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D 1.1.1: Crossfreight Business Process and ICT tools AS IS



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Introduction

This paper aims to present an in-depth analysis of business processes in the railway nodes identified within the CROSSFREIGHT project, with the objective of recognising the AS IS scenario and operational processes. The focus is on operational efficiency, bottleneck analysis and the integration of digital solutions to improve the management of freight flows and shunting operations. This AS IS analysis, proposes to highlight possible bottlenecks in the management of railway operations and infrastructure utilisation. Therefore, this document is intended to represent the starting step on which to elaborate the pilots to be realised within the project, contributing to present an integrated analysis of the railway operations of the partners.



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Methodology

For the realisation of the AS IS analysis, a semi-structured questionnaire was drawn up and submitted to all project partners in order to highlight the organisational management structure and the ICT solutions used in the various nodes under analysis.

The questionnaire is presented below.

Please fill in the master data sheet for your company:

General Information	
Company name:	
Trading name:	
Legal form:	
VAT/Tax ID number:	
Date of establishment:	
Registered office:	
Main operational headquarters:	
Contact Information	
Phone:	
Email:	
Website:	
Official electronic mail address:	
Legal Representation:	
Other Data	
Safety certificate (type and number):	
Other relevant certifications:	
Main Activities	
Types of services offered:	
Geographical area of operations:	
Annual freight tonnage transported:	
Number of trains operated daily:	
Main business partners:	
Social and Environmental Responsibility	
Sustainability policies:	



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Environmental certifications:	
Quality and other certifications:	

1. Analysis of the operational railways process:

Defining for each railway “node” of the project the specific current situation related to the **operational railways process emphasizing the needs and requirements for flow management.**

- Context Overview
 - General description of analyzed intermodal and port nodes
 - Stakeholders involved in rail shunting operations
- Current Rail Shunting Processes
 - Schematic mapping of existing processes. Please use a bullet list as the following example (and outline one or maximum two examples for each process):
 - **Arriving train:**
 - Primary shunting process description (Station - Tracks)
 - Secondary shunting process description (Tracks - Terminal)
 - **Departing train:**
 - Secondary shunting process description (Terminal - Tracks)
 - Primary shunting process description (Tracks - Station)
 - **Arriving/departing train**
 - Single shunting process description (arriving)
 - Single shunting process description (departing)
 - Flowcharts of operations
 - Average timelines for each process phase
- Issues and Bottlenecks
 - Identification of main criticalities in current processes
 - Analysis of causes of inefficiencies or delays

2. Analysis of the Business processes

Defining for each railway “node” of the project the specific current situation related to the core **business process to be improved.**

- Infrastructure and Resources
 - Description of available rail infrastructure



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- List and characteristics of resources used (locomotives, personnel, etc.)
- Current shunting capacity
- Environmental Aspects
 - Environmental impact of current shunting operations (In term of CO₂ per year)
 - Any ongoing sustainability initiatives
- Benchmarking with Similar Operations
 - Comparison with best practices from other intermodal or port nodes
- Regulatory and Safety Compliance
 - Assessment of compliance with current regulations
 - Analysis of safety procedures in place

3. Analysis of the main ICT Solutions

Defining for each railway “node” the **main ICT solution adopted**

- IT Systems and Tools
 - Inventory of IT systems and software in use
 - Level of process automation and digitalization
 - Interfaces and integrations between existing systems
- Information and Data Flows
 - Analysis of information flows between involved actors
 - Types of data exchanged and formats used
 - Any communication or data sharing issues

Final Reporting:

Please, as a sum of the different considerations presented above, briefly describe the shunting process carried out in the node in about 1500 words.



Crossfreight Business Process and ICT tools AS IS

The aim of this activity is to describe the existing AS IS railway process in specific nodes (shunting areas, intermodal terminals, rail industrial areas,) underlying current needs and requirements for seamless logistic flows, conducting a detailed analysis of the existing processes.

The analyses carried out for the different nodes of the project are reported below, highlighting the main operational and business models for the different logistical nodes under analysis.



