process to improve the timetable/track capacity planning. This includes integrating the capacity planning system (CMS) as provided by FA1-MOTIONAL WP4/5, demonstration 5.6 (WS1.1). The data includes operational TCRs and operational observations at specific track locations to indicate regularly non-matching arrival tracks in the plan delivered by the CMS.*
Related to task/subtask(s)	*Tasks 13.2.3, 14.1.2*
Technical Enabler(s)	*TE13 - "Cooperative planning multi-actors within rail".*
Stakeholders	*Primary stakeholder: TMS Operator (Traffic Controller) at IM; CMS Operator (track/network capacity planner), joint demonstration with FA1-MOTIONAL WP4/5, demonstration 5.6 (WS1.1).*
Goal	*Effective Multi-actor coordination involving TMS/TMS Operator, CMS/CMS Operator (FA1-MOTIONAL WP4/5, demonstration 5.6 (WS1.1)).*
Demonstration Requirements	*HACON demonstrator environment, TMS and CMS instances representing national systems covering a region around the cross-border section between Malmö and Oslo including its infrastructure model data, example timetable including assumed passenger and freight services. One or two demo operators taking the roles of the Traffic Controller (TMS Operator) and CMS Operator.*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software; enhanced TMS integration services.*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*A) Feedback of operational TCRs:*

	1. *A major incident causes an immediate blockage of a track section in TMS.* 2. *The TMS Operator creates an operational TCR to reflect a track section blockage and associated temporary speed restriction (TSR) on the neighbouring track for ten days leading to conflicts with running and planned trains.* 3. *The TMS generates solution options for regulating today's trains conflicting with the TCR.* 4. *The TMS Operator accepts a solution and the TMS implements the Operational Plan change for today's trains accordingly.* 5. *The TCR is sent to the CMS to re-plan train services for the next ten days.* 6. *The CMS receives the TCR from TMS.* 7. *CMS Operator is starting to analyse the impact on planned trains for the next days.* 8. *CMS Operator is changing the capacity plan accordingly.* 9. *The CMS sends updated operational plans for the next seven days to TMS, including the change.* 10. *TMS introduces the change into the operational plans, mitigating the impact.* *B) Feedback of operational observations:* 1. *The TMS Operator enters an observation assigned to a track at a station reflecting the non-matching arrival track for a train as seen in operations from the past two weeks.* 2. *The observation is sent to CMS to consider re-planning the track assignment for the train at the station for future capacity plans.* 3. *After talking to the responsible RU and station manager, the CMS Operator is changing the track for the given train at the given location in the capacity plan starting from tomorrow accordingly.* 4. *The CMS sends updated operational plans for the next seven days to TMS including the change.* 5. *TMS introduces the change into the operational plan(s), improving the quality.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 6: A cooperative multi-actor optimisation and decision support system for incidents and disruption management*

	with human in the loop, an advanced multi-media web-based HMI for the DSS.
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.13. Demonstration 14.4 – HMI for TMS based on User Experience (UX) Design and user input

7.13.1. Trespassing UC-FP1-WP10-26

Name	*Trespassing*
ID	*FP1-DEMO-14.4-UC-01*
Description	*This use case consists of the detection of one or more unauthorized persons entering the track area. Today, most often, it is a train driver who detects the person/-s and contacts the dispatcher/TMS operator using voice communication channels. The dispatcher/TMS operator then stops the traffic or gives directives of restricted speed until the police or other rescue services have taken care of the person/-s, or the dispatcher/TMS operator, in another way, can confirm that the track is clear again. Trespassing causes a lot of delays and is today the main cause of injuries and deaths in the railway system.*
Related to task/subtask(s)	*14.2*
Technical Enabler(s)	*TE 11, 13, 14*
Stakeholders	*Trafikverket and RU, in particular dispatchers and train drivers.*
Goal	*The goal is to demonstrate how the concept developed in the HMI methodology affects situation awareness and the assessment of mental workload compared to the state-of-art for an efficient TMS. Efficiency and punctuality are affected as well.*
Demonstration Requirements	*Subject matter experts (dispatchers), a realistic train plan, and a valid TMS, i.e., a test centre with the ability to simulate a realistic environment for traffic management.*
FP1 Developed components/functions/methods target of demonstration	*The demonstration concerns HMI methodology. However, a dummy of a new DSS will be used to demonstrate the methodology (the DSS will not be developed in this project but in the interfaces/systems it will look like it exists).*
Other involved components	*TMS for the railway sector with a scenario with disturbed situations (trespassing in this case).*
Expected Demonstration Location	*Trafikverket's (The Swedish Road administration) test facility*
Demonstration storyboard	*1. A train driver detects a possible trespassing.* *2. The dispatcher/TMS operator is informed that a trespassing problem exists and therefore blocks the*

	identified area by a proper command in the TMS interface, so the blocking becomes visually for the train drivers via the signalling system and ATP used (interface, trackside and/or onboard). The dispatcher/TMS operator also uses voice communication to inform all the directly affected trains (i.e., train drivers) about the restrictions given by the command in the TMS. *3. The affected area is protected from train traffic by the dispatcher/TMS operator i) using a proper command in the TMS interface and ii) using the voice communication channels interface.* *4. The relevant personnel (mostly the Police) are contacted by the dispatcher/TMS operator using voice communication channels interface and are directed to the area of interest.* *5. DSS gives proposals on possible traffic management in the TMS interface.* *6. The relevant personnel contact the dispatcher/TMS operator using a voice communication channels interface when the problem is examined and inform the dispatcher/TMS operator of the status of the problem.* *7. The dispatcher/TMS operator decides on the level of access to the area based on the information given by the personnel executing appropriate commands in the TMS interface.* *8. DSS updates proposals in the TMS interface based on the level of access.* *9. The traffic is re-planned by the dispatcher/TMS operator and continues accordingly.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*The expected evaluation is the HMI instrument have reached readiness level 8 as intended. The data will also be an evaluation of the dispatcher's experience of the new DSS and the task completed by the dispatchers. It is not a complete evaluation of a new DSS – the demonstration is a pre-study that will reveal if the DSS is functioning as expected. The researcher and TRV personnel will analyse the collected data.*
Exploitation	*The main outcome is the HMI instrument (used to assess MWL) work as intended which mean that the readiness level 8 is reached. The expected outcome is that the developed DSS work as intended, i.e., that dispatcher mental workload will decrease and efficiency will increase.* *Decision support system for disruption management (KER 6)*
Responsible partner/person	*Arne Cronvall, Trafikverket*

Notes	*None*

7.13.2. Infrastructure Problems Detected by Railway Staff UC-FP1-WP10-28

Name	*Infrastructure Problems Detected by Railway Staff*
ID	*FP1-DEMO-14.4-UC-02*
Description	*A train driver has identified infrastructure problems and contacts the dispatcher/TMS operator by voice. The dispatcher/TMS operator understands that actions are needed based on the information given by the train driver. Based on the information given by the driver, the dispatcher/TMS operator must decide if the traffic can continue and under which conditions. In this situation, the dispatcher/TMS operator needs the railway maintenance staff's support to determine the severe problem and which subsequent actions are appropriate. The dispatcher/TMS operator, therefore, contacts the maintenance coordinator by voice communication channels, who sends personnel into the field. The maintenance staff examines that infrastructure and sends (by voice communication channels) information to the dispatcher/TMS operator that has different alternatives for the problem. In all cases, the decision is communicated to the TMS using proper commands.*
Related to task/subtask(s)	*14.2*
Technical Enabler(s)	*TE 11, 13, 14*
Stakeholders	*Trafikverket and RU, in particular dispatchers and train drivers.*
Goal	*The goal is to demonstrate how the concept developed affects situation awareness and the assessment of mental workload compared to the state-of -art for an efficient TMS. Efficiency and punctuality are affected as well.*
Demonstration Requirements	*Subject matter experts (dispatchers), a realistic train plan, and a valid TMS. Test centre with the ability to simulate a realistic environment for traffic management.*
FP1 Developed components/functions/methods target of demonstration	*The demonstration concerns HMI methodology. However, a dummy of a new DSS will be used to demonstrate the methodology (the DSS will not be developed in this project but in the interfaces/systems it will look like it exists).*
Other involved components	*TMS for the railway sector with a scenario with disturbed situations (infrastructure problems in this case).*
Expected Demonstration Location	*Trafikverket's test facility in Borlänge, Sweden*
Demonstration storyboard	*1. A train driver detects an infrastructure problem.* *2. The dispatcher/TMS operator is informed that an*

	infrastructure problem exists and therefore blocks the identified area by a proper command in the TMS interface, so the blocking becomes visually for the train drivers via the signalling system and ATP used (interface, trackside and/or onboard). The dispatcher/TMS operator also uses voice communication to inform all the directly affected trains (i.e., train drivers) about the restrictions given by the command in the TMS. *3. The affected area is protected from train traffic by the dispatcher/TMS operator i) using a proper command in the TMS interface and ii) using the voice communication channels interface.* *4. The maintenance personnel are contacted by the dispatcher/TMS operator using voice communication channels interface and are directed to the area of interest.* *5. DSS gives proposals on possible traffic management in the TMS interface.* *6. The maintenance personnel contact the dispatcher/TMS operator using a voice communication channels interface when the problem is examined and inform the dispatcher/TMS operator of the status of the problem.* *7. The dispatcher/TMS operator decides on the level of access to the area based on the information given by the maintenance personnel executing appropriate commands in the TMS interface.* *8. DSS updates proposals in the TMS interface based on the level of access.* *9. The traffic is re-planned by the dispatcher/TMS operator and continues accordingly.*
Expected Demonstration Date	*2026-04*
Expected evaluation of results	*The expected evaluation is the HMI instrument have reached readiness level 8 as intended. The data will also be an evaluation of the dispatcher's experience of the new DSS and the task completed by the dispatchers. It is not a complete evaluation of a new DSS – the demonstration is a pre-study that will reveal if the DSS is functioning as expected. The researcher and TRV personnel will analyse the collected data.*
Exploitation	*The main outcome is the HMI instrument (used to assess MWL) work as intended which mean that the readiness level 8 is reached. The expected outcome is that the developed DSS work as intended, i.e., that dispatcher mental workload will decrease and efficiency will increase.* *Decision support system for disruption management (KER 6)*
Responsible partner/person	*Arne Cronvall, Trafikverket*

Notes	*None*

7.14. Demonstration 16.1 – Linking TMS to ATO/C-DAS for optimised operations

7.14.1. Train Path Envelope calculation

Name	*Train Path Envelope calculation*
ID	*FP1-DEMO-16.1-UC-01*
Description	*Based on an RTTP received from the TMS, the ATO-TS computes TPEs for all connected trains with possibly additional Timing Points to guarantee conflict-free traffic, which are sent to the ATO-OBs of the connected trains.*
Related to task/subtask(s)	*Tasks 15.3, 15.4, 16.2*
Technical Enabler(s)	*TE12, TE15*
Stakeholders	*Incontrol, TU Delft, Sopra Steria and CAF as technical partners. Signaller, Traffic controller, and Simulation leader from ProRail (IM). Train driver from NS as end users (RU).*
Goal	*Demonstration of active ATO-TS generating TPEs for ATO-OBs*
Demonstration Requirements	*Infra data, Timetable data, Train data*
FP1 Developed components/functions/methods target of demonstration	*Train Path Envelope Calculator (ATO-TS, Journey profiles)*
Other involved components	*FRISO RGS (rail computer simulation tool)* *ATO OB* *ATO TS (segment profiles)*
Expected Demonstration Location	*Part of Schiphol-Amsterdam-Almere-Lelystad -Zwolle: Double (multi) track line with an origin and destination station, crossing movements are possible at one or more locations.*
Demonstration storyboard	*Preconditions: All trains in simulation have ATO OB, ATO is enabled, safety system is ERTMS level2.* *1. TMS sends RTTP to ATO-TS.* *2. ATO-TS generates TPEs for all trains. If there are conflicting TPEs then ATO-TS tries to resolve them. If conflicts cannot be resolved for the current RTTP, the TMS is notified.* *3. ATO-TS sends conflict-free TPEs within SPs and JP to all connected ATO-OB.* *4. ATO-OB will update the train trajectory and aim at staying within the new TPE.*

Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*The project team will collect all data from the simulation runs and compile a report, evaluating TMS-ATO performance (e.g., number of TPE updates, train delays, energy consumption, number of conflicts).*
Exploitation	*Outputs/ conclusions/ recommendation of demonstrations related to KER 7*
Responsible partner/person	*Rob Goverde, TU Delft* *Egidio Quaglietta, TU Delft*
Notes	-

7.14.2. TMS-ATO feedback loop

Name	*TMS-ATO feedback loop*
ID	*FP1-DEMO-16.1-UC-02*
Description	*The ATO-TS updates the TPEs based on Status Reports from the ATO-OBs or asks the TMS to provide a new RTTP based on infeasible TPEs instances.*
Related to task/subtask(s)	*Tasks 15.3, 15.4, 16.2, 16.4.1*
Technical Enabler(s)	*TE12, TE15*
Stakeholders	*Incontrol, TU Delft, Sopra Steria and CAF as technical partners. Signaller, Traffic controller, and Simulation leader from ProRail (IM). Train driver from NS as end users (RU).*
Goal	*Demonstration of ATO-TMS feedback loop operation*
Demonstration Requirements	*Infra data, Timetable data, Train data* *Operators (signaller, train traffic controller, train driver)* *Demonstration environment: 2 separated rooms, 3 workstations,* *3 keyboards, 10 computer screens, local network, 1 tablet, Train driver desk, Software license (simulation tool)*
FP1 Developed components/functions/methods target of demonstration	*Train Path Envelope Calculator (ATO-TS, Journey profiles)* *ATO-TMS feedback loop* *ATO UI for all actors/end users*
Other involved components	*FRISO RGS (rail computer simulation tool)* *Trinity (Human-In-The-Loop simulation component)* *DMI (train driver)* *3dv (visualization for train driver)* *ATO OB* *ATO TS (segment profiles)*
Expected Demonstration Location	*Part of Schiphol-Amsterdam-Almere-Lelystad -Zwolle: Double (multi) track line with an origin and destination station, crossing movements are possible at one or more locations.*
Demonstration storyboard	*Preconditions: All trains in simulation have ATO OB,*

	ATO is enabled, Safety system is ERTMS level2. 1. *ATO-TS receives new RTTP from TMS or status reports from ATO-OB* 2. *For ATO-OB updates: ATO-TS updates TPEs. If no feasible TPE can be generated, TMS is warned to update RTTP, and TMS generates and sends updated RTTP to ATO-TS.* 3. *For RTTP update: ATO-TS updates TPEs* 4. *ATO-TS sends updated conflict-free TPEs within SPs and JP to all ATO-OBs.* 5. *ATO-OB will update the train trajectory and aim at staying within the new TPE.*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*The project team will collect all data from the simulation runs and compile a report, evaluating TMS-ATO performance (e.g., number of TPE updates, train delays, energy consumption, number of conflicts).*
Exploitation	*Outputs/ conclusions/ recommendation of demonstrations related to KER 7*
Responsible partner/person	*Emdzad Sehic, ProRail*
Notes	-

7.15. Demonstration 16.2 – Human in-the-loop simulations to test the ATO operational concept

7.15.1. TMS-ATO operation interactions between human actors in different conditions

Name	*TMS-ATO operation interactions between human actors in different conditions*
ID	*FP1-DEMO-16.2-UC-01*
Description	*Actions by and HF impact of human operators (i.e. Train drivers, CTC System Operators, TMS Operator) when using ATO-TMS*
Related to task/subtask(s)	*Tasks 15.3, 15.4, 16.2, 16.4*
Technical Enabler(s)	*TE12, TE 15*
Stakeholders	*Incontrol, TU Delft, Sopra Steria and CAF as technical partners* *Universiteit Twente as methodological/HF research partner* *Signaller, Traffic controller, operational concept expert, human factors expert, and Simulation leader from ProRail (IM); Train driver (NS) as end users (RU)*
Goal	*Testing the impact of ATO and TMS technology on railway operators.*
Demonstration Requirements	*Infra data, Timetable data, Train data* *Operators (signaller, train traffic controller, train driver)*

	Demonstration environment: 2 separated rooms, 3 workstations, 3 keyboards, 10 computer screens, Local network, 1 tablet, Train driver desk, Software license (simulation tool).
FP1 Developed components/functions/methods target of demonstration	*Train Path Envelope Calculator (ATO-TS, Journey profiles)* *ATO-TMS feedback loop* *ATO UI for all actors/end users* *HF toolkit*
Other involved components	*FRISO RGS (rail computer simulation tool)* *Trinity (Human-In-The-Loop simulation component)* *DMI (train driver)* *3dv (visualization for train driver)* *ATO OB* *ATO TS (segment profiles)*
Expected Demonstration Location	*Part of Schiphol-Amsterdam-Almere-Lelystad -Zwolle: Double (multi) track line with an origin and destination station, crossing movements are possible at one or more locations.* *Traffic control area: Schiphol* *TMS area: Asd Zuid*
Demonstration storyboard	*Preconditions: All trains in simulation have ATO OB, ATO is enabled, safety system is ERTMS level2.* *Three different scenarios are available:* *1. Interactions in normal conditions (without delays).* *2. Interactions in disturbed conditions (small delays).* *3. Interactions in disrupted conditions (changed services).* *We run each of the scenarios in the simulation environment and follow the work of the operators.*
Expected Demonstration Date	*Q3-Q4 2025*
Expected evaluation of results	*The research team will collect the observational and questionnaire data during/after the simulation, conduct interviews with actors and make a research report considering human factors constructs, such as operator performance, communication, etc., to measure the human factors impact.*
Exploitation	*Questionnaires, video recordings, system log files, graphs, research report related to KER 7.*
Responsible partner/person	*Julia Lo, ProRail*
Notes	-

7.16. Demonstration 16.3: Prioritized enhancements developed from WP15 for improved efficiency of C-DAS operations from a traffic management perspective

7.16.1. RTTP Updates to Increase C-DAS Efficiency

Name	*RTTP-updates to increase C-DAS efficiency*
ID	*FP1-DEMO-16.3-UC-01*
Description	*Provides support for updating the RTTP, manually and/or to some extent automatically, based on feedback from C-DAS TS and C-DAS OB to improve the quality of the RTTP and optimize the overall efficiency of traffic management.*
Related to task/subtask(s)	*15.3, 16.3*
Technical Enabler(s)	*TE12, TE15*
Stakeholders	*Primary stakeholder: Traffic Controller (TMS Operator) at IM.* *Indirect stakeholder: Train driver at RU.*
Goal	*The goal of the demonstration is to show how the efficiency of RTTP for C-DAS trains can be improved in a single-line setting with traffic of both C-DAS and non-C-DAS trains.*
Demonstration Requirements	*TRV IT environment, TRV TMS (Digital graf test environment) for Malmö region including its data, communication between TRV and RISE environment.* *TMS operator (Traffic controller) for Malmö region.*
FP1 Developed components/functions/methods target of demonstration	*RTTP Updater, as described in D15.2.* *Enhanced version of Digital graf test environment.*
Other involved components	*TRV's railway API (for external data communication)* *Deplide (RISE communication platform)* *IBM ILOG CPLEX Optimization Suite*
Expected Demonstration Location	*TRV office in Malmö.*
Demonstration storyboard	1. *Two trains are going to meet on a single-track line, one train has C-DAS, one does not have C-DAS.* 2. *In Digital graf UI, TMS Operator selects the two trains for (semi-) automatic RTTP adjustments* 3. *RTTP Updater calculates a new proposed RTTP, i.e., adjusted timings of the meeting for increased efficiency.* 4. *TMS Operator can select to accept, deny or automatically accept the proposed RTTP*
Expected Demonstration Date	*February 2026 – April 2026*
Expected evaluation of results	*End users (TMS Operator/Traffic controller) assess usability*

	aspects, RTTP quality, and functionality.
Exploitation	*The developed modules could be further enhanced in EU-RAIL wave 2 and also further developed into a plug-in module to TMS. The results relate to KER 7.*
Responsible partner/person	*Martin Joborn, RISE* *Peter Olsson, TRV*
Notes	*Connection to and response from C-DAS equipped trains (including train movements) will be simulated.*

7.17. Demonstration 16.4 – Improvement of forecast calculation through TMS and C-DAS integration

7.17.1. TMS enhancement to support C-DAS operation

Name	*TMS enhancement to support C-DAS operation*
ID	*FP1-DEMO-16.4-UC-01*
Description	*TMS forecast calculation module is improved by using information (timing point estimation to arrival) from the C-DAS TS.*
Related to task/subtask(s)	*Task 16.3*
Technical Enabler(s)	*TE 12, TE 15*
Stakeholders	*INDRA staff:* *- Responsible for operating the traffic management system during the simulations and assessing the impact of the results.* *- Simulation Operator provides scenarios to the simulation environment (e.g. new situations such as track circuit occupied, etc)*
Goal	*Improve TMS operation by enhancing TMS forecast calculation and subsequently provide new RTTP to the C-DAS-TS.*
Demonstration Requirements	*- Network topology data and timetable data* *- C-DAS data and integration* *- Simulated train movement data* *- Staff to operate the simulator, run simulations and analyse results.*
FP1 Developed components/functions/methods target of demonstration	*TMS forecast calculation software with new capabilities*
Other involved components	*- Simulation environment software* *- Traffic management system*
Expected Demonstration Location	*Virtual simulation environment with C-DAS integration (INDRA laboratory)*

Demonstration storyboard	1. *[TMS] [create the RTTPs and send them to the C-DAS TS through IL] [to provide updated information to the C-DAS TS]* 2. *[C-DAS TS] [process the information received and send it to the C-DAS OBs] [to provide specific information to C-DAS OB]* 3. *[C-DAS TS] [receives and processes information from C-DAS OB] [to obtain real time information]* 4. *[TMS] [receives the information from C-DAS TS] [to get status info]* 5. *[TMS] [processes the status info] [to generate new forecast calculations]* 6. *[TMS dispatcher] [analyses the forecast calculation] [to generate new RTTP]*
Expected Demonstration Date	*March 2026*
Expected evaluation of results	*Results will be evaluated by project members to assess the correct generation of forecast calculation.*
Exploitation	*KER 7*
Responsible partner/person	*Enrique Gómez González, INDRA* *Carmen Ramos Prieto, INDRA*
Notes	

7.18. Demonstration 16.5 - Prioritized enhancements for improved efficiency of C-DAS operations from a traffic management perspective.

7.18.1. C-DAS Simulator

Name	*C-DAS Simulator*
ID	*FP1-DEMO-16.5-UC-01*
Description	*Improved simulation environment to improve efficiency of C-DAS operations considering the interaction with the TMS (received RTTP) and the effect of the OB2TS communications, on-board location estimation and energy optimisation on the JP/TPE calculation*
Related to task/subtask(s)	*T15.3 and T16.3*
Technical Enabler(s)	*TE15*
Stakeholders	*IMs and operators to study C-DAS behaviour*
Goal	*To create more realistic simulations of C-DAS for capacity and energy analysis*
Demonstration Requirements	*Infrastructure, rolling stock data and RTTP* *Machine dedicated to C-DAS TS (communicate with TMS via IL)* *Machine dedicated to C-DAS OB*

FP1 Developed components/functions/methods target of demonstration	*Interface between TMS to C-DAS TS via IL* *Interface between C-DAS TS and C-DAS OB*
Other involved components	*TMS, IL, C-DAS TS, C-DAS OB*
Expected Demonstration Location	*Laboratory environment (CEIT offices)*
Demonstration storyboard	1. *C-DAS TS receives RTTP from TMS via IL* 2. *C-DAS TS generates JP for each of the connected trains* 3. *C-DAS OB calculates energy efficient trajectories and simulates movement and performance* 4. *C-DAS OB sends back the Status Report (SR) to the C-DAS TS* 5. *C-DAS TS sends SR to the TMS via IL*
Expected Demonstration Date	*April-May 2026*
Expected evaluation of results	*Project members evaluation with help of end user to test the correct information exchange between subsystems.*
Exploitation	*The developments are expected to be further developed in the next waves and eventually extended to the simulation and analysis of ATO. The results relate to KER 7.*
Responsible partner/person	*Pablo Ciáurriz, CEIT*
Notes	

7.19. Demonstration 16.6 - Performance comparison between C-DAS-C and C-DAS-O architectures

7.19.1. Performance comparison between C-DAS-C and C-DAS-O architectures

Name	*Performance comparison between C-DAS-C and C-DAS-O architectures*
ID	*FP1-DEMO-16.6-UC-01*
Description	*Demonstration of two C-DAS architectures, C-DAS-C (according to D15.1) and C-DAS-O (according to D15.1), and the comparison between their performances in terms of energy saving using algorithms from WP12.*
Related to task/subtask(s)	*Tasks 16.3*
Technical Enabler(s)	*TE12, TE15*
Stakeholders	*STS*
Goal	*Compare the performances of two different C-DAS*

	architecture
Demonstration Requirements	*Real infrastructure and train data* *Machine dedicated to ATO-TS* *Machine dedicated to TMS* *Machine dedicated to Integration Layer* *Machine dedicated to C-DAS* *Train driver's simulator*
FP1 Developed components/functions/methods target of demonstration	*Module which provides odometry information to the C-DAS from the trackside (at TMS level).*
Other involved components	*Integration Layer, TMS, ATO-TS, C-DAS TS, C-DAS OB*
Expected Demonstration Location	*Laboratory environment with real data*
Demonstration storyboard	1. *Simulation of train transits using C-DAS-C and C-DAS-O architectures* 2. *Comparison of their performances* 3. *Comparison of the results with real traffic data without C-DAS*
Expected Demonstration Date	*January 2026*
Expected evaluation of results	*Comparison of the results with real traffic data without C-DAS by STS.*
Exploitation	*C-DAS-C should have worse performances in terms of energy saving than C-DAS-O, but it has a lower impact on the train. The results relate to KER 7.*
Responsible partner/person	*Roberto Divano, STS*
Notes	

7.20. Demonstration 16.7 – ATO – TMS integration platform

7.20.1. ATO-TMS Integration

Name	*ATO-TMS Integration*
ID	*FP1-DEMO-16.7-UC-01*
Description	*Demonstration of ATO-TS-TMS integration platform supporting autonomous train operations to manage data transfer between the technologies/subsystems involved in WP15*
Related to task/subtask(s)	*15.4.4., 16.5*
Technical Enabler(s)	*TE15*
Stakeholders	*Demo partners to be determined, Integration Platform provided by STS*
Goal	*Prove a function of a framework developed in subtask 15.4.4.*
Demonstration Requirements	*Railway line, Train, Station, ETCS, Interlocking, TMS, TMS operator ATO-Trackside, ATO-Onboard (or C-DAS),*

	Driver, GSM-R (or another mobile network)
FP1 Developed components/functions/methods target of demonstration	*ATO <-> TMS Integration Platform*
Other involved components	*TCMS, Train schedule, Railway line description*
Expected Demonstration Location	*Railway line Kopidlno – Dolni Bousov, Jicin region, Czech Republic*
Demonstration storyboard	*1 - The TMS – ATO-TS integration platform (Integration Layer) continuously reacts to the events that occur on both TMS and ATO-TS sides.* *2 - The TMS operator or autonomous TMS subsystem sets train paths for involved train(s).* *3 - The TMS provides the planned timetable and is able to adjust this timetable regarding the current traffic situation.* *4 - The ATO-TS communicates with ATO-OB/C_DAS OB of involved train:* *Presents the adjusted timetable and train path following the input from TMS to the train.* *Gets position and estimated arrival times from the train, passes this information to the TMS and its subsystems in order to be able to optimise the traffic.*
Expected Demonstration Date	*2026, month to be determined*
Expected evaluation of results	• *Visual* ○ *A spectator (at the train, at the station or remote) will be able observe the train's execution of a journey, based on exchanged data.* • *Log review* ○ *A detailed log of exchanged data (packets) will be made on relevant interfaces:* ▪ *ATO-OB <-> ATO-TS* ▪ *ATO-TS <-> TMS*
Exploitation	*Evaluation, of the integration platform developed in task 15.4.4. The results relate to KER 7.*
Responsible partner/person	*Petr Stritesky, AZD Praha*
Notes	*ATO <-> TMS Integration platform will be provided by STS as an output of Task 15.4.4., where AZD participates*

7.21. Demonstration 16.8 – Traffic regulation

7.21.1. Traffic regulation based on the time of the day

Name	*Traffic regulation based on the time of the day*
ID	*FP1-DEMO-16.8-UC-01*

Description	*In this use case, the regulation of transport in the face of possible disturbances will be defined by the time, whether it is a rush or an off-peak hour.* *If it is a rush hour, it will be regulated by headway.* *If it is an off-peak hour, it will be regulated by timetable*
Related to task/subtask(s)	*Tasks 15.5, 16.5*
Technical Enabler(s)	*TE15*
Stakeholders	*No other stakeholders are involved in this phase of the project*
Goal	*Demonstrating the ability to regulate by time*
Demonstration Requirements	*Location: CAF laboratory* *Data: plan generated in FP1-DEMO-13.4-UC-3*
FP1 Developed components/functions/methods target of demonstration	*SW: Regulator and algorithm for regulating slight disturbances*
Other involved components	*Our regulator communicates with:* • *The interlocking to know the physical occupancies.* • *With the RBC to obtain the position reports provided by the EVC* • *It needs to know the TSRs* • *It needs the Status reports provided by the ATO-OB* • *Within the TMS itself, it needs the planner to know the operation plan on which it is going to work.*
Expected Demonstration Location	*The demonstration will take place in CAF Laboratory*
Demonstration storyboard	*It is needed at least two trains to test the interval regulation.* 1. *Train A suffers a delay at the station exit of 5% of the planned time.* 2. *It is evaluated if the established schedule is being met.* 3. *Two situations:* a. *If it is fulfilled, end of the use case* b. *If it is not fulfilled, it is assessed whether it is in a peak or off-peak hour, to generate the regulation strategy.* i. *Time-base Regulation. Rush hour. In the checks it must be verified that it is regulating by interval.* ii. *Time-Base Regulation. Peak hour. In the checks, it must be verified that it is being regulated by time.*

	4. *The necessary Journey profile is generated with the new regulation conditions in order to recover the planning that was being worked on.* 5. *The JPs are transmitted to the trains.* 6. *Trains execute the received JPs.* 7. *The regulation algorithm checks at the target point set by the regulation strategy whether schedule compliance has been recovered.* 8. *Two situations:* a. *If compliance is achieved, end of the use case.* b. *If not fulfilled, return to section 3b.*
Expected Demonstration Date	*May – June 2026*
Expected evaluation of results	*Project members and end users will test the capacity of the regulator solving disturbances based in space*
Exploitation	*An outcome is expected to be obtained on the efficiency of the regulator's operation under small disturbances.* *KER 7*
Responsible partner/person	*Isabel Meseguer Hijós, CAF Signalling*
Notes	

7.21.2. Traffic regulation based in track areas

Name	*Traffic regulation based in track areas*
ID	*FP1-DEMO-16.8-UC-02*
Description	*The regulation in this case will be defined by space, i.e. it will be influenced by whether the train is in an urban area or on the contrary in a branch line area*
Related to task/subtask(s)	*Tasks 15.5, 16.5*
Technical Enabler(s)	*TE15*
Stakeholders	*No other stakeholders are involved in this phase of the project*
Goal	*Demonstrating the ability to regulate by space*
Demonstration Requirements	*Location: CAF laboratory* *Data: plan generated in FP1-DEMO-13.4-UC-3*
FP1 Developed components/functions/methods target of demonstration	*SW: Regulator and algorithm for regulating slight disturbances*
Other involved components	*Our regulator communicates with:* • *The interlocking to know the physical occupancies.* • *With the RBC to obtain the position reports provided by the EVC* • *It needs to know the TSRs* • *It needs the Status reports provided by the ATO-OB*

	• *Within the TMS itself, it needs the planner to know the operation plan on which it is going to work.*
Expected Demonstration Location	*The demonstration will take place in CAF Laboratory*
Demonstration storyboard	*It is needed at least two trains to test the interval regulation.* 1. *Train A suffers a delay at the station exit of 5% of the planned time.* 2. *It is evaluated if the established schedule is being met.* 3. *Two situations:* a. *If it is fulfilled, end of the use case.* b. *If it is not fulfilled, it is assessed whether it is in a rush or off-peak hour, to generate the regulation strategy.* a. *Space-based Regulation. Urban core. Checks should verify that it is being regulated by interval.* b. *Space-based Regulation. Branches. In the checks it must be verified that it is being regulated by time schedule.* 4. *The necessary Journey profile is generated with the new regulation conditions in order to recover the planning that was being worked on.* 5. *The JPs are transmitted to the trains.* 6. *Trains execute the received JPs.* 7. *The regulation algorithm checks at the target point set by the regulation strategy whether schedule compliance has been recovered.* 8. *Two situations:* a. *If compliance is achieved, end of the use case.* b. *If not fulfilled, return to section 3b.*
Expected Demonstration Date	*May – June 2026*
Expected evaluation of results	*Project members and end-users will test the capacity of the regulator solving disturbances based in time*
Exploitation	*An outcome is expected to be obtained on the efficiency of the regulator's operation under small disturbances.* *KER 7*
Responsible partner/person	*Isabel Meseguer Hijós, CAF Signalling*
Notes	

7.21.3. Traffic regulation considering adhesion

Name	*Traffic regulation considering adhesion*

ID	*FP1-DEMO-16.8-UC-03*
Description	*The regulation in this case will be defined by space or by time, i.e., focusing on space, it will be influenced by whether the train is in an urban area or on the contrary in a branch line area; otherwise, if we focus on time there will be these two options:* • *If it is a rush hour, it will be regulated by headway.* • *If it is an off-peak hour, it will be regulated by timetable*
Related to task/subtask(s)	*Tasks 15.5, 16.5*
Technical Enabler(s)	*TE15*
Stakeholders	*No other stakeholders are involved in this phase of the project*
Goal	*To be able to see how the regulator behaves under low adhesion constraints.*
Demonstration Requirements	*Location: CAF laboratory* *Data: plan generated in FP1-DEMO-13.4-UC-3*
FP1 Developed components/functions/methods target of demonstration	*SW: Regulator and algorithm for regulating slight disturbances*
Other involved components	*Our regulator communicates with:* • *The interlocking to know the physical occupancies.* • *With the RBC to obtain the position reports provided by the EVC* • *It needs to know the TSRs* • *It needs the Status reports provided by the ATO-OB* • *Within the TMS itself, it needs the planner to know the operation plan on which it is going to work.*
Expected Demonstration Location	*The demonstration will take place in CAF Laboratory*
Demonstration storyboard	*It is needed at least two trains to test the interval regulation.* 1. *Train A receives a JP coming from the regulation system warning that there is a change of adhesion.* 2. *The ETCS curve is reduced and therefore the ATO curve is reduced. This implies that the speed of the train is reduced as there is a lower adhesion, braking starts earlier, the travel time increases (maximum deceleration decreases).* 3. *There is a delay of 5 to 10% over the planning in which the train is operating.*

	4. *An assessment is made as to whether the established schedule is being adhered to.* 5. *Two situations:* a. *If it is fulfilled, end of the use case* b. *If it is not fulfilled, it is evaluated whether it is regulated by time of day or by the space through which the train is running.* 6. *Two situations:* a. *If the train is running taking into account the time of day.* i. *It is assessed whether it is in a peak or off-peak hour, in order to generate the regulation strategy.* ii. *The necessary Journey profile is generated with the new regulation conditions in order to recover the planning that was being worked on.* iii. *The JPs are transmitted to the trains in real time, without the need for the trains to arrive at the stations.* iv. *Trains execute the received JPs.* v. *The regulation algorithm checks at the target point set by the regulation strategy whether schedule compliance has been recovered.* vi. *Two situations:* a. *If complied with, end of the use case.* b. *If not complied with, return to section 6.a.i.* b. *If the train runs taking into account the space through which it is running.* i. *It is assessed whether it is located in the urban core or in a branch area, in order to generate the regulation strategy.* ii. *The necessary Journey profile is generated with the new regulation conditions in order to recover the planning that was being worked on.* iii. *The JPs are transmitted to the trains in real time, without the*

	need for the trains to arrive at the stations. iv. Trains execute the received JPs. v. The regulation algorithm checks at the target point set by the regulation strategy whether schedule compliance has been recovered. vi. Two situations: 1. If compliance is met, end of the use case 2. 2. If not complied with, return to section 6.b.i.
Expected Demonstration Date	*May – June 2026*
Expected evaluation of results	*Project members and end users will test how the regulator make its function while low adhesion is defined*
Exploitation	*An outcome is expected to be obtained on the efficiency of the regulator's operation under small disturbances. KER 7*
Responsible partner/person	*Isabel Meseguer Hijós, CAF Signalling*
Notes	

7.22. Demonstrator 16.9 - Improvement of traffic forecast and operational plan update through TMS and ATO-TS integration

7.22.1. Operational Plan update through TMS and ATO-TS interaction

Name	*Operational Plan update through TMS and ATO-TS interaction*
ID	*FP1-DEMO-16.9-UC-01*
Description	*Improving forecasting calculation by using ATO-TS feedback (Status Report) and updating RTTP to be exchanged with ATO-TS.*
Related to task/subtask(s)	*Tasks 15.3, 16.5*
Technical Enabler(s)	*TE12*
Stakeholders	*A TMS Operator*
Goal	*To update the TMS Operational Plan and RTTP*
Demonstration Requirements	*Capacity plan and Track Topology and a CCS/ATO-TS simulator.*
FP1 Developed components/functions/methods target of demonstration	*Forecast module, TMS/ATO interface*
Other involved components	*Conflict detection and resolution module*

Expected Demonstration Location	*Virtual: Civitanova-Albacina; Fabriano-Albacina*
Demonstration storyboard	*1. TMS sends RTTP to CCS/ATO-TS.* *2. TMS receives a Status Report from CCS/ATO-TS* *3. Forecast is updated using the information of the above report.* *4. Any conflicts are detected by TMS.* *5. Conflicts are solved.* *6. RTTP and Operational Plan are updated.* *7. TMS sends updated RTTP to CCS/ATO-TS.*
Expected Demonstration Date	*June 2026*
Expected evaluation of results	*Evaluated in laboratory with a real plant configuration by end users testing the systems and assessing it.* *The evaluation will be done with attention at the solution quality and user usability experience.*
Exploitation	*MERMEC aims to exploit this development in their ETCS controlled lines.* *KER7*
Responsible partner/person	*Angelo Naselli, MERMEC*
Notes	

7.23. Demonstration 18.1 – Real Time Conflict Identification & Resolution

Name	*Real Time Conflict Identification & Resolution*
ID	*FP1-DEMO-18.2-UC-01*
Description	*AI-based conflict identification and resolution in Real time*
Related to task/subtask(s)	*Tasks 17.2.1, 18.2.1*
Technical Enabler(s)	*TE17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*ÖBB-INFRA, PR: IM,* *ÖBB-INFRA's affiliated entities, ENYSE, NRD: technical partners*
Goal	*AI-driven identification of potential conflicts within a specified timeframe, along with the calculation, prioritization, and ranking of resolution solutions based on operational guidelines, followed by the presentation of optimal solutions*
Demonstration Requirements	*Input data:* *Infrastructure data (network topology, etc.)* *Rolling stock data* *Operational/planning data (timetable, etc.)* *Simulation parameters (Conflict rules)* *Staff for:* *Operational Rules*

	User acceptance testing
FP1 Developed components/functions/methods target of demonstration	*Conflict Detection System (CDS)* *Conflict Resolution System (CRS)* *Graphical User Interface (GUI):*
Other involved components	*N.A.*
Expected Demonstration Location	*ÖBB-Infra Lab*
Demonstration storyboard	*1. [System] configured and in operation ready to detect conflicts* *2. [Conflict Detection System] based on the real time data, predicts the upcoming or already happened conflicts and triggers the conflict resolution system* *3. [Conflict Resolution System] Based on the operational rules, calculates the possible solutions and ranks them* *4. [GUI] Represents the conflicts and possible solutions to the operator* *5. [Operator] Selects one of the proposed solutions or rejects all of them* *6. [System] The systems learns from operator's choice to calculate future solutions*
Expected Demonstration Date	*Q3 2026*
Expected evaluation of results	*Defined KPIs and end users*
Exploitation	*KER 8*
Responsible partner/person	*Amirreza Tahamtan, ÖBB-INFRA*
Notes	*N.A.*

7.24. Demonstration 18.2 – Application to Depots and Terminal Stations environments of Algorithms for Automatic Conflict Detection and Resolution using AI

Name	*Automatic Conflict Detection and Resolution using AI applied to Depots and Terminal Stations environment*
ID	*FP1-DEMO-18.2-UC-1*
Description	*Application to Depots and Terminal Stations environments of Algorithms for Automatic Conflict Detection and Resolution using AI.*
Related to task/subtask(s)	*Tasks 17.2.2, 18.2.2*
Technical Enabler(s)	*TE17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*Apart from ENYSE:* *- OBB INFRA to provide infrastructure and operational data* *- FP6 for its application to Regional Lines*
Goal	*Provide updated operational plan by applying optimized*

	conflict resolution to the conflicts indicated by the forecast based on the user choosing from the list of all possible solutions identified by AI
Demonstration Requirements	*Input data:* *Infrastructure data (network topology, etc.)* *Rolling stock data* *Operational/planning data (timetable, etc.)* *Simulation parameters (Conflict rules)* *Staff for:* *AI development* *Data preparation* *TMS configuration* *Operate simulator* *Run simulation* *Analyse results* *AI SW Infrastructure:* *Existing algorithms* *Existing Libraries* *Licenses* *TMS SW Infrastructure:* *Existing SW platform customized for project* *Licenses* *DSS Visual environment SW Infrastructure*
FP1 Developed components/functions/methods target of demonstration	*Conflict Detection System (CDS)* *Conflict Resolution System (CRS)* *Graphical User Interface (GUI): required at later stage*
Other involved components	*AI HW infrastructure* *TMS SW infrastructure (e.g. WinCC OA)* *TMS HW infrastructure* *DSS Visual environment HW Infrastructure* *Simulation environment*
Expected Demonstration Location	*ENYSE Lab*
Demonstration storyboard	*1. [System (Terminal Station or Depot)] [configured with a conflict-free planning and the rules for conflict resolution] [in operation and ready to receive conflicts]* *2. [Operator] [A perturbance is included in the planning for the Terminal Station or Depot] [Trigger for starting Conflict Detection Process]* *3. [Conflict Detection System] [identification of conflict(s)] [Trigger for Starting Conflict Resolution Process]* *4. [Conflict Resolution System] [presentation about conflict] [proposal of different calculation alternatives based on user needs (including ranking criteria) if*

	possible. This info can be provided at first stage without an elaborated GUI, i.e. it might be a file for example] 5. [Conflict Resolution System] [calculation of possible solutions] [presentation of possible solutions ranked (according to the defined criteria) to the dispatcher. This info can be provided at first stage without an elaborated GUI, i.e. it might be a file for example] 6. [AI training] [The AI training will follow a reward system that establishes a criterion for desirable and undesirable behaviours] [Trained AI]
Expected Demonstration Date	*Q2 2026*
Expected evaluation of results	*A human being will provide the optimal solution and if possible additional ones.* *Those solutions will be compared with those generated by the AI.* *KPIs will be established to be able to compare them in case they are not identical*
Exploitation	*KER 8*
Responsible partner/person	*Francisco Lozano, ENYSE* *Jesús Rodrigo, ENYSE*
Notes	*None*