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PP1 – Fondazione ITL – Port of Ravenna

General Information

Company name:	MERCITALIA Shunting & Terminal -DINAZZANO PO
Trading name:	
Legal form:	Temporary joint venture
VAT/Tax ID number:	n.a. for a joint venture
Date of establishment:	2024
Registered office:	Ravenna (IT)
Main operational headquarters:	Ravenna (IT)

Contact Information

Phone:	
Email:	
Website:	
Official electronic mail address:	
Legal Representation:	

Other Data

Safety certificate (type and number):	IT1020240063 – Dinazzano Po
	EU1020220164 – MERCITALIA Shunting & Terminal
Other relevant certifications:	

Main Activities

Types of services offered:	Shunting activities and mainline traction services
Geographical area of operations:	Port and Rail Terminal of Ravenna
Annual freight tonnage transported:	
Number of trains operated daily:	About 15
Main business partners:	Marcegaglia (main customer)

Social and Environmental Responsibility

Sustainability policies:	ISO 14001:2015
Environmental certifications:	ISO 45001:2018
Quality and other certifications:	SO 9001:2015



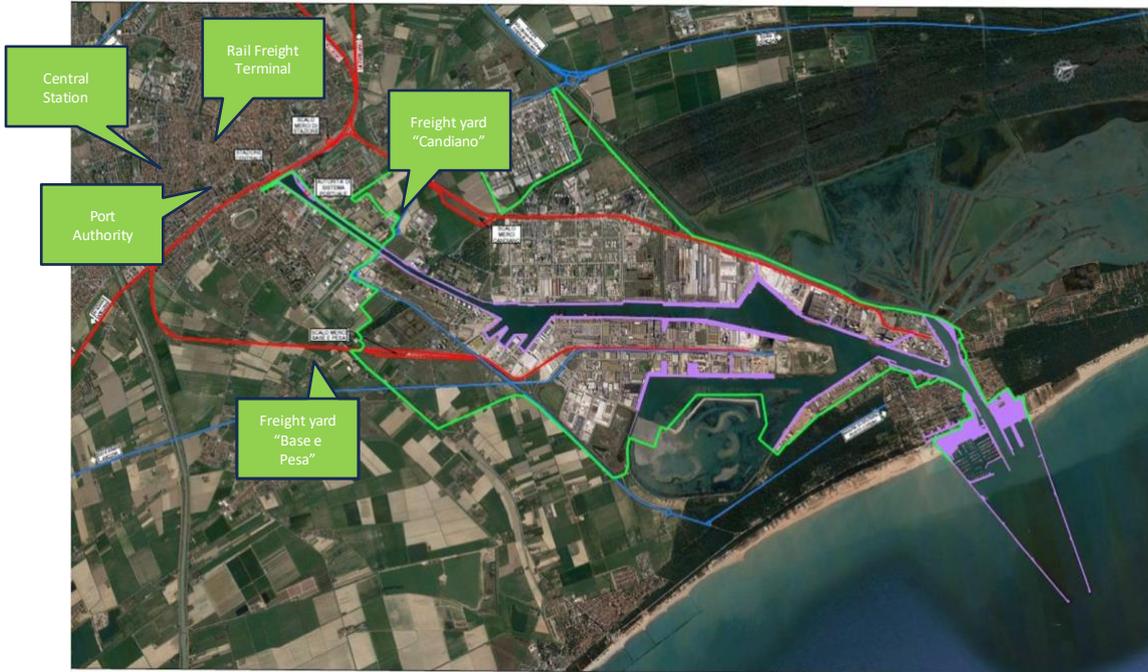


Figure 1: Map Port of Ravenna

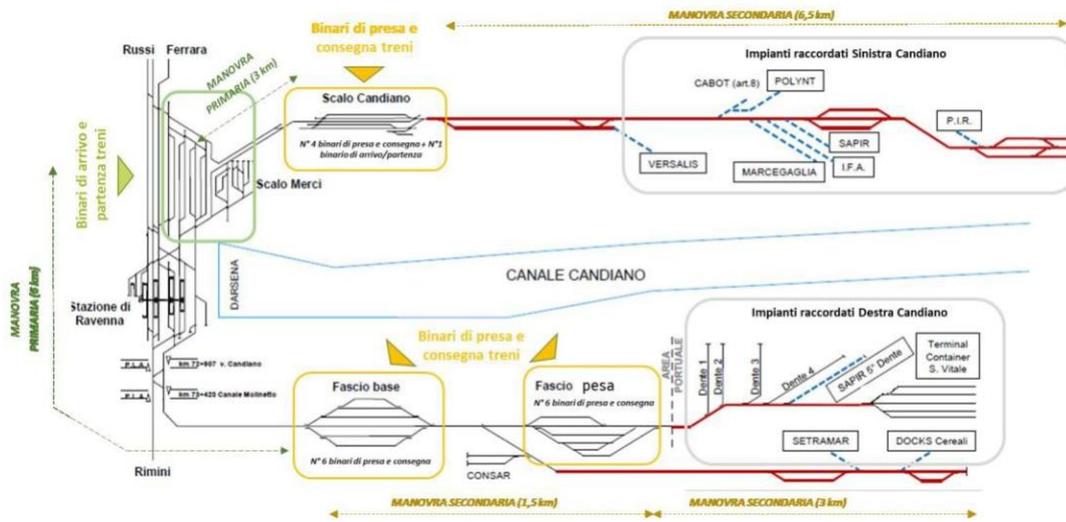


Figure 2: Synoptic Map Port of Ravenna



Analysis of the operational railways process:

The node is located near the Ravenna rail station and serves the port area. The infrastructure is connected to the national rail network (owned and managed by the national company RFI). Since February 2024 rail shunting operations are performed by a joint venture composed by MERCITALIA Shunting & Terminal (working on left-side yard “Candiano” and DINAZZANO PO (working on right-side yard “Base e Pesa”). There are 11 tracks in total (of which 3 are dedicated to dangerous freight) and 10 connected companies served.