7.25. Demonstration 18.3 – Improved Decision Support

Name	*Optimized conflict resolution based on realistic forecast calculation*
ID	*FP1-DEMO-18.3-UC-01*
Description	*Provide updated operational plan by applying optimized conflict resolution to the conflicts indicated by the calculated forecast.*
Related to task/subtask(s)	*Tasks 17.2.3, 17.2.6, 18.2.3*
Technical Enabler(s)	*TE17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*Primary stakeholder: TMS Operator (Traffic Controller) at IM*
Goal	*The goal is to automatically maintain a continuously updated feasible, optimal Operational Plan with respect to an implemented optimizer objective function considering the existing constraints, rules and valid train control decisions (i.e., active Control Rules according to previous decisions by the TMS Operator).*
Demonstration Requirements	*HACON demonstrator environment, TMS application instance representing a national TMS covering a region around the cross-border section between Malmö and Oslo*

	including its infrastructure model data, example timetable including assumed passenger and freight services. *The Operational Plan shall include at least one valid TCR and at least one active Control Rule reflecting a valid control decision previously taken by the TMS Operator.* *One demo operator in the role of the TMS Operator (Traffic Controller).*
FP1 Developed components/functions/methods target of demonstration	*Enhanced TMS application software*
Other involved components	*TPS application server and system software,* *hosting system including* *server hardware* *server operating system,* *Oracle database software,* *Apache Kafka* *client computer and operation system software*
Expected Demonstration Location	*Virtual demonstration using a region around the Scan-Med corridor section Malmö-Oslo.*
Demonstration storyboard	*1. Incoming train position reports for the running trains are registered in the TMS.* *2. The next cycle for forecast calculation, optimization and operational plan update is initiated automatically by the TMS.* *3. The TMS performs the resulting update of the Operational Plan and shows the result in the GUI (live-Train Graph, tabular views).* *4. The TMS Operator checks for rule compliance and consideration of TCRs and active Control Rules.*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 8: Algorithms and decision support tools for optimised (automated) decisions and support for traffic management.*
Responsible partner/person	*Rolf Gooßmann, HACON*
Notes	-

7.26. Demonstration 18.4 – Advanced Automation of Real time Operation

7.26.1. Automated avoidance of very short-term sequencing conflicts using AI in moving block operation

Name	*Automated avoidance of very short-term sequencing conflicts using AI in moving block operation*
ID	*FP1-DEMO-18.4-UC-01*
Description	*During the time span from 0 to a few minutes ahead, even little deviations can cause high impact, if the planned sequence of trains becomes changed. An AI algorithm is trained to solve these conflicts by stopping or slowing down lower priority trains to keep TMS planning stable.* *If necessary, plan execution is requested to shorten already approved movement authorities for the lower priority train to release headway for higher priority train.* *The upcoming automated action by algorithm is visualized to operator and allows to cancel the automated action.*
Related to task/subtask(s)	*WP17.2.5 and WP18.2.4*
Technical Enabler(s)	*TE16*
Stakeholders	*GTSD*
Goal	*Demonstrate usability of AI algorithm to solve situations with sequencing conflict in moving block operation*
Demonstration Requirements	*GTSD simulation environment. Real world infrastructure data at Gothard tunnel, Train simulator, point simulator, ATO simulator, PE simulator, MBS simulator, AI engine, SCI-OP to feed in operational plans.*
FP1 Developed components/functions/methods target of demonstration	*AI training environment, multi agent deep reinforcement learning AI algorithm, PE simulator, MBS simulator, SCI-OP interface*
Other involved components	*GTS simulation environment*
Expected Demonstration Location	*LAB simulation at GTSD Berlin using Gothard tunnel real world infrastructure.*
Demonstration storyboard	1. *GTSD create operational plan with 2 train conflict* 2. *Simulation executes plan* 3. *AI algorithm time to react on this conflict is recorded* 4. *AI proposed actions are recorded* 5. *Execution of proposed action is recorded* 6. *Interaction with PE is recorded* 7. *GTSD evaluates recordings according test case* 8. *Use cases will be tested with increasing number of trains up to 10*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further*

	enhanced in EU-RAIL wave 2. *KER 8: Algorithms and decision support tools for optimised (automated) decisions and support for traffic management.*
Responsible partner/person	*Klaus Schuldes, GTSD*
Notes	

7.26.2. Automated avoidance of very short-term deadlock conflicts using AI in moving block operation

Name	*Automated avoidance of very short-term deadlock conflicts using AI in moving block operation*
ID	*FP1-DEMO-18.4-UC-02*
Description	*During the time span from 0 to a few minutes ahead, impact of deadlock conflicts can be minimized, if the train can be stopped an ETCS marker board, where rerouting is possible. An AI algorithm is trained to avoid this conflict by stopping the train automatically in very short time. This enables operator to manage this disturbance, without being busy to avoid increasing impact or organizing reversing train out of deadlock situation.* *If necessary, plan execution is requested to shorten already approved movement authority for the stopped train to avoid unnecessary blocking of other trains.* *The upcoming automated action by algorithm is visualized to operator and allows to cancel the automated action.*
Related to task/subtask(s)	*WP17.2.5 and WP18.2.4*
Technical Enabler(s)	*TE16*
Stakeholders	*GTSD*
Goal	*Demonstrate usability of AI algorithm to solve situations with sequencing conflict in moving block operation*
Demonstration Requirements	*GTSD simulation environment. Real world infrastructure data , Train simulator, point simulator, ATO simulator, PE simulator, MBS simulator, AI engine, SCI-OP to feed in operational plans.*
FP1 Developed components/functions/methods target of demonstration	*AI training environment, multi agent deep reinforcement learning AI algorithm, PE simulator, MBS simulator, SCI-OP interface*
Other involved components	*GTS simulation environment*
Expected Demonstration Location	*LAB simulation at GTSD Berlin using Gothard tunnel real world infrastructure.*
Demonstration storyboard	*1. GTSD create operational plan with 1 train* *2. GTSD create a deadlock situation by failed point.* *3. Simulation executes plan* *4. AI algorithm time to react on this conflict is recorded* *5. AI proposed actions are recorded*

	6. Execution of proposed action is recorded *7. Interaction with PE is recorded* *8. GTSD evaluates recordings according test case* *9. GTSD will test use case with increasing number of trains up to 10* *10. GTSD will test use case with deadlock caused by failed train*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 8: Algorithms and decision support tools for optimised (automated) decisions and support for traffic management.*
Responsible partner/person	*Klaus Schuldes, GTSD*
Notes	

7.26.3. Automated delay of departure from platform if headway is blocked by sequencing conflict or deadlock conflicts using AI in moving block operation

Name	*Automated delay of departure from platform if headway is blocked by sequencing conflict or deadlock conflicts using AI in moving block operation*
ID	*FP1-DEMO-18.4-UC-03*
Description	*During the time span from 0 to a few minutes ahead, deadlock or sequencing conflicts can block the headway of a train ready for departure. In moving block operation without route setting train departure must be delayed to avoid unnecessary blocking of other trains. An AI algorithm is trained to delay departure in this situation.* *If necessary, plan execution is requested to shorten already approved movement authority for the stopped train to avoid unnecessary blocking of other trains.* *The upcoming automated action by algorithm is visualized to operator and allows to cancel the automated action.*
Related to task/subtask(s)	*WP17.2.5 and WP18.2.4*
Technical Enabler(s)	*TE16*
Stakeholders	*GTSD*
Goal	*Demonstrate usability of AI algorithm to solve complex situations with sequencing conflicts, deadlock conflicts and multiple trains involved. This use case is relevant specifically for moving block operation*
Demonstration Requirements	*GTSD simulation environment. Real world infrastructure data, Train simulator, point simulator, ATO simulator, PE*

	simulator, MBS simulator, AI engine, SCI-OP to feed in operational plans.
FP1 Developed components/functions/methods target of demonstration	*AI training environment, multi agent deep reinforcement learning AI algorithm, PE simulator, MBS simulator, SCI-OP interface*
Other involved components	*GTS simulation environment*
Expected Demonstration Location	*LAB simulation at GTSD Berlin using Gothard tunnel real world infrastructure.*
Demonstration storyboard	*1. GTSD create operational plan with 1 train* *2. GTSD create a deadlock situation by failed point.* *3. GTSD create a deadlock situation by failed train.* *4. Simulation executes plan* *5. AI algorithm time to react on this conflict is recorded* *6. AI proposed actions are recorded* *7. Execution of proposed action is recorded* *8. Interaction with PE is recorded* *9. GTSD evaluates recordings according test case* *10. GTSD will test use case with increasing number of trains up to 10*
Expected Demonstration Date	*May 2026 – June 2026*
Expected evaluation of results	*End users assessed functionality and usability aspects.*
Exploitation	*The developed enhancements are planned to be further enhanced in EU-RAIL wave 2.* *KER 8: Algorithms and decision support tools for optimised (automated) decisions and support for traffic management.*
Responsible partner/person	*Klaus Schuldes, GTSD*
Notes	

7.27. Demonstration 18.5 – Advanced Decision Support for Real time Operation

7.27.1. Automated in-station train dispatching using AI

Name	*Automated in-station train dispatching using AI*
ID	*FP1-DEMO-18.5-UC-01*
Description	*In-station train dispatching plays a central role in maximising the effective utilisation of available railway infrastructures and in mitigating the impact of incidents and delays. Unfortunately, in-station train dispatching is still largely handled manually by human operators in charge of a group of stations.* *STS proposes to adopt AI-driven automatic planning to automatise this domain.*
Related to task/subtask(s)	*Subtask 17.2.6, 18.2.5*

Technical Enabler(s)	*TE17 "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*Apart from STS, this demo will use historical traffic data, timetables and dispatching commands from RFI*
Goal	*To automatically optimise the in-station dispatching to achieve a conflict-free traffic flow*
Demonstration Requirements	*Historical traffic data, timetables and dispatching commands for specific dates*
FP1 Developed components/functions/methods target of demonstration	*AI-driven automated in-station dispatcher*
Other involved components	*TMS*
Expected Demonstration Location	*The proposed AI-driven automatic planning will be tested and validated in a lab environment using the historical traffic data of the Genova Brignole (Italy) railway station.*
Demonstration storyboard	*The storyboard of the demo is based on the following loop:* 1. *The dispatcher receives from TMS the updated operational plan* 2. *The dispatcher processes the updated operational plan and proposes to TMS possible optimal solutions* 3. *TMS receives the possible optimal solutions and selects the most suitable one.* 4. *On this decision, the operational plan will be further updated*
Expected Demonstration Date	*Between 10/2025 and 3/2026*
Expected evaluation of results	*Automated dispatching will be assessed against human decision using historical data on different days and different day intervals (peak and non-peak traffic).*
Exploitation	*The proposed module will become part of the new STS automated TMS.* *It will contribute to KER8*
Responsible partner/person	*Carmelo Lofiego, STS*
Notes	-

7.27.2. Train that cannot continue on its route

Name	*Train that cannot continue on its route*
ID	*FP1-DEMO-18.5-UC-02*
Description	*The TMS Operator may suspend the automatic route setting for a train in the event the train cannot continue.*
Related to task/subtask(s)	*Subtask 17.2.6, 18.2.5*
Technical Enabler(s)	*TE 17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*TMS/TMS Operator*

Goal	*During forecast calculation and automatic conflict solution, the system must consider the train unavailable to move for a configurable time interval.*
Demonstration Requirements	*Network data of the Genoa TMS area.*
FP1 Developed components/functions/methods target of demonstration	*AI-driven automated in-station dispatcher*
Other involved components	*TMS*
Expected Demonstration Location	*Simulated environment based on Genoa railway node TMS data*
Demonstration storyboard	*1. The TMS Operator recognizes a train that could cause a traffic disruption;* *2. The TMS Operator suspends the automatic route setting for this train;* *3. The optimizer consider the train unavailable to move for a configurable time interval;* *4. When the service is reallocated, the forecast calculation and automatic conflict resolution are updated.*
Expected Demonstration Date	*Between 10/2025 and 3/2026*
Expected evaluation of results	*RFI team*
Exploitation	*The expected result is an optimised regulation even in the presence of small disturbances.*
Responsible partner/person	*Francesco Cirillo, FS/RFI*
Notes	-

7.27.3. Dispatcher constraints entry

Name	*Dispatcher constraints entry*
ID	*FP1-DEMO-18.5-UC-03*
Description	*The TMS Operator sets one or more constraints which are binding for the optimizer.*
Related to task/subtask(s)	*Subtask 17.2.6, 18.2.5*
Technical Enabler(s)	*TE 17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*TMS/TMS Operator*
Goal	*The optimizer takes into account the constraints set by the dispatcher and cannot modify or delete them.*
Demonstration Requirements	*Network data of the Genoa TMS area.*
FP1 Developed components/functions/methods target of demonstration	*AI-driven automated in-station dispatcher*
Other involved components	*TMS*
Expected Demonstration Location	*Simulated environment based on Genoa railway node TMS data*

Demonstration storyboard	1. *The TMS Operator sets a constraint into the system;* 2. *The optimizer cannot remove the constraint defined by the TMS Operator;* 3. *The optimizer must take into account the constraint in the elaborations.*
Expected Demonstration Date	*Between 10/2025 and 3/2026*
Expected evaluation of results	*RFI team*
Exploitation	*The expected result is an optimised regulation even in the presence of constraints.*
Responsible partner/person	*Francesco Cirillo, FS/RFI*
Notes	

7.28. Demonstration 18.6 – Advanced Conflict Decision Support and Route Setting

Name	*Real-time Operation of Algorithm*
ID	*FP1-DEMO-18.6-UC-01*
Description	*Automatic conflicts detection as soon as they appear in time, conflict resolution on request.*
Related to task/subtask(s)	*18.2.6*
Technical Enabler(s)	*TE17*
Stakeholders	*AZD, TMS operator, IM.*
Goal	*To provide real-time operating demo for detection and resolution of defined conflicts.*
Demonstration Requirements	*AZD laboratory, TMS, Railway network, TMS operator, Trains*
FP1 Developed components/functions/methods target of demonstration	*Software for detecting and resolving conflicts on defined area. This software will be integrated as part of TMS, which is used by train operators.*
Other involved components	*Train schedule, Railway line description, TMS*
Expected Demonstration Location	*AZD Laboratory,*
Demonstration storyboard	1. *The interlocking knows the train occupancies by rail circuits* 2. *TMS knows trains TT* 3. *AZD demo is integrated in TMS* 4. *Demo will detect conflict situation* 5. *Demo will immediately announce conflict to TMS operator by HMI* 6. *Demo will count set of possibilities how to solve a conflict situation* 7. *TMS operator will choose one possibility from the list or refuse all* 8. *Application of chosen solution* 9. *Conflict is solved*

Expected Demonstration Date	*Q3, 2026*
Expected evaluation of results	*Project members and external end-users from non-AZD environment will test conflict detection automation of the demonstrator.* *Evaluation will be based on TMS requirements*
Exploitation	*Expected outcome is functional conflict detection and resolution demonstrator integrated as part of TMS.* *KER8*
Responsible partner/person	*Martin Bojda/Zuzana Holekova, AZD Praha*
Notes	*None*

7.29. Demonstration 18.7 – Decision Support for improved traffic management operation

7.29.1. Automatic Conflict detection and resolution

Name	*Automatic Conflict detection and resolution*
ID	*FP1-DEMO-18.7-UC-1*
Description	*Support the dispatcher with automatic conflict detection and resolution tool dedicated to the near future conflicts.*
Related to task/subtask(s)	*Tasks 17.2.7*
Technical Enabler(s)	*TE 17*
Stakeholders	*INDRA staff:* *- Responsible for operating the traffic management system during the simulations and assessing the impact of the results.* *- Simulation Operator provides scenarios to the simulation environment (e.g. new situations such as track circuit occupied, etc.)*
Goal	*The main goal is to demonstrate the effectiveness of the automatic conflict detection and resolution (ACR) module in resolving conflicts and achieving the best possible based on assessment criteria.*
Demonstration Requirements	*- Network topology data and timetable data* *- Simulation environment setup (TMS, train and driver simulator)* *- Staff to operate the simulator, run simulations and analyze results.* *- Locations for simulation of virtual environments (laboratory)*
FP1 Developed components/functions/methods	*-Automatic conflict detection and resolution software*

target of demonstration	
Other involved components	- *Simulation environment software* - *Traffic management system*
Expected Demonstration Location	*Virtual: INDRA laboratory*
Demonstration storyboard	1. *[Train dispatcher] [accesses the TMS] [to monitor the train paths and analyse conflicts]* 2. *[Train dispatcher] [switch on the ACR function] [to solve conflicts close to the timeline]* 3. *[ACR function] [solves the conflicts close to the timeline] [to maintain the performance of the operation]* 4. *[Train dispatcher] [switch off the ACR function] [to use the manual or semiautomatic modes]*
Expected Demonstration Date	*March 2026*
Expected evaluation of results	*Results will be evaluated by project members to determine the effectiveness of the ACR.*
Exploitation	*KER 8*
Responsible partner/person	*Enrique Gómez González, INDRA* *Carmen Ramos Prieto, INDRA*
Notes	

7.29.2. Decision support system for different conflicts

Name	*Decision support system for different conflicts*
ID	*FP1-DEMO-18.2-UC-1*
Description	*The use case includes a sandbox that allows to simulate different situations, check the effects in the train paths and decide to apply or not depending on the convenience of the changes.*
Related to task/subtask(s)	*Tasks 18.2.7*
Technical Enabler(s)	*TE 17*
Stakeholders	*INDRA staff:* - *Responsible for operating the traffic management system during the simulations and assessing the impact of the results.* - *Simulation Operator provides scenarios to the simulation environment (e.g. new situations such as track circuit occupied, etc)*
Goal	*Improve the Decision Support System by providing a What-if tool based on real-time operation disruptions.*
Demonstration Requirements	- *Network topology data and timetable data* - *Simulation environment setup (TMS, train and driver simulator)* - *Staff to operate the simulator, run simulations, and*

	analyse results. *- Locations for simulation of virtual environments (laboratory)*
FP1 Developed components/functions/methods target of demonstration	*What – if functionality (sandbox) software in TMS*
Other involved components	*- Simulation environment software* *- Traffic management system*
Expected Demonstration Location	*-Virtual: INDRA laboratory*
Demonstration storyboard	*1. [Train dispatcher] [accesses the TMS sandbox] [to apply resolution methods to the train paths]* *2. [TMS sandbox] [processes the conflict resolution to the train paths] [to show the effects of the operation]* *3. [Train dispatcher] [decides the application (or not) of the operation] [to solve immediate conflicts]*
Expected Demonstration Date	*March 2026*
Expected evaluation of results	*Results will be evaluated by project members to determine the effectiveness of the DSS with What-If functionality.*
Exploitation	*KER 8*
Responsible partner/person	*Enrique Gómez González, INDRA* *Carmen Ramos Prieto, INDRA*
Notes	

7.30. Demonstration 18.8 – Automation of Real time Operation Conflict detection and resolution

7.30.1. Conflict detection and resolution.

Name	*Conflict detection and resolution.*
ID	*FP1-DEMO-18.8-UC-01*
Description	*Providing conflict detection after a train deviation and applying or suggesting conflict solution.*
Related to task/subtask(s)	*Tasks 17.2.8,18.2.8*
Technical Enabler(s)	*TE16, TE17*
Stakeholders	*A TMS Operator*
Goal	*To get conflict free timetable.*
Demonstration Requirements	*Capacity plan and Track Topology*
FP1 Developed components/functions/methods target of demonstration	*Conflict detection and resolution module*
Other involved components	*A train graph or a timetable viewer user interface*

Expected Demonstration Location	*Virtual: Civitanova-Albacina*
Demonstration storyboard	1. *A deviation for a train is detected by the related module.* 2. *Forecast is updated for the above train.* 3. *Conflicts are detected and shown to the TMS Operator (semi-automatic mode).* 4. *Conflicts are solved and solution is applied in automatic mode or proposed to the TMS Operator in semi-automatic mode.* 5. *TMS Operator can choose a solution in semi-automatic mode.*
Expected Demonstration Date	*June 2026*
Expected evaluation of results	*Evaluated in laboratory with a real plant configuration by end users testing the systems and assessing it.* *The evaluation will be done with attention at the solution quality and user usability experience.*
Exploitation	*MERMEC aims to exploit this CD/CR modules in their controlled lines.* *KER 8*
Responsible partner/person	*Angelo Naselli, MERMEC*
Notes	

7.30.2. Very short-term decision

Name	*Very short-term decision*
ID	*FP1-DEMO-18.8-UC-02*
Description	*In automatic and semi-automatic mode in the case in which the operational plan has to be performed within a couple of minutes the system shall actuate it.*
Related to task/subtask(s)	*Tasks 17.2.8,18.2.8*
Technical Enabler(s)	*TE16, TE17*
Stakeholders	*A TMS*
Goal	*To get a conflict solved in at last a couple of minutes if the operator does not take a decision.*
Demonstration Requirements	*Capacity plan and Track Topology*
FP1 Developed components/functions/methods target of demonstration	*Conflict detection and resolution module*
Other involved components	*A train graph or a timetable viewer user interface*
Expected Demonstration Location	*Virtual: Civitanova-Albacina*
Demonstration storyboard	1. *A conflict with a conflict solution proposal is present on TMS User Interface (UI).* 2. *The conflict should be solved in at last couple of minutes or it remains unsolved, so the TMS Conflict*

	Resolution module forces the solution that is based on the chosen algorithm. 3. The conflict disappears on TMS UI.
Expected Demonstration Date	*June 2026*
Expected evaluation of results	*Evaluated in laboratory with a real plant configuration by end users testing the systems and assessing it.* *The evaluation will be done with attention at the solution quality and user usability experience.*
Exploitation	*MERMEC aims to exploit this CD/CR modules in their controlled lines.* *KER 8*
Responsible partner/person	*Angelo Naselli, MERMEC*
Notes	

7.30.3. Dispatcher constraints entry

Name	*Dispatcher constraints entry*
ID	*FP1-DEMO-18.8-UC-03*
Description	*The TMS Operator sets one or more constraints which are binding for the optimizer.*
Related to task/subtask(s)	*Subtask 17.2.8, 18.2.8*
Technical Enabler(s)	*TE 17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*TMS/TMS Operator*
Goal	*The optimizer takes into account the constraints set by the dispatcher and cannot modify or delete them.*
Demonstration Requirements	*Network data of the Civitanova Albacina TMS area.*
FP1 Developed components/functions/methods target of demonstration	*New TMS Conflict Detection module, new TMS Conflict Resolution module*
Other involved components	*TMS*
Expected Demonstration Location	*Simulated environment based on Civitanova Albacina railway line TMS data*
Demonstration storyboard	1. *The TMS Operator sets a constraint into the system;* 2. *The optimizer cannot remove the constraint defined by the TMS Operator;* 3. *The optimizer must take into account the constraint in the elaborations.*
Expected Demonstration Date	*June 2026*
Expected evaluation of results	*RFI team*
Exploitation	*The expected result is an optimised regulator even in the presence of constraints.*
Responsible partner/person	*Francesco Cirillo, FS/RFI*
Notes	

7.31. Demonstration 18.9 – Performance evaluation of optimisation algorithms for local level traffic management in a single region

7.31.1. Evaluation platform

Name	*Evaluation platform*
ID	*UC-FP1-WP10-60*
Description	*Development of a platform, based on a microscopic simulator, to evaluate the performances of the TMS in a control area*
Related to task/subtask(s)	*Tasks 17.2.3,18.3.2*
Technical Enabler(s)	*TE 17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*TMS/TMS Operator, IM*
Goal	*Develop a platform to evaluate the performances of the TMS in a control area*
Demonstration Requirements	*Input data: simulation model and parameters, optimization algorithms.*
FP1 Developed components/functions/methods target of demonstration	*None*
Other involved components	*Microscopic simulator (OpenTrack)*
Expected Demonstration Location	*Bordeaux – Marseille*
Demonstration storyboard	*1. Acquisition of all the input data: simulation model and parameters, optimization algorithms.* *2. Definition of the features of the prediction and of the parameters of the interfaces between the prediction, the simulator and the optimization algorithms.* *3. Definition and implementation of the evaluation KPIs.*
Expected Demonstration Date	*2026 Q1*
Expected evaluation of results	*The evaluation will be performed by UnivEiffel and SNCF experts. KPIs on train delay measures and travel times will be assessed. The performance of the optimization algorithms will be compared to the ones achieved when applying simple traffic management rules in different contexts.*
Exploitation	*Evaluation platform to be used for the test bed for local*

	TMS evaluation (UC-FP1-WP10-61) *KER 8 - Algorithms and decision support tools for optimised (automated) decisions and support for traffic management*
Responsible partner/person	*UnivEiffel/SNCF*
Notes	

7.31.2. Test bed for local TMS evaluation

Name	*Test bed for local TMS evaluation*
ID	*UC-FP1-WP10-61*
Description	*Performance evaluation of optimisation algorithms for local level traffic management in a single region*
Related to task/subtask(s)	*Subtask 17.2.4, 18.3.2*
Technical Enabler(s)	*TE 17 - "Real-time conflict detection & resolution for main line and optimization"*
Stakeholders	*TMS/TMS Operator, IM*
Goal	*Develop a platform to evaluate the performances of the TMS*
Demonstration Requirements	*Simulation model and parameters, optimization algorithms.*
FP1 Developed components/functions/methods target of demonstration	*None*
Other involved components	*Microscopic simulator (OpenTrack)*
Expected Demonstration Location	*Paris St. Lazare control area*
Demonstration storyboard	1. *Definition of specific deployment parameters (which KPIs for the optimization algorithm and for the evaluation, frequency of the optimization, types of operational decisions).* 2. *Run tests on the evaluation platform to evaluate the algorithm performances.* 3. *If needed, improvement of the optimization algorithms and return to steps 1 and 2 for further evaluation.*
Expected Demonstration Date	*2026 Q1*
Expected evaluation of results	*The evaluation will be performed by UnivEiffel and SNCF experts. KPIs on train delay measures and travel times will be assessed. The performance of the optimization algorithms will be compared to the ones achieved when applying simple traffic management rules in different contexts.*

Exploitation	*KER 8 - Algorithms and decision support tools for optimised (automated) decisions and support for traffic management*
Responsible partner/person	*UnivEiffel/SNCF*
Notes	

8. Demonstrations WS1.3

In chapter 8, all use cases from WS1.3 demonstrations in FP1 MOTIONAL are presented, which gives an overview of the content of the 16 demonstrations expected on this workstream.

8.1. Demonstration 21.2 – MaaS platform for B2B intermodal services (Madrid)

8.1.1. Journey Planning as a B2B intermodal planning

Name	*Journey Planning as a B2B intermodal planning*
ID	*FP1-DEMO-21.2-UC-01*
Description	*TSP provides parts of an itinerary in their transportation domain in order to calculate itineraries which fulfil B2B mobility requests, to provide a journey to a traveller.*
Related to task/subtask(s)	*Task 21.2* *Task 21.4*
Technical Enabler(s)	*TE18, TE19*
Stakeholders	*INDRA, plays the role of technology supplier* *MDM (Metro of Madrid operator), provides journey planning data for mobility services in Madrid region* *HAC (MaaS platform provider), provides the MaaS platform in the Luxembourg region and the OJP interface to accomplish the B2B connection between platforms* *CFL (Luxembourg rail operator), provides journey planning data for mobility services in Luxembourg region*
Goal	*Demonstrate the journey planning service across different transport modes using data from other partner's platforms.*
Demonstration Requirements	*Journey planning data from the different transportation stakeholders.* *Access to the journey planning application (mobile/web).*
FP1 Developed components/functions/methods target of demonstration	*Retailer: Mobile application, Maas platform (Journey Planning Orchestrator)* *TSP: OJP service*
Other involved components	*N/A*
Expected Demonstration Location	*Madrid*
Demonstration storyboard	*1. INDRA and MDM train the travellers on how to use the retailer app and the goals of the demonstration period.* *2. Travellers use the retailer app to plan their journeys during the demonstration period to plan multimodal trips.* *3. Travellers should plan multimodal trips including the following services:* *a. MDM rail services*

	b. *EMT bus services*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Travellers will evaluate the journey planning services provided by the platform, through a questionnaire by the end of the demonstration period. Open feedback will also be collected.*
Exploitation	*KER 9 – Extension of existing ITS standards towards the integration of train with other mobility modes.*
Responsible partner/person	*INDRA – Enrique Jiménez* *MDM – Ioannis Douratsos* *SMO PT – Marco Ferreira* *CFL – Nesrine Chatelkhir*
Notes	*None*

8.1.2. Retailer as ticket vendor selling a product provided by a TSP as distributor via OSDM API

Name	*Retailer as ticket vendor selling a product provided by a TSP as distributor via OSDM API*
ID	*FP1-DEMO-21.2-UC-02*
Description	*It shows the benefits of the use of OSDM for the interoperable distribution of rail and intermodal products. Allowing a retailer to sell 3rd party products via OSDM API.*
Related to task/subtask(s)	*Task 21.4*
Technical Enabler(s)	*TE18, TE19*
Stakeholders	*INDRA, plays the role of technology supplier* *MDM (Metro of Madrid operator), provides journey planning data for mobility services in Madrid region* *DB (MaaS platform provider), provides the MaaS platform and the OSDM interface to accomplish the ticket selling between platforms*
Goal	*Demonstrate the possibility of buying a ticket from another partner through our MaaS app.*
Demonstration Requirements	*Journey planning data from the different transportation stakeholders.* *Access to the journey planning application (mobile/web).*
FP1 Developed components/functions/methods target of demonstration	*Retailer: Mobile application, MaaS platform* *OSDM distributor service*
Other involved components	*N/A*
Expected Demonstration Location	*Madrid*
Demonstration storyboard	1. *INDRA and MDM train the travellers on how to use the retailer app and the goals of the demonstration period.*

	2. *Travellers use the retailer app to plan their journeys during the demonstration period to plan multimodal trips.* 3. *Travellers select and book offer.* 4. *The distributor confirms and finalizes the fulfilment, providing it to the purchaser.* 5. *Travellers should plan multimodal trips including the following services:* a. *MDM rail services*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Travellers will evaluate the journey planning services provided by the platform, through a questionnaire by the end of the demonstration period. Open feedback will also be collected.*
Exploitation	*KER 9 – Extension of existing ITS standards towards the integration of train with other mobility modes.*
Responsible partner/person	*Enrique Jiménez, INDRA* *Ioannis Douratsos, MdM* *Clemens Gantert, DB*
Notes	*None*

8.2. Demonstration 21.3 – Decision support system for passengers allowing efficient multimodal travel planning (Lodz)

Name	*Decision support system allowing efficient multimodal travel planning*
ID	*FP1-DEMO-21.3-UC-01*
Description	*Demonstrate the validity of data centralization through data lake by providing decision support for travel planning and information exchange between B2B partners.*
Related to task/subtask(s)	*Specification: 19.1, 19.2* *Development: 20.1, 20.1.1* *Demonstration: 21*
Technical Enabler(s)	*TE18, TE19*
Stakeholders	*PKP S.A.* *ŁKA* *Railway Service Providers; City Transit Operators; Municipal Independent Operators; Other multimodality operators;*
Goal	*The demonstration aims to illustrate how centralized data, managed through a data lake, can empower stakeholders in their goal to efficiently manage multimodal transport. By providing data lake access,*

	Power BI dashboards and travel planners it will enable high level business decision making.
Demonstration Requirements	*Timetables from operators involved in the region.*
FP1 Developed components/functions/methods target of demonstration	*Data Lake, DSS Dashboard, Travel Planning Application*
Other involved components	*MS Power BI; PostgreSQL; Python; Java; OpenTripPlanner, Angular*
Expected Demonstration Location	*Lodz, Poland*
Demonstration storyboard	*Demonstration will cover three technical use cases. UC-FP1-WP19-09 is realized by individual data updates and accesses by transport operators and users of data lake. It is done with the following schema:* *1. Actor specifies required data and metadata through API* *2. Request is being sent* *3. Data is being verified for changes* *4. Data is being sent* *5. Actor processes the data* *UC-FP1-WP19-10 and UC-FP1-WP19-11 will rely on usage of dashboards, which will allow for generation of necessary reports and views into the processes.*
Expected Demonstration Date	*Q4 2026*
Expected evaluation of results	*Assessment by project team based on surveys among selected users. They will verify data lake stability, effectiveness of the API, functionalities of dashboards.*
Exploitation	*Linked to KER9 - Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*Jerzy Baranowski, PKP S.A.*
Notes	-

8.3. Demonstration 21.4 – MaaS Platform for B2B intermodality including reservation and distribution

8.3.1. B2B Journey Planning and demand analysis platform in Luxembourg

8.3.1.1. Integrating Rail with other transport modes

Name	*Integrating Rail with other transport modes*
ID	*FP1-DEMO-21.4-UC-01*
Description	*This demonstration use case should be focused on*

	demonstrating journey planning functionalities in Luxembourg, integrating rail services with other transport modes.
Related to task/subtask(s)	*Task 21.4*
Technical Enabler(s)	*TE18*
Stakeholders	*HACON, plays the role of technology supplier* *CFL (Luxembourg rail operator), plays the main role on this demonstration coordinating the interaction with local stakeholders in Luxembourg. Provides transportation data related rail and park and ride services.* *FLEX (car sharing operator in Luxembourg), provides access to journey planning services.* *DB (Germany rail operator), provide journey planning data for rail services in Germany.* *Travellers, use the journey planning tools during the demonstration period*
Goal	*Demonstrate the seamless journey planning services across different transport modes and across Luxembourg borders*
Demonstration Requirements	*Journey planning data from the different transportation stakeholders.* *Access to the journey planning application (webapp or mobile).* *Small group of travellers to test the platform.*
FP1 Developed components/functions/methods target of demonstration	*MaaS Platform*
Other involved components	*Retailer app, Transport Service Providers API services*
Expected Demonstration Location	*Luxembourg*
Demonstration storyboard	*1. HACON and CFL train the travellers on how to use the retailer app and the goals of the demonstration period* *2. Travellers use the retailer app to plan their journeys during the demonstration period to plan multimodal trips* *3. Travellers should plan multimodal trips including the following services:* *a. CFL rail services* *b. CFL Park and Ride services* *c. FLEX car-sharing services* *d. DB rail services*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*Travellers will evaluate the journey planning services provided by the platform, through a questionnaire by the end of the demonstration period. Open feedback will also be collected.* *CFL will also evaluate the journey planning services*

	provided by the platform, from the rail operator perspective.
Exploitation	*KER 9 - Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*Marco Ferreira, SMO PT* *Nesrine Chatelkhir, CFL*
Notes	*None*

8.3.1.2. Integrating MaaS platforms (FP6 - Regional Lines)

Name	*Integrating MaaS platforms*
ID	*FP1-DEMO-21.4-UC-02*
Description	*This demonstration use case should be focused on demonstrating journey planning functionalities across different MaaS platforms using B2B interfaces. This use case will be demonstrated integrating the Luxembourg MaaS platform developed in FP1 Motional and a MaaS platform developed in FP6 Future dedicated to a German region, which focused is on the integration of regional lines and demand responsive transportation (DRT).* *The interface between the platforms used the OJP standard as the communication means to achieve distributed journey planning between the platforms.*
Related to task/subtask(s)	*Task 21.4*
Technical Enabler(s)	*TE18, TE19*
Stakeholders	*HACON, plays the role of technology supplier* *CFL (Luxembourg rail operator), plays the main role on this demonstration coordinating the interaction with local stakeholders in Luxembourg. Provides transportation data related rail and park and ride services.* *FLEX (car sharing operator in Luxembourg), provides access to journey planning services.* *ZPS (Regional transport operator), provide journey planning data for rail services in rural region of Germany.* *Travellers, use the journey planning tools during the demonstration period*
Goal	*Demonstrate the seamless journey planning services across different MaaS platforms, allowing the users of the Luxembourg MaaS platform to plan journeys in the region provided by the FP6 project including regional rail service and DRT.*
Demonstration Requirements	*Journey planning data from the different transportation stakeholders.* *Access to the journey planning application (webapp or mobile).* *Small group of travellers to test the platform.* *OJP Interface established between the MaaS platforms.*

FP1 Developed components/functions/methods target of demonstration	*MaaS Platform*
Other involved components	*Retailer app, Transport Service Providers API services*
Expected Demonstration Location	*Luxembourg*
Demonstration storyboard	*1. HACON and CFL train the travellers on how to use the retailer app and the goals of the demonstration period* *2. Travellers use the retailer app to plan their journeys during the demonstration period to plan multimodal trips* *3. Travellers should plan multimodal trips including the following services:* *a. FP6 ZPS regional rail services* *b. FP6 DRT services*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*Travellers will evaluate the journey planning services provided by the platform, through a questionnaire by the end of the demonstration period. Open feedback will also be collected.* *CFL will also evaluate the journey planning services provided by the platform, from the rail operator perspective.*
Exploitation	*KER 9 - Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*Marco Ferreira (SMO PT), Matthias Walter (HACON) (FP6)* *Nesrine Chatelkhir, CFL*
Notes	*The OJP interface will not have an orchestration layer to orchestrate offers from both MaaS system, so even though the regions covered by the MaaS platforms border each other, the system will not allow to perform cross-border journey.*

8.3.1.3. Integrating MaaS platforms (Madrid)

Name	*Integrating MaaS platforms*
ID	*FP1-DEMO-21.4-UC-03*
Description	*This demonstration use case should be focused on demonstrating journey planning functionalities across different MaaS platforms using B2B interfaces. This use case will be demonstrated integrating the Luxembourg MaaS platform developed in FP1 Motional and another MaaS platform developed in the project dedicated to Madrid region, which focused is on the integration of urban services.* *The interface between the platforms used the OJP standard*

	as the communication means to achieve distributed journey planning between the platforms.
Related to task/subtask(s)	*Task 21.4*
Technical Enabler(s)	*TE18, TE19*
Stakeholders	*HACON, plays the role of technology supplier* *CFL (Luxembourg rail operator), plays the main role on this demonstration coordinating the interaction with local stakeholders in Luxembourg. Provides transportation data related rail and park and ride services.* *FLEX (car sharing operator in Luxembourg), provides access to journey planning services.* *INDRA (MaaS platform provider), provide the MaaS platform and the OJP interface to accomplish the B2B connection between platforms* *MdM (Metro of Madrid operator), provide journey planning data for mobility services in Madrid region.* *Travellers, use the journey planning tools during the demonstration period*
Goal	*Demonstrate the seamless journey planning services across different MaaS platforms, allowing the users of the Luxembourg MaaS platform to plan journeys in the Madrid region provided by Indra and MdM.*
Demonstration Requirements	*Journey planning data from the different transportation stakeholders.* *Access to the journey planning application (webapp or mobile).* *Small group of travellers to test the platform.* *OJP Interface established between the MaaS platforms.*
FP1 Developed components/functions/methods target of demonstration	*MaaS Platform*
Other involved components	*Retailer app, Transport Service Providers API services*
Expected Demonstration Location	*Luxembourg*
Demonstration storyboard	*1. HACON and CFL train the travellers on how to use the retailer app and the goals of the demonstration period* *2. Travellers use the retailer app to plan their journeys during the demonstration period to plan multimodal trips* *3. Travellers should plan multimodal trips including the following services:* *a. Metro of Madrid services*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*Travellers will evaluate the journey planning services provided by the platform, through a questionnaire by the end of the demonstration period. Open feedback will also*

	be collected. *CFL will also evaluate the journey planning services provided by the platform, from the rail operator perspective.*
Exploitation	*KER 9 - Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*Marco Ferreira, SMO PT* *Nesrine Chatelkhir, CFL* *Enrique Jiménez, INDRA (Madrid)* *Ioannis Douratsos, MdM (Madrid)*
Notes	*The OJP interface will not have an orchestration layer to orchestrate offers from both MaaS system, so even though the regions covered by the MaaS platforms border each other, the system will not allow to perform cross-border journey.*

8.3.1.4. Forecast Demand information and alerts for the traveller (part of Demonstration 25.3)

Name	*Forecast Demand information and alerts for the traveller*
ID	*FP1-DEMO-25.3-UC-01*
Description	*This demonstration use case should be focused on demonstrating demand forecasting calculations using data collected from the MaaS platform used in Luxembourg. This information should be used to provide a forecast of the occupancy of the vehicles when the traveller is planning their journeys. This use cases should also provide users alerts in case their planned journeys get changes on the occupancy status, becoming overcrowded. The traveller should also be able to re-plan their journey in the case of receiving alerts.*
Related to task/subtask(s)	*Task 25.3*
Technical Enabler(s)	*TE23, TE24, TE27*
Stakeholders	*HACON, plays the role of technology supplier* *CFL (Luxembourg rail operator), plays the main role on this demonstration coordinating the interaction with local stakeholders in Luxembourg. Provides transportation data related rail and park and ride services.* *Travellers, use the journey planning tools during the demonstration period*
Goal	*Demonstrate the possibility to provide demand forecast information to improve journey planning services experience in MaaS platforms.*
Demonstration Requirements	*Journey planning data from the different transportation stakeholders.* *Access to the journey planning application (webapp or*

	mobile). *Small group of travellers to test the platform.* *Travellers subscribed to planned journeys.*
FP1 Developed components/functions/methods target of demonstration	*MaaS Platform, Data analytics platform, ML occupancy models, Alert generation service*
Other involved components	*Retailer app, Transport Service Providers API services*
Expected Demonstration Location	*Luxembourg*
Demonstration storyboard	1. *HACON and CFL train the travellers on how to use the retailer app and the goals of the demonstration period* 2. *Travellers use the retailer app to plan their journeys during the demonstration period to plan multimodal trips, checking the forecast occupancy information on their journey and subscribing to the journey that they want to be alert on possible disruption or status changes* 3. *The travellers should monitor if the subscribed journeys provide disruption or occupancy alerts, on these cases the traveller should be able to check for alternative journeys*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*Travellers will evaluate the quality of the demand forecast information provided through the journey planning services CFL will also evaluate the journey planning services provided by the platform, from the rail operator perspective.*
Exploitation	*KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Marco Ferreira, SMO PT* *Nesrine Chatelkhi, CFL*
Notes	

8.3.1.5. Forecast Demand information and alerts for the transport service provider (part of Demonstration 25.3)

Name	*Forecast Demand information and alerts for the transport service provider*
ID	*FP1-DEMO-25.3-UC-02*
Description	*This demonstration use case should be focused on demonstrating demand forecasting calculations using data collected from the MaaS platform used in Luxembourg.* *This information should be used to provide demand forecast to the transport service providers in the form of a dashboard with detailed information or alerts.* *This information can then be used for resource planning,*

	optimize operations efficiency, adjust pricing or to collaborate with other modes of transport do adjust offers to the demand.
Related to task/subtask(s)	*Task 25.3*
Technical Enabler(s)	*TE23, TE24, TE27*
Stakeholders	*HACON, plays the role of technology supplier* *CFL (Luxembourg rail operator), plays the main role on this demonstration coordinating the interaction with local stakeholders in Luxembourg. Provides transportation data related rail and park and ride services.*
Goal	*Demonstrate the possibility to provide demand forecast information to a service provider to improve customers journeys experience.*
Demonstration Requirements	*Journey planning data from transportation stakeholders. Small group of employees from a transport service provider to test the platform.*
FP1 Developed components/functions/methods target of demonstration	*MaaS Platform, Data analytics platform, ML occupancy models, Alert generation service, Data analytics dashboard*
Other involved components	*Transport Service Providers API services*
Expected Demonstration Location	*Luxembourg*
Demonstration storyboard	*1. HACON and CFL train the test users on how to use the data analytics dashboard and the goals of the demonstration period* *2. The test users will test the data analytics dashboard evaluating the quality of the data provided and how they can improve the operations and customers experience using the provided information*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*CFL will evaluate the quality of the demand forecast information provided through the data analytics dashboard journey planning services.*
Exploitation	*KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Marco Ferreira, SMO PT* *Nesrine Chatelkhi, CFL*
Notes	

8.3.1.6. Exchange of Forecast Demand information between transport service providers (part of Demonstration 25.3)

Name	*Forecast Demand information and alerts for the transport service provider*
ID	*FP1-DEMO-25.3-UC-02*

Description	*This demonstration use case should be focused on demonstrating demand forecasting calculations using data collected from the MaaS platform used in Luxembourg.* *This information should be used to provide demand forecast to the transport service providers in the form of a dashboard with detailed information or alerts.* *This information is private and each transport provider usually only have access to his data.* *On this use case the transport service providers have the option to share their demand forecast information with other transportation stakeholders, so that we can have a more coordinated management of the services available to the traveller.*
Related to task/subtask(s)	*Task 21.4*
Technical Enabler(s)	*TE23, TE24*
Stakeholders	*HACON, plays the role of technology supplier* *CFL (Luxembourg rail operator), plays the main role on this demonstration coordinating the interaction with local stakeholders in Luxembourg. Provides access to demand forecast data.* *FLEX (car sharing operator in Luxembourg), Provides access to demand forecast data.*
Goal	*Demonstrate the possibility to exchange demand forecast information between transport service provider, in order to improve the alignment of services according to the forecasted demand. The operational changes implementation is external to the tools provided in this demonstration.*
Demonstration Requirements	*Availability of demand forecast data from the transport service providers.* *Small group of employees from two transport service provider to test the platform.*
FP1 Developed components/functions/methods target of demonstration	*Data analytics platform, Data analytics dashboard*
Other involved components	
Expected Demonstration Location	*Luxembourg*
Demonstration storyboard	*1. HACON and CFL train the test users on how to use the data analytics dashboard consulting other transport service providers data, and the goals of the demonstration period* *2. The test users will test the data analytics dashboard evaluating the quality of the data provided and how they can improve the operations and customers experience using the provided information*

	3. *The test users should also guarantee that data privacy and security is not compromised*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*CFL and FLEX will evaluate the quality of the demand forecast information provided through the data analytics dashboard journey planning services. It should also be evaluated the possible improvements to operations and that the data privacy and security is under their control.*
Exploitation	*KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Marco Ferreira, SMO PT* *Nesrine Chatelkhi, CFL*
Notes	

8.3.2. B2B reservation and distribution platforms in Sweden and Germany

Name	*Retailer as ticket vendor selling a product provided by a TSP as distributor via OSDM API*
ID	*FP1-DEMO-21.4-UC-04*
Description	*It shows the benefits of the use of OSDM for the interoperable distribution of rail and intermodal products. Allowing a retailer to sell 3rd party products via OSDM API.*
Related to task/subtask(s)	*20.1.1*
Technical Enabler(s)	*TE19*
Stakeholders	*SJ using SQILLS as OSDM provider to enable DB as OSDM consumer to sell combined products via the DB Retail Application (Mobile or Web). Indirect involvement: tariff data providers (OSDM offline data) to cover additional routes beyond DBUIC as provider of consolidated timetable data to SJ and DB. Alternatively: SJ using SQILLS as OSDM consumer to enable SJ as OSDM consumer to sell combined products with DB acting as OSDM provider of DB products including local traffic. Indirect involvement: tariff data providers (OSDM offline data) to cover additional routes beyond DBUIC as provider of consolidated timetable data to SJ and DB*
Goal	*The main objective or goal of the demonstration the use of OSDM to sell products of multiple providers for a customer journey.*
Demonstration Requirements	*The OSDM connections between the test systems of SJ and DB need to be set up.* *SJ consuming OSDM API of DB* *DB consuming OSDM API of SJ*

	Test systems should have a data version close to production.
FP1 Developed components/functions/methods target of demonstration	*DB components providing the OSDM API* *DB components consuming OSDM API and integrating the offers in the DB booking flow.* *SJ components providing the OSDM API* *SJ components consuming OSDM API and integrating the offers in the SJ booking flow.*
Other involved components	*DB distribution system* *SJ distribution system*
Expected Demonstration Location	*Via MS Teams*
Demonstration storyboard	*SJ as Consumer* 1. *customer [enter timetable search for journey] [ask for offers]* 2. *SJ [evaluate the timetable and ask for offers internally and at DB] [retrieve offers for the customer]* 3. *DB [find offers for the journey][provide offers]* 4. *customer [select offer and prebook] [get a prebooking]* 5. *SJ [prebook SJ part internally and ask for prebooking at DB] [retrieve prebooking]* 6. *DB [prebook offer][provide prebooking]* 7. *customer [confirm and pay] [payment at SJ]* 8. *SJ [handle payment]* 9. *SJ [confirm SJ part internally and ask for confirmation at DB] [retrieve booking]* 10. *DB [confirms booking][confirmed booking]* 11. *SJ [prepare fulfilments of internal parts and ask for fulfilments] [retrieve fulfilments]* 12. *DB [provide fulfilment(s)][fulfilments]* 13. *SJ [hand fulfilments to the customer]* *DB as Consumer* 1. *customer [enter timetable search for journey] [ask for offers]* 2. *DB [evaluate the timetable and ask for offers internally and at SJ] [retrieve offers for the customer]* 3. *SJ [find offers for the journey][provide offers]* 4. *customer [select offer and prebook] [get a prebooking]* 5. *DB [prebook DB part internally and ask for prebooking at SJ] [retrieve prebooking]* 6. *SJ [prebook offer][provide prebooking]* 7. *customer [confirm and pay] [payment at DB]*

	8. DB [handle payment] 9. DB [confirm DB part internally and ask for confirmation at SJ] [retrieve booking] 10. SJ [confirms booking][confirmed booking] 11. DB [prepare fulfilments of internal parts and ask for fulfilments] [retrieve fulfilments] 12. SJ [provide fulfilment(s)][fulfilments] 13. DB [hand fulfilments to the customer]
Expected Demonstration Date	*11/2025*
Expected evaluation of results	*Evaluation of the test tickets received.*
Exploitation	*KER 9 - Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*Jan Möllmann, DB AG*
Notes	-

8.4. Demonstration 21.5 – Deployment of financial services (revenue apportionment and settlement) in a multimodal environment

8.4.1. Financial Services, Mobility Offer Apportionment

Name	*Financial Services, Mobility Offer Apportionment*
ID	*FP1-DEMO-21.5-UC-01*
Description	*Demonstration within a MaaS context of the distribution of the revenue collected by a retailer to stakeholders delivering the service (i.e. TSP, Transport Service Provider). Test data includes several mobility modes: Main Line, Regional Transport as well as non-transport service.*
Related to task/subtask(s)	*Task 21.5* *Involved technical use cases:* *UC-FP1-WP19-04 Financial Services. Mobility Offer apportionment* *UC-FP1-WP19-06 Financial Services. Distributed Ledger*
Technical Enabler(s)	*TE 18*
Stakeholders	*GTSD, plays the role of technology supplier and provides the testing environment*
Goal	*Demonstrate configurability and efficiency of the proposed revenue apportionment platform that delivers a key B2B Service to Mobility Providers.*
Demonstration Requirements	*Availability of the Financial Platform in Public Cloud. Data configuration including Main Line train tickets, regional train ticket, urban transport tickets and non-transport tickets.*

FP1 Developed components/functions/methods target of demonstration	*ASP Financial Platform, Distributed Ledger Interface*
Other involved components	*Test Retail App and as an alternative Web Shop. Qortal as distributed Ledger*
Expected Demonstration Location	*Platform is used for test only. No real revenue management. Main Line is the Eurostar network, regional and urban transport network is based on Paris area*
Demonstration storyboard	*1. Customer: Opens the App or the Web shop, purchases a combo including multiple tickets and checks out* *2. Financial Platform: Receives the resulting transactions, does the revenue apportionment.* *3. Steps 1 and 2 repeated several times with different Customers and purchase options* *4. Financial Platform: Proceeds to the settlement (triggered either manually or automatically). The resulted fund transfers are visible* *5. Distributed Ledger Interface. Resulting settlements records are anchored in the distributed ledger. Transactions are created between participants. On a given node, financial movements are checked.*
Expected Demonstration Date	*M40-M46*
Expected evaluation of results	*Testers will evaluate the accuracy of the apportionment and settlement, using the Financial Platform portal and the Ledger*
Exploitation	*KER 9. Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*GTSD*
Notes	*There can be multiple test cases depending on the purchase options*

8.4.2. Financial Services, Pay-As-You-Go Apportionment

Name	*Financial Services, Pay-As-You-Go Apportionment*
ID	*FP1-DEMO-21.5-UC-02*
Description	*Demonstration of the logic for distributing transport revenue within the context of the usage of a Mobility Account: travellers own a Mobility account allowing to travel over multiple mobility modes. They use an ID (transport card or equivalent) when entering, leaving or using transport modes. Travels are collected by Mobility Providers, pushed to the MAP (Mobility Account Provider) platform that consolidates travels and redistributes*

	revenue. Within the context of the demonstration, the ASP Financial Platform manages the Mobility Account as well as the revenue distribution. *Test data includes several mobility modes: Main Line, Regional Transport.*
Related to task/subtask(s)	*Task 21.5* *Involved technical use cases:* *UC-FP1-WP19-05 Financial Services. Pay as-you-go apportionment* *UC-FP1-WP19-06 Financial Services. Distributed Ledger*
Technical Enabler(s)	*TE 18*
Stakeholders	*GTSD, plays the role of technology supplier and provides the testing environment*
Goal	*Demonstrate configurability and efficiency of the proposed revenue apportionment platform that delivers a key B2B Service to Mobility Providers.*
Demonstration Requirements	*Availability of the Financial Platform in Public Cloud.* *Data configuration including Main Line transportation network and Regional + Urban transportation network.* *Travels are simulated using an interactive network map as well as configurable scenarios.*
FP1 Developed components/functions/methods target of demonstration	*ASP Financial Platform, Distributed Ledger Interface*
Other involved components	*Travel Simulator*
Expected Demonstration Location	*Platform is used for test only. No real revenue management. Main Line is the Eurostar network, regional and urban transport network is based on Paris area*
Demonstration storyboard	1. *Travel simulation using real network configuration: Main Line and Regional Network* 2. *Financial Platform: Receives the resulting transactions, does the consolidation against the Mobility Account and the revenue apportionment.* 3. *Steps 1 and 2 repeated several times with different Customers and purchase options* 4. *Financial Platform: Proceeds to the settlement (triggered either manually or automatically). The resulted fund transfers are visible* 5. *Distributed Ledger Interface. Resulting settlements records are anchored in the distributed ledger.*

	Transactions are created between participants. On a given node, financial movements are checked.
Expected Demonstration Date	*M40-M46*
Expected evaluation of results	*Testers will evaluate the accuracy of the apportionment and settlement, using the Financial Platform portal and the Ledger*
Exploitation	*KER 9. Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*GTSD*
Notes	*There can be multiple test cases depending on travels.*

8.4.3. Financial Services, Processing of CEN NeTEx Fare Data

Name	*Financial Services, Processing of CEN NeTEx Fare Data*
ID	*"FP1-DEMO-21.5-UC-03*
Description	*This demonstration is connected with FP1-DEMO-21.5-UC-01. It shows the distribution by the ASP (Maas Financial Platform) of the transport revenue collected by a distributor or retailer. However, instead of using front-end simulators (App or Web Portal), the transaction feed is made NeTEx part 3 Sales Transactions making the ASP service available to any distributor/retailer provided it implements CEN Transactions.*
Related to task/subtask(s)	*Task 21.5* *Involved technical use cases:* *UC-FP1-WP19-07 Financial Services. Processing of CEN NeTEx Fare data* *UC-FP1-WP19-06 Financial Services. Distributed Ledger*
Technical Enabler(s)	*TE 18, TE19*
Stakeholders	*GTSD, plays the role of technology supplier and provides the testing environment.* *A simulator is used for generating NeTEx transactions. Optionally, transactions generated by a distribution channel, when available could be used.*
Goal	*Demonstrate the capacity of the proposed revenue apportionment platform to process CEN transactions*
Demonstration Requirements	*Availability of the Financial Platform in Public Cloud. Data configuration including Main Line train tickets, regional train ticket, urban transport tickets and non-transport tickets* *CEN NeTEx adapter.*
FP1 Developed components/functions/methods target of demonstration	*ASP Financial Platform, Distributed Ledger Interface, CEN NeTEx adapter*
Other involved components	*CEN Transaction generator*

Expected Demonstration Location	*Platform is used for test only. No real revenue management. Main Line is the Eurostar network, regional and urban transport network is based on Paris area*
Demonstration storyboard	1. *Off-line preparation of the context with the operation of sales and the generation of CEN Transactions.* 2. *Transmission of CEN Transactions* 3. *Financial Platform: Receives the resulting transactions, does the revenue apportionment.* 4. *Steps 1 to 3 repeated several times with different Customers and purchase options* 5. *Financial Platform: Proceeds to the settlement (triggered either manually or automatically). The resulted fund transfers are visible* 6. *Distributed Ledger Interface. Resulting settlements records are anchored in the distributed ledger. Transactions are created between participants. On a given node, financial movements are checked.*
Expected Demonstration Date	*M40-M46*
Expected evaluation of results	*Testers will evaluate the processing of CEN Transactions and the accuracy of the apportionment and settlement, using the Financial Platform portal and the Ledger*
Exploitation	*KER 9. Extension of existing ITS standards towards the integration of train with other mobility modes*
Responsible partner/person	*GTSD*
Notes	*There can be multiple test cases and optionally the use of an external distribution channel.*

8.5. Demonstration 21.6 – Stand-alone version of a Seamless Multi-Modal Management Framework

8.5.1. Disruption Management & Standardized Interfaces

Name	*Disruption Management & Standardized Interfaces*
ID	*FP1-DEMO-21.6-UC-01*
Description	*Demonstrate the implementation of a standardized interface, adhering to the SIRI SX standard protocol, for exchanging disruption and mitigation strategy information.*
Related to task/subtask(s)	*Task 21.6*
Technical Enabler(s)	*TE 18, 19*
Stakeholders	*Hitachi Rail plays the role of standardized Data Provider to*

	a Data Consumer
Goal	*To facilitate interoperability, this demonstration use case will develop a functionality to acquire and process incident message data (event information and mitigation advice) and transform it into a message formatted according to the SIRI SX standard interface for seamless integration and to allow a proper information to travellers, operators and/or external systems.*
Demonstration Requirements	*Reception of incident message updates from external systems* *The selection of a mitigation strategy by an Operator from the Disruption Management HMI*
FP1 Developed components/functions/methods target of demonstration	*Disruption Management System*
Other involved components	*Integration Layer*
Expected Demonstration Location	*Virtual demonstration based on Railway line from Foggia to Bari and then to Lecce in Puglia region in Italy.*
Demonstration storyboard	*1. The data processing component of the Disruption Management System is subscribed to external systems, i.e. Integration Layer, to receive messages.* *2. The data processing component of the Disruption Management System receives from the Integration Layer the incident message.* *3. The data processing component of the Disruption Management System creates a SIRI SX message with the incident information.* *4. The SIRI SX message will be sent to a Data Consumer (if available) for validation.* *5. If the Railway Service Provider chooses to implement a mitigation strategy, the data processing component of the Disruption Management System updates the SIRI SX message with details on the mitigation strategy.* *6. The SIRI SX message will be sent to a Data Consumer (if available) for validation.*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Searching for a partner to validate the generated SIRI SX message (if not available another validator will be used).*
Exploitation	*KER9 - Extension of existing ITS standards towards the integration of train with other mobility modes*

Responsible partner/person	*Pietro Calcagno, STS*
Notes	

8.6. Demonstration 23.1 – PRM Assistance and hands-free solutions that allows seamless validation (Madrid)

8.6.1. Frictionless validation

Name	*Frictionless validation*
ID	*FP1-DEMO-23.1-UC-19*
Description	*A user is able to validate a ticket without showing any visual ticket validation equipment facilitating the access to public transport.*
Related to task/subtask(s)	*Task 23.1*
Technical Enabler(s)	*TE20, TE21*
Stakeholders	*INDRA, plays the role of technology supplier* *MDM (Metro of Madrid operator), plays the role of transport operator, and the demonstration will be done on one of their stations*
Goal	*Demonstrate the technology UWB and BLE applied to a gate that will successfully make a seamless validation of a ticket without any physical interaction with the validation equipment.*
Demonstration Requirements	*Trip ticket previously purchased* *Access to the application (mobile/web)*
FP1 Developed components/functions/methods target of demonstration	*Validation equipment* *MaaS app*
Other involved components	*Ticketing system*
Expected Demonstration Location	*Madrid*
Demonstration storyboard	1. *INDRA trains the users on how to use the mobile application and buy a ticket that will later be validated seamlessly* 2. *The test users will approach the platform and after the validation equipment detects the mobile app, the ticket will be validated*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Travellers will evaluate the frictionless validation experience, through a questionnaire by the end of the demonstration period. Open feedback will also be collected.*
Exploitation	*KER 10 – Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management.*

Responsible partner/person	*Enrique Jiménez, INDRA* *Ioannis Douratsos, MdM*
Notes	*None*

8.6.2. Indoor Guidance

Name	*Indoor Guidance*
ID	*FP1-DEMO-23.1-UC-20*
Description	*The user receives information of the map of the station and its indoor position and wayfinding inside the station facilitating the access of PRM to public transport.*
Related to task/subtask(s)	*Task 23.1*
Technical Enabler(s)	*TE20, TE21*
Stakeholders	*INDRA, plays the role of technology supplier* *MDM (Metro of Madrid operator), plays the role of transport operator, and the demonstration will be done on one of their stations*
Goal	*Demonstrate that a PRM user can be successfully indoor located through the station to reach the destination desired.*
Demonstration Requirements	*Access to the application (mobile/web)*
FP1 Developed components/functions/methods target of demonstration	*MaaS platform* *MaaS app* *Indoor Guidance Tool*
Other involved components	*Wireless devices in stations*
Expected Demonstration Location	*Madrid*
Demonstration storyboard	*1. INDRA trains the test users to use the mobile application and how to use the indoor guidance tool and search for the destiny required* *2. The application will show the indications on the map that appears on the screen in order to track the user until it reaches the destiny required*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Travellers will evaluate the indoor guidance experience, through a questionnaire by the end of the demonstration period. Open feedback will also be collected.*
Exploitation	*KER 10 – Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management.*
Responsible partner/person	*Enrique Jiménez, INDRA* *Ioannis Douratsos, MdM*
Notes	*None*

8.6.3. Account based ticketing

Name	*Account based ticketing*
ID	*FP1-DEMO-23.1-UC-21*
Description	*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 the number of taps calculates the fare, which is charged to the passenger during or post journey. This means users no longer need to buy a ticket and can benefit from best fare policies.*
Related to task/subtask(s)	*Task 23.1*
Technical Enabler(s)	*TE20, TE21*
Stakeholders	*INDRA, plays the role of technology supplier* *MDM (Metro of Madrid operator), plays the role of transport operator, and the demonstration will be done on one of their stations*
Goal	*Demonstrate that a user can travel without buying a ticket, and the fee will be charged when the journey has finished.*
Demonstration Requirements	*Access to the application (mobile/web)*
FP1 Developed components/functions/methods target of demonstration	*ABT*
Other involved components	*Account manager* *Fare manager* *Transaction manager*
Expected Demonstration Location	*Madrid*
Demonstration storyboard	*1. INDRA explains to the users the process of calculating the price for the trip at the end of the day or when the complete trip is finished* *2. To achieve the final fare, the users must tap each time they enter a station or change transport mode, therefore, the token associated to each account will be registered* *3. The calculation of the final fare will be done by the back office*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Travellers will evaluate the ABT experience, through a questionnaire by the end of the demonstration period. Open feedback will also be collected.*
Exploitation	*KER 10 – Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management.*
Responsible partner/person	*Enrique Jiménez, INDRA* *Ioannis Douratsos, MdM*
Notes	*None*

8.7. Demonstration 23.2 - Improved informational system, which encompasses travellers (specially focused on PRM) information of incidents, accessibility and other relevant issues that can help to improve travellers experience (Málaga)

8.7.1. Totem T-Ais. 1

Name	*Totem T-Ais. 1* *Specific spot for people with visual disability.*
ID	*UC-FP1-WP19-12*
Description	*Totem receives information from transportation information sources, offering specific information by loudspeaker and magnetic induction loop or by headset to people, which will rely on the touch screen for interaction. This use case focuses on blind people.*
Related to task/subtask(s)	*T19.3, T22.1 (Subtask 22.1.2), T23.2, 19.5*
Technical Enabler(s)	*TE20*
Stakeholders	*ADIF FM*
Goal	*Accessible and personalized information for people with visual disability*
Demonstration Requirements	*Registered INECO Totem T-Ais research project.* *To have the access of data that provides this information: PTO and Rail Administrator's data sources.* *Data from Metro of Malaga (PTO)* *Data from Administrator.* *A 3.5 jack headset is available if the user wants privacy in the information obtained from the totem.* *The user has the ACCESSROBOT application installed on their mobile phone, which allows them to link up with the accessible robot.* *The user has installed on his mobile phone and is registered in the application "Guiding Accessible Intelligent Tool".*
FP1 Developed components/functions/methods target of demonstration	*Totem T-Ais System.* *Accessible user interface for blind people due to compliance with the UNE-EN 301549:2022 standard on 'Accessibility requirements for ICT products and services'.* *Calculation of accessible routes within the station based on available accessibility information.*
Other involved components	*Integration of "Guiding Accessible Software" with TSP and Rail Administrator Information Platforms.*

	Integration of "Guiding Accessible Software" with Accessible Robot. *Integration of "Guiding Accessible Software" with "Guiding Accessible Intelligent Tool".*
Expected Demonstration Location	*Málaga María Zambrano Station*
Demonstration storyboard	*Locate Totem in an easy to reach and accessible place inside the station.* *Accessible information about journeys and accessible routes to different places at the station will be shown for people with visual disability in this way:* *1. User locates the totem by sound and reaches it.* *2. The totem is in standby mode.* *3. User touches bottom left corner of touch screen to activate screen narrator.* *4. Totem offers options of the services available at the station to the user via speakerphone or headset.* *5. User selects the service of interest by interacting with the touch screen as prompted by the on-screen narrator.* *6. Totem calculates accessible route from the totem to the location of the chosen service (destination), and offers the user the accessibility aid systems within the station: accessible robot and "Guiding Accessible Intelligent Tool".* *7. Interacting with the touch screen following the indications of the on-screen narrator, user selects accessibility aid system to reach the destination.* *8. Totem provides on-screen narrator prompts to use accessibility aid system.* *9. User accesses the accessibility aid that allows him/her to walk to the destination.* *10. Totem returns to standby mode.*
Expected Demonstration Date	*April 2025*
Expected evaluation of results	*How?* *A visual disability person is able to follow the demonstration storyboard without assistance.* *Verification by visual disability people under the supervision of team members.*
Exploitation	*KER 10* - Services for inclusive rail based mobility including assistive tools, hands-free experience, passenger flow management
Responsible partner/person	*ADIF FM and Metro de Málaga*
Notes	*N/A*

8.7.2. Totem T-Ais. 2

Name	*Totem T-Ais. 2* *Specific spot for people with hearing impairment, PRM, motor disability, cognitive impairment and language misunderstanding.*
ID	*UC-FP1-WP19-13*
Description	*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.* *This use case focuses on people with hearing impairment, PRM, motor disability, cognitive impairment and language misunderstanding.*
Related to task/subtask(s)	*T19.3, T22.1 (Subtask 22.1.2), T23.2*
Technical Enabler(s)	*TE20*
Stakeholders	*ADIF FM*
Goal	*Accessible and personalized information for people with disabilities other than visual impairment.*
Demonstration Requirements	*Registered INECO Totem T-Ais research project.* *To have the access of data that provides this information: PTO and Rail Administrator's data sources.* *Data from Metro of Malaga (PTO)* *Data from Administrator.* *A 3.5 jack headset is available if the user wants privacy in the information obtained from the totem.* *The user has installed on his mobile phone and is registered in the application "Guiding Accessible Intelligent Tool".*
FP1 Developed components/functions/methods target of demonstration	*Totem T-Ais System.* *Accessible user interface for people with hearing impairment, PRM, motor disability, cognitive impairment and language misunderstanding, due to compliance with the UNE-EN 301549:2022 standard on 'Accessibility requirements for ICT products and services'.* *Calculation of accessible routes within the station based on available accessibility information.*
Other involved components	*Integration of "Guiding Accessible Software" with TSP and Rail Administrator Information Platforms.* *Integration of "Guiding Accessible Software" with Accessible Robot.* *Integration of "Guiding Accessible Software" with "Guiding Accessible Intelligent Tool".*
Expected Demonstration	*Málaga María Zambrano Station*

Location	
Demonstration storyboard	*Locate Totem in an easy to reach and accessible place inside the station.* *Accessible information about journeys and accessible routes to different places at the station will be shown in this way:* *1. User locates the totem by visualising its lighting system and top information display or by sound, and reaches it.* *2. The totem is in standby mode.* *3. User touches the touch screen or an ergonomic button to activate the system.* *4. Totem offers options of the services available at the station to the user via the touch screen.* *5. User selects the service of interest by interacting with the touch screen or the ergonomic buttons.* *6. Totem calculates accessible route from the totem to the location of the chosen service (destination) and offers the user the accessibility aid systems within the station: accessible robot and "Guiding Accessible Intelligent Tool".* *7. Interacting with the touch screen or ergonomic buttons, user selects accessibility aid system to reach the destination.* *8. Totem offer touch screen prompts to use accessibility aid system.* *9. User accesses the accessibility aid that allows him/her to walk to the destination.* *10. Totem returns to standby mode.*
Expected Demonstration Date	*April 2025*
Expected evaluation of results	*PRM, motor disability and cognitive impairment people are able to follow the demonstration storyboard without assistance.* *Verification by PRM, motor disability and cognitive impairment people under the supervision of team members.*
Exploitation	*KER 10 - Services for inclusive rail based mobility including assistive tools, hands-free experience, passenger flow management*

Responsible partner/person	*ADIF FM and Metro de Málaga*
Notes	*N/A*

8.7.3. Gap Filler

Name	*Gap Filler to minimise the effects of the horizontal gap on platform accessibility*
ID	*UC-FP1-WP19-14*
Description	*Fixed platform edge extension to reduce horizontal gap between platform and train.*
Related to task/subtask(s)	*T19.5, T22.1 (Subtask 22.1.2), T22.3*
Technical Enabler(s)	*TE22*
Stakeholders	*ADIF FM, Relevant PRM associations in the area, travellers.*
Goal	*Reducing the horizontal gap between platform and rolling stock and facilitating the transition of passengers between train and platform. Resolution of interfaces between infrastructure and rolling stock.*
Demonstration Requirements	*Existing information: Topographic data of the station, rolling stock gauges, track detailed description, analysis of platforms, technical standards and information about rail stock using the platform.* *Development phase output report: detailed description of the gap filler and location.* *Gap filler fabricated and physically available in the station.* *Staff for installing the element.* *The reduction of horizontal gap measured for each type of train that uses the platform.*
FP1 Developed components/functions/methods target of demonstration	*Physical element identified as gap filler*
Other involved components	*Gap filler, Railway Station, Technical Integration*
Expected Demonstration Location	*El Puig Station (Valencia, Spain)*
Demonstration storyboard	*1. The gap filler will be installed by staff selected by ADIF FM in El Puig Station.* *2. It will be in use in the selected platforms for a certain amount of time with station staff reviewing the daily use of it and how travellers have received this innovation.* *3. The reduction of horizontal gap will be measured for each type of train that stops at the platform.*
Expected Demonstration Date	*September 2025*
Expected evaluation of results	*Measurements of how the horizontal gap is reduced depending on the type of rail stock in the platform.*

Exploitation	*KER 10 - Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management*
Responsible partner/person	*Victorya Guryn, ADIF FM*
Notes	*N/A*

8.7.4. Dynamic signage (Gobo)

Name	*Dynamic signage (Gobo) for the traveller with or without disabilities*
ID	*UC-FP1-WP19-15*
Description	*Adjustable Gobo projection system to provide real time information about the location of the accessible Rolling stock door / carriage along the platform*
Related to task/subtask(s)	*T19.5, T22.1 (Subtask 22.1.2), T23.2, 22.3*
Technical Enabler(s)	*TE22*
Stakeholders	*ADIF FM, Relevant PRM associations in the area, travellers*
Goal	*Important accessible information showed at certain places.*
Demonstration Requirements	*Existing information: Rollingstock type and possible locations of accessible carriages.* *Development phase output report: technical information of gobos and their locations.* *Gobos.* *Staff for installing the element.* *Passengers using the specific platform.* *PRM association that provides feedback*
FP1 Developed components/functions/methods target of demonstration	*New use for Gobos to solve a changing situation on platforms (different possible stops and Rollingstock arrangements)*
Other involved components	*Gobo , Railway Station, Technical Integration*
Expected Demonstration Location	*Málaga María Zambrano Station (Málaga, Spain)*
Demonstration storyboard	1. *Gobos will be installed by staff selected by ADIF FM in Málaga María Zambrano Station.* 2. *It will be in use in the selected platform for a certain amount of time with station staff reviewing the daily use of it and how travellers have received this innovation.* 3. *A relevant PRM association of the area will be invited to experience and give feedback on the use of Gobos.*
Expected Demonstration Date	*January 2025*
Expected evaluation of results	*Positive/Negative feedback by station staff referring travellers experience and feedback by relevant PRM*

	association.
Exploitation	*KER 10 - Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management*
Responsible partner/person	*ADIF FM*
Notes	*N/A*

8.7.5. Accessible Robot

Name	*Accessible Robot*
ID	*UC-FP1-WP19-16*
Description	*Guiding of people with disabilities inside of the multimodal railway station*
Related to task/subtask(s)	*T19.3, T22.1 (Subtask 22.1.2), T23.2*
Technical Enabler(s)	*TE20*
Stakeholders	*ADIF FM*
Goal	*Support with displacement and orientation at the station of the traveller with disabilities or other special needs towards the correct spot in the station.*
Demonstration Requirements	*Four (4) electrical outlets in 4 different locations, spread throughout the station.* *A place to set up a table or small stand with a roll-up to attend to the users summoned for the tests. The roll-up is standard to warn that there is a robot under test.* *To have the access of data that provides Rail Administrator's.* *The user has the ACCESSROBOT application installed on their mobile phone, which allows them to link up with the accessible robot in some situations (visual disability).* *Registered INECO Totem T-Ais research project if the demonstration starts from the totem pole.* *"Assistance Integrative Mobile App" installed on the user's mobile phone if the demonstration starts at a location other than the totem pole.*
FP1 Developed components/functions/methods target of demonstration	***Service Booking Module:*** ***- Connection Tests of 'Assistance Integrative Mobile App' with ACCESSROBOTS Booking System****:* *The 'Assistance Integrative Mobile App' will give access to the ACCESSROBOTS booking system. The ACCESSROBOTS*

	booking system will register the user, their request and confirm the availability of the service for the date, start and end time of the escort service. At the time of booking the user will also be able to choose which points of interest within the station he/she wishes to visit, defining an itinerary of stops, from the meeting point to the final destination at the entrance of his/her platform. ***- Connection Tests of Totem T-Ais with ACCESSROBOTS Booking System***: *The user will be able to access the ACCESSROBOTS booking system also via Totem.* ***- Connection Tests from ACCESSROBOTS to the Administrator's information system***: *This connection will allow ACCESSROBOTS to determine the final destination point of the escort, which will be the platform from which the passenger's train departs and if there are any incidents in the passenger's journey timetable.* ***Autonomous Navigation Module:*** ***- Autonomous navigation of the robot to the meeting point with the traveller.*** *The robot shall move autonomously and at the time defined in the reservation, from the charging station to the meeting point with the traveller.* ***Locating and linking the user with the assigned robot:*** *Tests will be carried out on the user-robot linking process. Depending on the different disability profiles of each traveller, this pairing will be carried out in different ways, which are the subject of these tests:* *- Tests of linking from the robot interface with a numerical locator.* *- Linking tests from the robot interface with a graphic locator based on pictograms.* *- Linking tests from the user's own personal device.* • ***- Guidance modes:*** *Navigation tests shall be conducted in two modes:* *a. User follows the robot to be guided.* *b. User holds on to the robot to be guided.* ***- Navigation:*** *The following validations will be carried out during navigation:*

	- The robot makes stops at the reserved intermediate points of interest. *- The robot stops and resumes walking from the robot tablet or from the user's mobile device with the start and pause buttons.* *- The robot crosses the safety arch through a pre-defined and pre-configured passage.* *- At the time dictated by the Administrator platform, the robot accompanies the user to the head of the platform where their train is located.* ***- End of accompaniment:*** *Tests shall be aimed at validating that the robot returns to its loading point autonomously.*
Other involved components	*N/A*
Expected Demonstration Location	*Málaga María Zambrano Station*
Demonstration storyboard	***For Service Booking:*** ***- From Assistance Integrative Mobile App:*** *1. User accesses the robot reservation functionality.* *2. Assistance Integrative Mobile App gives access to the ACCESSROBOTS Booking System.* *3. User registers with ACCESSROBOTS and selects date and time to receive the escort service. Also at this time, the user chooses which points of interest within the station to visit by defining an itinerary of stops, from the meeting point to the final destination.* *4. ACCESSROBOTS will confirm the reservation with a locator, or will inform that there is no availability for that date.* ***- From Totem T-Ais:*** *1. User interacts with the Totem and selects a destination.* *2. User requests service from the robot to go to the selected destination.* *3. Totem will confirm the booking with a pager and offer directions via touch screen or on-screen narrator (depending on the user's disability), to use the accessible robot, or inform that there is no availability at that time.* ***For Autonomous Navigation:***

	- From mobile phone: *1. The robot shall move autonomously and at the time defined in the reservation, from the charging station to the meeting point with the passenger.* *2. User meets the robot at the meeting point and accesses the ACCESSROBOTS application.* *3. Linking the user with the assigned robot: Depending on the different disability profiles of each traveller, this linking will be carried out in different ways, which are the subject of these tests:* *- User enters numerical locator from the Tablet of the robot.* *- User displays pictogram-based graphic locator to the robot's Tablet.* *- User activates the start of the service from the ACCESSROBOTS application.* *4. User follows or holds on to the robot to be escorted.* *5. The robot starts the navigation. The robot makes stops at the reserved intermediate points of interest.* *6. User restarts the robot after each stop or generates new stops from the robot's tablet or mobile device with the start and pause buttons.* *7. The robot takes the user to his destination and ends the service.* *8. The robot returns to its charging point autonomously.* ***- From Totem T-Ais:*** *1. The robot shall move autonomously from the charging station to the Totem.* *2. User meets the robot.* *3. Linking the user with the assigned robot: Depending on the different disability profiles of each traveller, this linking will be carried out in different ways, which are the subject of these tests:* *- User enters the numerical locator provided by the Totem through the robot's tablet.* *- User accesses the ACCESSROBOTS application and activates the start of the service from the ACCESSROBOTS application.* *Steps 4, 5, 6, 7 and 8 are the same as in the situation where the user starts with the mobile.*

Expected Demonstration Date	*April 2025*
Expected evaluation of results	*How?* *Visual disability, PRM, motor disability and cognitive impairment people are able to follow the demonstration storyboard without assistance.* *Verification by visual disability, PRM, motor disability and cognitive impairment people under the supervision of team members.*
Exploitation	*KER 10* - Services for inclusive rail based mobility including assistive tools, hands-free experience, passenger flow management
Responsible partner/person	*ADIF FM*
Notes	*N/A*

8.7.6. Guiding Accessible Software

Name	*Guiding Accessible Software*
ID	*UC-FP1-WP19-17*
Description	*Providing information and guiding of people with disabilities inside of the multimodal railway station*
Related to task/subtask(s)	*T19.3, T19.5, T22.1 (Subtask 22.1.2), T23.2, 22.3*
Technical Enabler(s)	*TE 20, TE 22*
Stakeholders	*ADIF FM*
Goal	*Improvement of the travel experience for people with disabilities.* *Specifically, by:* *Providing accessible information to people with different disabilities.* *Provide accessible routes within the station based on available accessibility information.* *Allow users with different disabilities to access the robot's services via the totem pole or the user's mobile device.* *Allow users with different disabilities to access "Guiding Accessible Intelligent Tool" services via the totem pole or the user's mobile device.*
Demonstration Requirements	*Registered INECO Totem T-Ais research project.* *To have the access of data that provides this information: PTO and Rail Administrator's data sources.* *Data from Metro of Malaga (PTO)* *Data from Administrator.* *A 3.5 jack headset is available if the user wants privacy in the information obtained from the totem.*

	The user has the ACCESSROBOT application installed on their mobile phone, which allows them to link up with the accessible robot. *The user has installed on his mobile phone and is registered in the application "Guiding Accessible Intelligent Tool".* *"Assistance Integrative Mobile App" installed on the user's mobile phone if the demonstration starts at a location other than the totem pole.*
FP1 Developed components/functions/methods target of demonstration	*Integration of "Guiding Accessible Software" with TSP and Rail Administrator Information Platforms.* *Integration of "Guiding Accessible Software" with Accessible Robot.* *Integration of "Guiding Accessible Software" with "Guiding Accessible Intelligent Tool".* *Accessible user interface for people with disabilities in "Assistance Integrative Mobile App".* *Calculation of accessible routes within the station based on available accessibility information.*
Other involved components	*N/A*
Expected Demonstration Location	*Málaga María Zambrano Station*
Demonstration storyboard	*Digital support that could improve traveller experience for people with disabilities and make it more accessible in this way:* *1. User accesses Guiding Accessible Software, (the System), this will be done both through the totem T-Ais and "Assistance Integrative Mobile App".* *2. The System offers options of the available information.* *3. User selects train-related option.* *4. The System, after consulting the Administrator's data, offers accessible information on timetables and parking lanes.* *5. User returns to previous screen.* *6. User selects Metro option.* *7. The System, after consulting the Metro data, offers accessible information on frequency.* *8. User returns to previous screen.* *9. User selects station services.* *10. User selects a destination within the station.* *11. System calculates accessible route and displays on screen.*

	12. User returns to previous screen. *13. System administrator modifies accessibility of available routes.* *14. User selects the same destination.* *15. System calculates different accessible route with new accessibility information and displays it on screen.* *16. User requests robot to go to that destination.* *17. System returns confirmation or not on availability.* *18. User returns to previous screen.* *19. User requests "Guiding Accessible Intelligent Tool" service.* *20. System gives instructions on how to use "Guiding Accessible Intelligent Tool".*
Expected Demonstration Date	*April 2025*
Expected evaluation of results	*How?* *Visual disability, PRM, motor disability and cognitive impairment people are able to follow the demonstration storyboard without assistance.* *Verification by visual disability, PRM, motor disability and cognitive impairment people under the supervision of team members.*
Exploitation	*KER 10* - Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management
Responsible partner/person	*ADIF FM and Metro de Málaga*
Notes	*N/A*

8.7.7. Guiding Accessible Intelligent Tool

Name	*Guiding Accessible Intelligent Tool with physical complementary signalling in different languages*
ID	*UC-FP1-WP19-18*
Description	*Guiding of people with disabilities inside of the multimodal railway station*
Related to task/subtask(s)	*T19.3, T19.5, T22.1 (Subtask 22.1.2), T23.2, 22.3*
Technical Enabler(s)	*TE 20, TE 22*
Stakeholders	*ADIF FM*
Goal	*Support with displacement and orientation at the station of the traveller with disabilities or other special needs towards the correct spot in the station.*
Demonstration Requirements	*Podotactile pathways on the floor.* *Stickers or posters with QR codes*

	The user has installed on his mobile phone and is registered in the application "Guiding Accessible Intelligent Tool". *Registered INECO Totem T-Ais research project if the demonstration starts from the totem pole.* *"Assistance Integrative Mobile App" installed on the user's mobile phone if the demonstration starts at a location other than the totem pole.*
FP1 Developed components/functions/methods target of demonstration	*Integration of Guiding Accessible Software with "Guiding Accessible Intelligent Tool"*
Other involved components	*N/A*
Expected Demonstration Location	*Málaga María Zambrano Station*
Demonstration storyboard	*Digital support that could improve traveller experience for people with disabilities and make it more accessible in this way:* *1. User accesses to the System, this will be done both through the totem T-Ais and "Assistance Integrative Mobile App".* *2. The system offers choices of destinations (services) at the station.* *3. User selects a destination within the station.* *4. System calculates accessible route and displays it on screen.* *5. User selects "Guiding Accessible Intelligent Tool" to reach destination.* *6. System gives instructions on how to use "Guiding Accessible Intelligent Tool".* *7. User accesses "Guiding Accessible Intelligent Tool" which allows him/her to walk to the destination.*
Expected Demonstration Date	*April 2025*
Expected evaluation of results	*How?* *Visual disability, PRM, motor disability and cognitive impairment people are able to follow the demonstration storyboard without assistance.* *Verification by visual disability, PRM, motor disability and cognitive impairment people under the supervision of team members.*
Exploitation	*KER 10* - Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management

Responsible partner/person	*ADIF FM*
Notes	*N/A*

8.8. Demonstration 23.3 – Hands-free solutions for travellers in a intermodal hub (Amsterdam)

8.8.1. FP1-DEMO-23.3-UC-01 - Hands-free with UWB technology for intermodal journey

Name	*Hands-free with UWB technology for intermodal journey*
ID	*ID of the Use Case "FP1-DEMO-23.3-UC-01"*
Description	*Test of the usage of UWB (Ultra-Wide Band) technology as hands-free interaction solution in case of a transfer from one mobility mode to another mobility mode. The traveller goes through an automatic gate (entering and leaving a metro). They optionally get an indication for the next travel segment to another mobility mode.*
Related to task/subtask(s)	*Task 23.3* *Involved technical use cases:* *UC-FP1-WP19-22 Hands-Free. UWB Walk-in* *UC-FP1-WP19-23 Hands-Free. UWB Walk-out* *UC-FP1-WP19-24 Hands-Free. UWB Intermodal transfer*
Technical Enabler(s)	*TE 21*
Stakeholders	*GTSD, plays the role of technology supplier* *GVB (Amsterdam operator), plays the main role on this demonstration coordinating the local installation and the interaction with the public.* *Travellers, wear the UWB Tag.*
Goal	*Demonstrate the seamless validation services across different transport mode using UWB technology*
Demonstration Requirements	*Installation of UWB Anchors, demonstration gate, display panel, local computer.*
FP1 Developed components/functions/methods target of demonstration	*Gate Line, RTLS Location Service, HFCS Control System*
Other involved components	*UWB tag and Anchors, display panel or floor signs.*
Expected Demonstration Location	*Station in Amsterdam with multiple mobility modes. To be selected with GVB.*
Demonstration storyboard	1. ***Traveller***; *moves to the Entry side of the Gate with a valid UWB tag; the Gate opens, and the traveller can enter the station*

	2. ***Traveller**; moves to the Exit side of the Gate with a valid UWB tag; the Gate opens, and the traveller can exit the station* 3. ***Traveller** (optional connection case); follow the floor sign or the display panel; the traveller is guided to the next transport mean*
Expected Demonstration Date	*M40-M46*
Expected evaluation of results	*Travellers will evaluate the seamless validation, and the feedback will be collected.* *GVB will also evaluate from the rail operator perspective the interest from travellers.*
Exploitation	*KER 10. Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management*
Responsible partner/person	*GTSD*
Notes	*In case the traveller UWB tag is not registered in the system, entry or exit will be refused.*

8.8.2. FP1-DEMO-23.3-UC-02 - Hands-free with UWB technology for in station assistance

Name	*Hands-free with UWB technology for in station assistance*
ID	*ID of the Use Case "FP1-DEMO-23.3-UC-02"*
Description	*Test of the usage of UWB (Ultra-Wide Band) technology as hands-free interaction solution in the perspective of delivering in station assistance to people with disabilities. The targeted scenario consists in having an automatic detection of the arrival of the Passenger combined with the information of station staff via text message.*
Related to task/subtask(s)	*Task 23.3* *Involved technical use cases:* *UC-FP1-WP19-25 Hands-Free. UWB In station assistance*
Technical Enabler(s)	*TE 21*
Stakeholders	*GTSD, plays the role of technology supplier* *GVB (Amsterdam operator), plays the main role on this demonstration coordinating the installation and the interaction with the public.* *Travellers, wear the UWB Tag.*
Goal	*Demonstrate the notification received by the station staff when the UWB tag as a disabled profile associated*
Demonstration Requirements	*Installation of UWB Anchors in the test area, local computer, SMS gateway* *The Traveller is wearing a UWB tag registered in the system with a disabled profile.* *A person with the role of station supervisor with a mobile*

	phone *A station staff who can also be the station supervisor for the demonstration.*
FP1 Developed components/functions/methods target of demonstration	*RTLS Location Service, HFCS Control System*
Other involved components	*UWB tag, Anchors and SMS gateway*
Expected Demonstration Location	*Station in Amsterdam with multiple mobility modes. To be selected with GVB.*
Demonstration storyboard	1. *Traveller; arrives at the station and enters the detection zone; a SMS is sent to the Station Supervisor* 2. *Station supervisor; Ask a station staff to reach the location indicated in the SMS; the station staff helps the traveller*
Expected Demonstration Date	*M40-M46*
Expected evaluation of results	*GVB will evaluate from the rail operator perspective the interest from travellers and the reactivity of the end-to-end process.*
Exploitation	*KER 10. Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management*
Responsible partner/person	*GTSD*
Notes	*In case the traveller UWB tag is not registered in the system there will be no indication.*

8.8.3. FP1-DEMO-23.3-UC-03 - Hands-free with facial recognition technology for seamless validation

Name	*Hands-free with facial recognition technology for seamless validation*
ID	*ID of the Use Case "FP1-DEMO-23.3-UC-03"*
Description	*Test of the usage of Face Recognition for entering or exiting a closed area in a mobility hub. The Passenger approaches an automatic gate that captures the face signature using a dedicated terminal, checks the validity with the back-office and grants access.*
Related to task/subtask(s)	*Task 23.3* *Involved technical use cases:* *UC-FP1-WP19-26 Hands-Free. Face recognition Walk-in* *UC-FP1-WP19-27 Hands-Free. Face recognition Walk-out*
Technical Enabler(s)	*TE 21*
Stakeholders	*GTSD, plays the role of technology supplier* *GVB (Amsterdam operator), plays the main role on this demonstration coordinating the installation in the station*

	and the interaction with the public.
Goal	*Demonstrate the seamless validation services using facial recognition technology*
Demonstration Requirements	*Travellers shall be enrolled. This enrolment is part of the test. This is done using a test App. The intention is to have a set of Mobile Phones dedicated to the test. The alternative would be to have the App available at the store so that travellers can download it and then register with their own phone.* *The demonstration fare gate shall be installed in the station with dedicated terminals (Face Capture Module) and connected to the communication network.* *The Back-office (Face Recognition Server) is deployed.*
FP1 Developed components/functions/methods target of demonstration	*Gate Line, FCM Face Capture Module, FRS Face Recognition Server*
Other involved components	*App to register the traveller in the system*
Expected Demonstration Location	*Station in Amsterdam with multiple mobility modes. To be selected with GVB.*
Demonstration storyboard	1. *Traveller; goes towards the Entry zone of the Gate; the FCM detects the face, the FRS identifies the face and sends back the result to open the Gate, the traveller can cross the Gate.* 2. *Traveller: goes towards the Exit zone of the AFC Gate; the FCM detects the face, the FRS identifies the face and sends back the result to open the Gate, the traveller can cross the Gate.*
Expected Demonstration Date	*M40-M46*
Expected evaluation of results	*Travellers will evaluate the seamless validation, and the feedback will be collected.* *GVB will also evaluate from the rail operator perspective the interest from travellers.*
Exploitation	*KER 10. Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management*
Responsible partner/person	*GTSD*
Notes	*In case the traveller face is not registered in the system the access will not be granted*

8.9. Demonstration 23.4 – Platform-based guidance (Leipzig & Hannover)

8.9.1. Illuminated Platform Panels

Name	*Illuminated Platform Panels*
ID	*FP1-DEMO-23.1-UC-01*
Description	*Test of demonstrator "illuminated platform edge" (Attention, Orientation and Capacity) to evaluate it's benefits in terms of increased safety, efficiency and capacity.*
Related to task/subtask(s)	*22.1.2*
Technical Enabler(s)	*TE20, TE22*
Stakeholders	*Technical Partners / Suppliers: SIUT and S-Bahn Hamburg (sensors), construction companies, Travellers, Regulating and Federal authorities*
Goal	*Proving, that the system helps to reduce duration of passenger entry and exit, increase the sense of safety and thus customer satisfaction as well as exploit existing platform capacities, supports railway companies in improving punctuality*
Demonstration Requirements	*Train data, accessible Cloud-service for processing and providing information for local system, IT-Security requirements, space for installing IT-components on site*
FP1 Developed components/functions/methods target of demonstration	*LED-equipped floor panels, mini-server, train detection sensors (trackside) or virtual data interfaces, local network incl. remote access, special monitoring program*
Other involved components	*Optical Sensor (trackside) for gauging capacity utilization in the train, train length*
Expected Demonstration Location	*Central station in Leipzig (City Tunnel) and Hannover*
Demonstration storyboard	*1. Passenger train gets recognized by sensor or respective train data is pushed to the system (data interface) before train arrives at station* *2. Server processes data and initiates pre-defined light pattern at platform (LED-Stripe)* *3. Sensor at the platform or data-interface recognise train stop. Immediate deactivation of LED-lights follows* *4. Sensor at the platform or data-interface recognise train movement/departure. Immediate activation of LED-lights follows*
Expected Demonstration Date	*2025-2026*
Expected evaluation of results	*Assessment by project team based on customer surveys, database and video analysis, cost-effectiveness study. Presentation to the management afterwards*
Exploitation	*Suitability for regular use in defined train stations proven*

	KER 10. Services for inclusive rail-based mobility including assistive tools, hands-free experience, passenger flow management
Responsible partner/person	*Christopher Schubert, Christoph Hertner, DB InfraGO AG*
Notes	-

8.10. Demonstration 25.1.1 - Demonstration at FS focused on (a) management of unplanned demand variations, (b) unplanned disruptions and detection of minimum connection time.

8.10.1. Timetable optimization based on MCT

Name	*Timetable optimization based on MCT*
ID	*FP1-DEMO-25.1.1-UC-01*
Description	*Timetable optimization to generate new connections by modification of an initial timetable*
Related to task/subtask(s)	*Subtask 25.1.1*
Technical Enabler(s)	*TE 26*
Stakeholders	*Hitachi Rail plays the role of developer of a Capacity Optimization HMI* *Trenitalia: conduction of the demonstration of the developed framework*
Goal	*Demonstrate that the developed component is able to consistently optimize timetable based on connection time* *The optimized timetable will be presented on a graphical HMI, enabling effective monitoring and evaluation of KPIs.*
Demonstration Requirements	*Data availability (timetable, infrastructure and rolling stock characteristics), optimization algorithms*
FP1 Developed components/functions/methods target of demonstration	*Capacity Optimization HMI* *Optimization software*
Other involved components	*Database*
Expected Demonstration Location	*Virtual demonstration for portion or totality of national network*
Demonstration storyboard	1. *Each time the Operator launches an optimization cycle for a selected timetable, the data pre-processing for the optimization software takes place;* 2. *Optimization run;* 3. *Data post-processing and ingestion in a dashboard for result visualization and validation by the operator.* 4. *The Capacity Optimization HMI acquires the scheduled and optimized timetables from the Railway Timetable Database.*

	5. *The Capacity Optimization HMI enables operators to analyse the enhanced connections resulting from the timetable optimization process for a specific station.* 6. *The operator has also the ability to visually assess and analyse specific KPIs generated by the optimization process, providing valuable insights for results validation.*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Evaluation by the railway operator of various timetable optimization scenarios through dashboards*
Exploitation	*KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Pietro Calcagno, STS* *Giovanni Luca Giacco, Trenitalia*
Notes	

8.10.2. Planned Disruption Management through optimization processes

Name	*Planned Disruption Management through optimization processes*
ID	*FP1-DEMO-25.1.1-UC-02*
Description	*Demonstrate the effectiveness of the developed Disruption Management System in identifying multimodal mitigation strategies for traveller redistribution following a planned disruption event.*
Related to task/subtask(s)	*Subtask 25.1.1*
Technical Enabler(s)	*TE 27*
Stakeholders	*Hitachi Rail plays the role of developer of the Disruption Management System and the Disruption Management HMI.* *Trenitalia plays the role of Railway Operator and data provider*
Goal	*By offering operators multimodal mitigation strategies, this demonstration use case aims to improve travellers resilience and minimize the impact of planned disruptions.*
Demonstration Requirements	*Reception of planned and predicted maintenance events* *Passenger flow data from Trenitalia*

FP1 Developed components/functions/methods target of demonstration	*Disruption Management System* *Disruption Management HMI*
Other involved components	*Integration Layer*
Expected Demonstration Location	*Virtual demonstration based on Railway line from Foggia to Lecce in Puglia region in Italy.*
Demonstration storyboard	1. *The Disruption Management System regularly receives and processes passenger flow data from Trenitalia.* 2. *The Disruption Management System estimates the occupancy of each train.* 3. *To identify and address disruptions, the Disruption Management System collects and analyses disruption information, such as affected trains and their last operational points, from the external systems, i.e. Integration Layer.* 4. *Optimization algorithms are employed to determine the most effective redistribution of travellers.* 5. *The disruption management HMI presents optimized mitigation strategies, empowering operators to make effective decisions and improve disruption response.*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*To facilitate decision-making, the results of the optimization process will be presented on a graphical HMI, allowing operators to evaluate and select the most appropriate strategy to be implemented.*
Exploitation	*KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Pietro Calcagno, STS* *Giovanni Luca Giacco, Trenitalia*
Notes	

8.10.3. Unplanned Disruption Management through optimization processes

Name	*Unplanned Disruption Management through optimization processes*
ID	*FP1-DEMO-25.1.1-UC-03*

Description	*Demonstrate the effectiveness of the developed Disruption Management System in identifying multimodal mitigation strategies for traveller redistribution following an unplanned disruption event.*
Related to task/subtask(s)	*Subtask 25.1.1*
Technical Enabler(s)	*TE 27*
Stakeholders	*Hitachi Rail plays the role of developer of the Disruption Management System and the Disruption Management HMI.* *Trenitalia plays the role of Railway Operator and data provider*
Goal	*By offering operators multimodal mitigation strategies, this demonstration use case aims to improve travellers resilience and minimize the impact of unplanned disruptions.*
Demonstration Requirements	*Reception of incident messages from external systems* *Reception of average resolution time of an unplanned incident from FP3* *Passenger flow data from Trenitalia*
FP1 Developed components/functions/methods target of demonstration	*Disruption Management System* *Disruption Management HMI*
Other involved components	*Integration Layer*
Expected Demonstration Location	*Virtual demonstration based on Railway line from Foggia to Lecce in Puglia region in Italy.*
Demonstration storyboard	1. *The Disruption Management System regularly receives and processes passenger flow data from Trenitalia.* 2. *To identify and address disruptions, the Disruption Management System collects and analyses disruption information, such as affected trains and their last operational points, from the external systems, i.e. Integration Layer.* 3. *The Disruption Management System receives an updated disruption message containing the average resolution time of the unplanned incident from the elaboration process of FP3.* 4. *Optimization algorithms are employed to determine the most effective redistribution of travellers.*

	5. *The disruption management HMI presents optimized mitigation strategies, empowering operators to make effective decisions and improve disruption response.*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*To facilitate decision-making, the results of the optimization process will be presented on a graphical HMI, allowing operators to evaluate and select the most appropriate ones for implementation.*
Exploitation	*KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Pietro Calcagno, STS* *Giovanni Luca Giacco, Trenitalia*
Notes	

8.10.4. Ex-Ante Timetable Punctuality

Name	*Ex-ante timetable punctuality*
ID	*FP1-DEMO-25.1.1-UC-04*
Description	*Evaluation of ex-ante punctuality based on infrastructure settings and timetable scenario*
Related to task/subtask(s)	*Subtask 25.1.1*
Technical Enabler(s)	*TE26*
Stakeholders	*Trenitalia: conduction of the demonstration of the developed framework*
Goal	*Demonstrate that the developed component is able to consistently predict timetable punctuality*
Demonstration Requirements	*Data availability (timetable, historical punctuality, infrastructure and rolling stock characteristics), ML model*
FP1 Developed components/functions/methods target of demonstration	*Database, punctuality estimator*
Other involved components	*In-house operational simulation software*
Expected Demonstration Location	*Virtual demonstration for line or portion of national network*
Demonstration storyboard	1. *The punctuality estimator is equipped with a ML model trained with timetable and historical punctuality data, infrastructure and rolling stock characteristics;* 2. *The punctuality estimator acquires the timetable for which a punctuality prediction is required by the operator;*

	3. *Multiple timetable scenarios are then implemented and results sent to a dashboard to evaluate the best timetable scenario according to its predicted punctuality.*
Expected Demonstration Date	*Q1 2026*
Expected evaluation of results	*Evaluation of various timetable scenarios simulation by the railway operator*
Exploitation	*KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Giovanni Luca Giacco, Trenitalia*
Notes	

8.11. Demonstration 25.1.2 - Demonstration focused on methods of load estimation and prognosis efficiency in transport management decision support.

Name	*Demonstration focused on methods of load estimation and prognosis efficiency in transport management decision support*
ID	*FP1-DEMO-25.1.2-UC-01*
Description	*Demonstrate the validity of data centralization through data lake by providing decision support for local railway transport operators. In particular short term (week-to-week) occupancy requirements, long term (bimonthly) timetabling update and disruption monitoring and evaluation.*
Related to task/subtask(s)	*Specification: Task 19.6,19.7, 19.9* *Development: Task 24.1, Task 24.2, Task 24.4, Task 24.5, T20.1.1* *Demonstration: Task 25*
Technical Enabler(s)	*TE 23, 24, 26, 27*
Stakeholders	*PKP S.A.* *ŁKA*
Goal	*The demonstrator focuses on developing and testing algorithms for short-term and long-term demand forecasting in urban transport, integrating data such as working hours, weather, passenger flows, and public events. It includes disruption analysis to enhance forecasting accuracy and flexibility during unexpected events. The prototypes, demonstrated at TRL 6-7 in Łódź Municipality, aim to support transport operators and planners with*

	tools for load estimation, disruption management, and demand verification, enabling improved timetable optimization and decision-making.
Demonstration Requirements	*Disruption data, Historical data, Weather data*
FP1 Developed components/functions/methods target of demonstration	*Municipal data lake, DSS dashboard, short term prediction software, analysis support Module, Demand dataset builder*
Other involved components	*MS Power BI, Python; Data Mart*
Expected Demonstration Location	*Lodz, Poland*
Demonstration storyboard	*This demonstrator covers four technical use cases for UC-FP1-WP19-41, UC-FP1-WP19-48, UC-FP1-WP19-52* *Operation is similar and follows the following schema:* *1. Planner requests prognosis during capacity planning* *2. System creates prognosis using data obtained from Data Lake* *3. Prognosis is visualized and presented in form of a dashboard* *4. Planner creates capacity plan/timetable.* *UC-FP1-WP19-35 is realized by processing of disruption data through data lake integration.* *It follows following schema:* *1. Actor specifies required data and metadata through API* *2. Request is being sent* *3. Data is being verified for changes* *4. Data is being sent* *5. Actor processes the data*
Expected Demonstration Date	*Q4 2026*
Expected evaluation of results	*Assessment by project team based on surveys among selected users. They will evaluate data validity, prediction stability and general functional usefulness.*
Exploitation	*Linked to KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Jerzy Baranowski, PKP S.A.*
Notes	-

8.12. Demonstration 25.2 – Demonstration of traffic demand predictive systems in the intermodal station of Málaga (Spain) encompassed in a multimodal environment

Focused on a traffic demand predictive systems in order to improve client's experience and operator's decision making through (a) Validation at TRL 5 of long-term demand calculation concept and (b) short term demand calculation concept at final TRL 7.

8.12.1. Notices for other modes of transport with connections at the railway station

Name	*Notices for other modes of transport with connections at the railway station*
ID	*UC-FP1-DEMO25.2-UC-1*
Description	*Create a warning to inform the other operators providing services at the station in order to improve the provision of their services. This warning is obtained from the results of the rail passenger demand forecasting model, comparing the long-term demand forecast data with the average expected demand data for that period at the station. Then an information warning will be published to the rest of the operators of transport services related to the station. These operators will be mainly the Malaga metro and taxi drivers. In this way the capacity of the different modes of transport that make up the modal chains at the station can be guaranteed.*
Related to task/subtask(s)	*Specification: Task 19.6, 19.7* *Development: Task 24.1, 24.2* *Demonstration: Task 25.2*
Technical Enabler(s)	*TE24*
Stakeholders	*Operational partners: ADIF FM, Metro de Málaga* *Technical partners: INDRA*
Goal	*Informative warning to adjust the frequencies of the services of the other modes of transport to ensure a good service. And better management of resources*
Demonstration Requirements	*Opendata portals correct publication* *Indra's physical server with the demonstration environment appropriately configured* *Team representation of each partner*
FP1 Developed components/functions/methods target of demonstration	*Forecast Platform* *HMI Dashboard*
Other involved components	*Train schedule publication in opendata portal GTFS* *Metro schedule publication in opendata portal GTFS* *Passenger reading systems at the station* *AEMET Opendata portal for meteorology* *Málaga hall open data portal for events agenda*

Expected Demonstration Location	*Virtual demonstration, data from Málaga Station*
Demonstration storyboard	1. *The user accesses to the HMI and the station map are presented with the different resources and means of transport* 2. *The user selects the corresponding resource for the commuter access and the passenger predictions are presented* 3. *In case that any alert is triggered, it is then presented to the user in the HMI* 4. *The user notifies the alert to other modes of transport with connections at the railway station*
Expected Demonstration Date	*2025*
Expected evaluation of results	*The results will be evaluated by all the stakeholders* *Mainly, the technical stakeholders will evaluate the correct results of the models, in order to comply with the KPIs for both the short term and long-term predictions, as well as confirm the correct triggering of alerts when the defined thresholds are exceeded* *The operational stakeholders will evaluate the same as explained for the technical stakeholders and, in addition to this, the correct notification to other modes of transport with connections at the railway station*
Exploitation	*KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*ADIF FM + Indra*
Notes	*Additional notes for the Use Case*

8.12.2. Notifications for activation of passenger flow management protocols

Name	*Notifications for activation of passenger flow management protocols*
ID	*UC-FP1-DEMO25.2-UC-1*
Description	*In the event that the results of short-term passenger demand forecasts imply a substantial increase in demand compared to the usual station demand for that timetable, a series of protocols for passenger flow management at the station may be applied. These protocols shall be developed by the station manager and shall define the different safety levels to be applied depending on the increase in demand. For this Use Case, it is necessary to define the limit increases in demand above which it will be necessary to implement these protocols at the station. The main objective is to guarantee the safety and fluidity of*

	pedestrian flows in the station.
Related to task/subtask(s)	*Specification: Task 19.6* *Development: Task 24.1* *Demonstration: Task 25.2*
Technical Enabler(s)	*TE23*
Stakeholders	*Operational partners: ADIF FM, Metro de Málaga* *Technical partners: INDRA*
Goal	*Anticipation for the implementation of passenger flow management protocols.*
Demonstration Requirements	*Opendata portals correct publication* *Indra's physical server with the demonstration environment appropriately configured* *Team representation of each partner*
FP1 Developed components/functions/methods target of demonstration	*Forecast Platform* *HMI Dashboard*
Other involved components	*Train schedule publication in opendata portal GTFS* *Metro schedule publication in opendata portal GTFS* *Passenger reading systems at the station* *AEMET Opendata portal for meteorology* *Málaga hall open data portal for events agenda*
Expected Demonstration Location	*Virtual demonstration, data from Málaga Station*
Demonstration storyboard	*1. The user accesses to the HMI and the station map is presented with the different resources and means of transport* *2. The user selects the corresponding resource for the commuter access and the passenger predictions are presented* *3. In case that any alert is triggered, it is then presented to the user in the HMI* *4. The user notifies the alert to the station manager for the activation of passenger flow management protocols*
Expected Demonstration Date	*2025*
Expected evaluation of results	*The results will be evaluated by all the stakeholders* *Mainly, the technical stakeholders will evaluate the correct results of the models, in order to comply with the KPIs for both the short term and long-term predictions, as well as confirm the correct triggering of alerts when the defined thresholds are exceeded* *The operational stakeholders will evaluate the same as explained for the technical stakeholders and, in addition to this, the correct notification to the station manager for the activation of passenger flow management protocols*
Exploitation	*KER 11 - Short and long-term demand models and solutions*

	including capacity and disruption management
Responsible partner/person	*ADIF FM + Indra*
Notes	*Additional notes for the Use Case*

8.12.3. Estimation of station staff required to provide quality customer service

Name	*Estimation of station staff required to provide quality customer service*
ID	*UC-FP1-DEMO25.2-UC-3*
Description	*In the event that the results of long-term passenger demand forecasts imply a substantial increase in demand compared to the usual station demand for that timetable in order to adequately sizing the staff required to meet this demand while complying with minimum quality standards. This dimensioning can be applied for long-term passenger demand.*
Related to task/subtask(s)	*Specification: Task 19.6, Task 19.7* *Development: Task 24.1, 24.2* *Demonstration: Task 25.2*
Technical Enabler(s)	*TE24*
Stakeholders	*Operational partners: ADIF FM* *Technical partners: INDRA*
Goal	*Anticipation for exceptional station staffing*
Demonstration Requirements	*Opendata portals correct publication* *Indra's physical server with the demonstration environment appropriately configured* *Team representation of each partner*
FP1 Developed components/functions/methods target of demonstration	*Forecast Platform* *HMI Dashboard*
Other involved components	*Train schedule publication in opendata portal GTFS* *Metro schedule publication in opendata portal GTFS* *Passenger reading systems at the station* *AEMET Opendata portal for meteorology* *Málaga hall open data portal for events agenda*
Expected Demonstration Location	*Virtual demonstration, data from Málaga Station*
Demonstration storyboard	1. *The user accesses to the HMI and the station map is presented with the different resources and means of transport* 2. *The user selects the corresponding resource for the commuter access and the passenger predictions are presented*

	3. *In case that any alert is triggered, it is then presented to the user in the HMI* 4. *The user notifies the alert to the station manager for the estimation of staff*
Expected Demonstration Date	*2025*
Expected evaluation of results	*The results will be evaluated by all the stakeholders* *Mainly, the technical stakeholders will evaluate the correct results of the models, in order to comply with the KPIs for both the short term and long-term predictions, as well as confirm the correct triggering of alerts when the defined thresholds are exceeded* *The operational stakeholders will evaluate the same as explained for the technical stakeholders and, in addition to this, the correct notification to the station manager for the estimation of staff*
Exploitation	*KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*ADIF FM + Indra*
Notes	*Additional notes for the Use Case*

8.13. Demonstration 25.3 - Demonstration focused on (a) validation of long term demand calculation concept and (b) demonstration of short term demand forecast combined with the management of disruptions across modes.

The demonstration use cases related to this demonstration are described in sections 8.3.1.4, 8.3.1.5 and 8.3.1.6.

8.14. Demonstration 25.4 - Demonstration focused on the capabilities of early response to disruptions in Multi-modal mobility.

8.14.1. Generation of the library of situations

Name	*Generation of the library of situations*
ID	*UC-FP1-DEMO25.4-UC-1-*
Description	*Situations for Strategic Management can be generated by identifying them by experts and by unsupervised learning methods. Both methods will be used to generate the Library of Situations with the historical data provided by FGC in the demonstrator of task 25.4.*
Related to task/subtask(s)	*Specification: Task 19.9* *Development: Task 24.4, Task 24.5* *Demonstration: Task 25.4*

Technical Enabler(s)	*TE 26* *TE 27*
Stakeholders	*FGC as Transport Service Provider*
Goal	*This use case aims to verify the veracity of the generated situations.*
Demonstration Requirements	*Historical data (disruption information, timetables)*
FP1 Developed components/functions/methods target of demonstration	*Situation Manager*
Other involved components	*Situation Detector* *Situation Library*
Expected Demonstration Location	*Barcelona metropolitan area*
Demonstration storyboard	*Personnel from FGC test the Generation of the Library of Situations to detect anomalous situations related to the demand data.*
Expected Demonstration Date	*01/03/2026*
Expected evaluation of results	*The results will be evaluated by FGC. They will determine if the clusters in which the situations were grouped are the relevant ones or not, depending on if they fit with the real description of the situation. In case yes, the library will be considered as initial one, because it will be updated in case any new occurs. In case it does not fit with the most updated situation, new clusters will be done*.
Exploitation	*The tool will be used in the near future by FGC to detect and predict anomalous demand situations* *KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Sergi Grau, ETRA*
Notes	-

8.14.2. Detection of situations

Name	*Detection of situations*
ID	*UC-FP1-DEMO25.4-UC-2*
Description	*Based on the situations stored in the situations library and the information generated in real time by FGC in the demonstrator of task 25.4, the current state of the transport network will be identified with the situations available in the library.*
Related to task/subtask(s)	*Specification: Task 19.9* *Development: Task 24.4, Task 24.5* *Demonstration: Task 25.4*

Technical Enabler(s)	*TE 26* *TE 27*
Stakeholders	*FGC as Transport Service Provider*
Goal	*This test case aims to detect new situations and label them using the library of situations.*
Demonstration Requirements	*Availability of new data (disruption information, timetables)*
FP1 Developed components/functions/methods target of demonstration	*Situation Manager*
Other involved components	*Situation Detector* *Situation Library* *Strategic Manager*
Expected Demonstration Location	*Barcelona metropolitan area*
Demonstration storyboard	1. *Personnel from FGC test the Generation of the Library of Situations to predict anomalous situations related to the demand data.*
Expected Demonstration Date	*01/03/2026*
Expected evaluation of results	*The situations will be evaluated at any time by FGC. They will compare the new situation with those already generated and included in the library generated in the use case in section 8.14.1 to check if it matches with any or not. In case the situation was already considered, the best way to proceed was already defined, in case not, a new one will be included by the personnel of FGC as new one in the library.*
Exploitation	*The tool will be used in the near future by FGC to predict anomalous demand situations* *KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Sergi Grau, ETRA*
Notes	-

8.14.3. Training of the short-term prognosis model

Name	*Training of the short-term prognosis model*
ID	*UC-FP1-DEMO25.4-UC-3*
Description	*Train a forecast model to predict next 24-hours of demand in trains.*
Related to task/subtask(s)	*Specification: Task 19.6* *Development: Task 24.1, Task 24.2* *Demonstration: Task 25.4*

Technical Enabler(s)	*TE 23*
Stakeholders	*FGC as Transport Service Provider*
Goal	*This use case aims to train the demand prediction model. To do this, the Transport Service Provider activates the training so that the Data Manager provides the available historical data that is processed by the Trainer. This feeds a recurrent deep learning model with the data and adapts the parameters that characterize the prediction model. Once training is completed, the model is ready for prediction.*
Demonstration Requirements	*Historical train demand data available.*
FP1 Developed components/functions/methods target of demonstration	*Trainer* *Predictor*
Other involved components	-
Expected Demonstration Location	*Barcelona metropolitan area*
Demonstration storyboard	*1. Personnel from ETRA will train the demand prediction model by using data of passengers provided by FGC.*
Expected Demonstration Date	*01/03/2026*
Expected evaluation of results	*The results were evaluated by ETRA. The historical dataset was split into three sets train, evaluation and test. During the training phase the evaluation set was the one used to define if model is performing well or not through mean absolute error loss. Finally, the test set was used to evaluate the model also using the MAE metric.*
Exploitation	*The tool will be used to train the prediction model for passenger's demand.* *KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Sergi Grau, ETRA*
Notes	-

8.14.4. Short-term prognosis

Name	*Short-term prognosis*
ID	*UC-FP1-DEMO25.4-UC-4*
Description	*From the previously trained model and using real-time data provided by FGC in the demonstrator corresponding to Task 25.4, the short-term prediction will be made. The forecasted data will be compared with the real ones, the quality of the prognosis will be determined and the corresponding KPIs will be generated.*

Related to task/subtask(s)	*Specification: Task 19.6* *Development: Task 24.1, Task 24.2* *Demonstration: Task 25.4*
Technical Enabler(s)	*TE 23*
Stakeholders	*FGC as Transport Service Provider*
Goal	*To execute forecast predictions using real-time data.*
Demonstration Requirements	*Live train demand data available.*
FP1 Developed components/functions/methods target of demonstration	*Predictor Manager*
Other involved components	*Trainer* *Predictor*
Expected Demonstration Location	*Barcelona metropolitan area*
Demonstration storyboard	*1. Personnel from FGC will be able to predict the demand of the trains.*
Expected Demonstration Date	*01/03/2026*
Expected evaluation of results	*The results will be evaluated by FGC as Transport Service Provider, who will evaluate if the demand predicted fits with the real one. To evaluate these results, a comparison between the real demand values and the predicted ones has been done.*
Exploitation	*The tool will be used to predict the passengers demand anticipating the real situation and allowing the transport operator to adapt the number of trains, frequency or other transport mode to support the real number of users.* *KER 11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Sergi Grau (ETRA)*
Notes	*-*

8.15. Demonstration 25.5 - Demonstration focused on modelling passenger demand and flow within Digital Twin using source data such as ticketing, timetables, frequencies, capacities.

8.15.1. Transport offer optimisation

Name	*Transport offer optimisation*
ID	*FP1-DEMO-25.5-UC-01*
Description	*Optimisation of the transport offer at a macro level based on long term prediction of how passengers flow across the urban transport network.*

Related to task/subtask(s)	*Task 24.5*
Technical Enabler(s)	*TE25*
Stakeholders	*GTSD plays the role of Planning Operator.*
Goal	*The aim of this use case is to assist the Planning Operator in optimizing the transport offer at a macro level.*
Demonstration Requirements	*None*
FP1 Developed components/functions/methods target of demonstration	*Macro Simulator* *Digital twin HMI*
Other involved components	*Simulator of Forecast Platform (passenger demand)*
Expected Demonstration Location	*Dataset from Munich*
Demonstration storyboard	1. *The macro simulator initializes with information about the urban transportation systems that it has previously requested from the Urban Transport Service Provider.* 2. *Each time the Planning Operator requests situational awareness on a selected day of operation, the macro simulator collects the planned offer for that day from the Urban Transport Service Provider, as well as the passenger long-term demand from the Forecast platform.* 3. *The macro simulator then simulates how passengers flow across the urban transport network.* 4. *At the end, the Digital twin HMI displays Passenger KPI based on the simulation, and the Planning Operator interacts with them to get a better idea of how to optimize the offer.*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*Ideally a real Planning Operator will assess the functionality through a questionnaire at the end of the demonstration period. Open feedback will also be gathered.*
Exploitation	*KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Philippe Bernard, GTSD* *Nicolas Germain, GTSD*
Notes	-

8.15.2. Decision support for incidents management

Name	*Decision support for incidents management*
ID	*FP1-DEMO-25.5-UC-02*
Description	*Decision support for the operator to carry out corrective actions (reinforcement of service for example) and to manage incidents on the urban transport network, thanks to the short-term passenger flow prediction.*

Related to task/subtask(s)	*Task 24.5*
Technical Enabler(s)	*TE25*
Stakeholders	*GTSD plays the role of Traffic Operator.*
Goal	*The aim of this use case is to assist the Traffic Operator in managing incidents on the urban transport network and implementing corrective actions, such as reinforcing services, by utilizing short-term passenger flow prediction.*
Demonstration Requirements	*None*
FP1 Developed components/functions/methods target of demonstration	*Micro Simulator* *Digital twin HMI*
Other involved components	*Simulator of Forecast Platform (passenger demand)* *Simulator of train movements* *Simulator weather conditions* *Simulator of alerts*
Expected Demonstration Location	*Dataset from Paris*
Demonstration storyboard	*1. The micro simulator initializes with information about the urban transportation systems that it has previously requested from the Urban Transport Service Provider.* *2. The micro simulator collects continuously current offer forecast (vehicle movements) and incident information from the Urban Transport Service Provider, as well as the passenger short-term demand from the Forecast platform and weather conditions from Weather station.* *3. In parallel, each time the Traffic Operator requests situational awareness, the micro simulator simulates how passengers flow across the urban transport network, the Digital twin HMI then displays Passenger KPI based on the simulation, and the Traffic Operator interacts with them to get a better idea of how to manage the incidents.*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*Ideally a real Traffic Operator will assess the functionality through a questionnaire at the end of the demonstration period. Open feedback will also be gathered.*
Exploitation	*KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Philippe Bernard, GTSD* *Nicolas Germain, GTSD*
Notes	*-*

8.15.3. Sandboxing for test of incident mitigation scenarios

Name	*Sandboxing for test of incident mitigation scenarios*
ID	*FP1-DEMO-25.5-UC-03*
Description	*This use case extends the behaviour of the "Decision*

	support for incidents management" use case by providing the operator with a digital twin acting as a sandbox where he can simulate different scenarios and assess the impact of potential changes or improvements. By experimenting in the sandbox, the operator can test new strategies and make data-driven decisions before implementing them in the physical world.
Related to task/subtask(s)	*Task 24.5*
Technical Enabler(s)	*TE25*
Stakeholders	*GTSD plays the role of Traffic Operator.*
Goal	*The aim of this use case is to assist the Traffic Operator in managing incidents on the urban transport network by providing him with a digital twin acting as a sandbox where he can simulate different scenarios.*
Demonstration Requirements	*None*
FP1 Developed components/functions/methods target of demonstration	*Micro Simulator* *Digital twin HMI*
Other involved components	*Simulator of Forecast Platform (passenger demand)* *Simulator of train movements* *Simulator weather conditions* *Simulator of alerts*
Expected Demonstration Location	*Dataset from Paris*
Demonstration storyboard	1. *The micro simulator initializes with information about the urban transportation systems that it has previously requested from the Urban Transport Service Provider.* 2. *The micro simulator collects continuously current offer forecast (vehicle movements) and incident information from the Urban Transport Service Provider, as well as the passenger short-term demand from the Forecast platform and weather conditions from Weather station.* 3. *In parallel, the Traffic Operator experiments in a sandbox different scenarios to assess the impact of potential changes or improvements. Each time the Traffic Operator requests situational awareness with a mitigation scenario, the micro simulator simulates how passengers flow across the urban transport network, the Digital twin HMI then displays Passenger KPI based on the simulation, and the Traffic Operator interacts with them to get a better idea of how to manage the incidents.*
Expected Demonstration Date	*Q4 2025*
Expected evaluation of results	*Ideally a real Traffic Operator will assess the functionality through a questionnaire at the end of the demonstration period. Open feedback will also be gathered.*

Exploitation	*KER11 - Short and long-term demand models and solutions including capacity and disruption management*
Responsible partner/person	*Philippe Bernard, GTSD* *Nicolas Germain, GTSD*
Notes	-

8.16. Demonstration 26.6 Fare collection and Automatic Vehicle Location. The demonstration will include disruption management across different mobility modes enabling operators to collaboratively solve the disruption and properly inform passengers.

8.16.1. Disruption management through Transport Data Hub

Name	*Disruption management through Transport Data Hub*
ID	*FP1-DEMO-25.6-UC-33*
Description	*The Transport Data Hub is an advanced solution fed with real-time information received from TSPs systems. The system gathers real-time data incidents information, allowing immediate monitoring and control of incidents and this information is provided to the users.*
Related to task/subtask(s)	*Task 25.2*
Technical Enabler(s)	*TE27*
Stakeholders	*INDRA, plays the role of technology supplier* *PTO (to be defined on the demonstration phase)*
Goal	*Demonstrate that the Transport Data Hub sends disruption information in real time to transport systems/devices, and the users are informed about them in real-time.*
Demonstration Requirements	*None*
FP1 Developed components/functions/methods target of demonstration	*Transport Data Hub*
Other involved components	*None*
Expected Demonstration Location	*Madrid*
Demonstration storyboard	1. *INDRA explains the users how the system works, and how the incidents are communicated and updated* 2. *The information will be shown in transport devices and stations*
Expected Demonstration Date	*Q2 2026*
Expected evaluation of results	*The disruption management experience will be evaluated through questionaries done by the users at the end of the demonstration period. Open feedback will also be collected.*
Exploitation	*KER 11 – Short- and long-term demand models and*

	solutions including capacity and disruption management
Responsible partner/person	*Enrique Jiménez, INDRA* *PTO (to be defined on the demonstration phase)*
Notes	*None*

9. Conclusions

This deliverable, D2.5 "Use Cases for Project Demonstrations," provides a comprehensive overview of the use cases that will be demonstrated within the MOTIONAL project. The document outlines the practical applications of the technical developments achieved in the project, showcasing how these advancements will be validated through various demonstrations.

The use cases described in this deliverable are designed to reflect the project's objectives, providing clear storyboards for the preparation and execution of the planned demonstrations. These use cases serve as a critical tool for validating the demonstration goals and ensuring that the technical activities within the MOTIONAL project are effectively showcased.

By detailing the demonstration use cases, this deliverable facilitates effective communication among project partners and stakeholders. It enables them to assess the progress and impact of the developed components and functionalities, ensuring alignment with the overall project objectives and scope. The structured approach to describing the use cases, including the identification of stakeholders, goals, requirements, and expected outcomes, provides a clear understanding of the demonstrations' purpose and expected results.

As the project progresses, the detailed descriptions of the demonstrations will be further developed in the respective demonstration work packages starting in December 2024. These work packages will follow the demonstration strategy defined in “D2.4 Demonstration Strategy” and provide demonstration reports with in-depth information regarding the specific details, actions, interactions, and results of each use case, building upon the initial definitions provided in this deliverable.

In conclusion, this deliverable lays the groundwork for the successful execution and validation of the project's demonstrations, contributing to the overall goal of improving the flexibility, efficiency, resilience, and capacity adaptation of the European rail network.

10. Bibliography

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    - Authors: Marco Ferreira
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