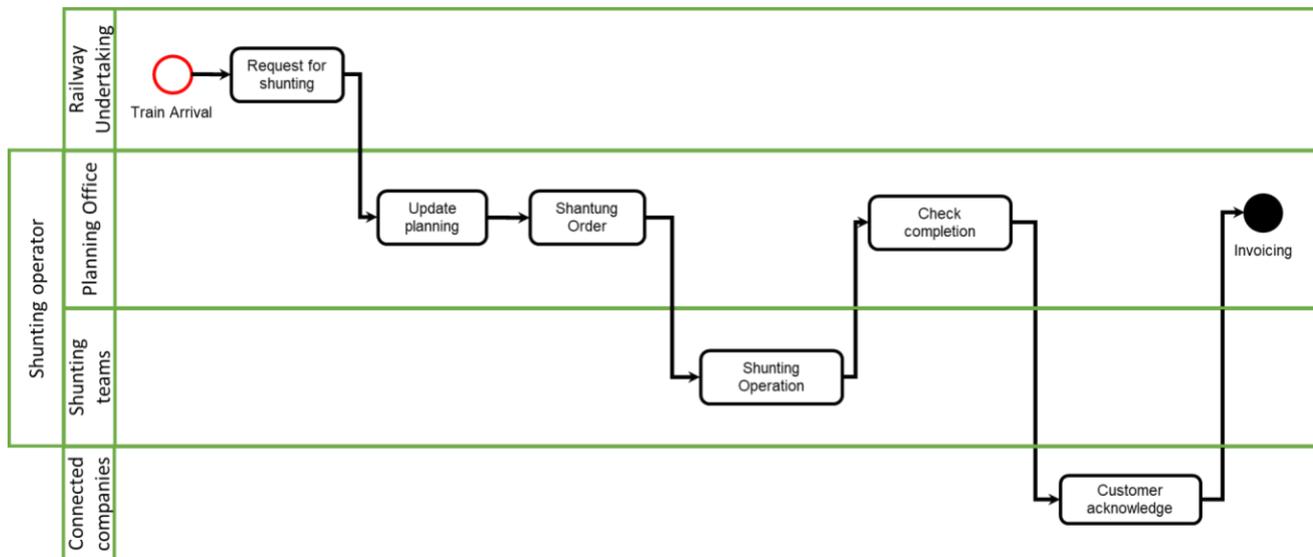


Figure 3: Schematic representation of operational process port of Ravenna

Arriving/departing train:

- Single shunting process: given the structure of the terminal (two separate yards leading to related connected companies) there is a single shunting process. After arriving in the station, the train is parked in the arrival track until the terminal has the scheduled slot free. The



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shunting team then attaches the rolling stock to the shunting loco to pull it in a dedicated track until the destination.

- Planning happens once a week with daily updates to add/suppress trains and to allocate teams.

Current bottlenecks:

1. There is not an IT management system, communication (from/to railways undertaking and customers) and assignments (to teams) are managed via email and phone. The IT shunting module is under development
2. Optimization strategy: there is not an optimization implemented yet for prioritizing shunting and managing other services.
3. In the right-side yard there are not buffer tracks to be used to manage shunted rolling stocks

Analysis of the Business Process:

Infrastructure and Resources

The node is divided into different **bundles of tracks**

Left-side yard “Candiano”:

- 4 shunting tracks
- 1 arrival/departure track
- 6 connected companies

Right-side yard “Base e Pesa”:

- 6 shunting tracks
- No arrival/departure track (shunting are used)
- Weight system (currently not working) with 6 dedicated tracks)
- 3 connected companies + 1 terminal container
- 4 shunting necks



Personnel and Capacity:

- 3 teams + 1 for extraordinary needs
- 6 days/7 (foreseen 7/7 h24)
- 15 shunting/days operated

Environmental Aspects

Apart from the ISO 14001 certification, there is not evidence of specific policies or plans for environmental assessment. The optimization brought by CROSSFREIGHT could be an opportunity to include environmental aspects into new projects and developments.

Benchmarking with Similar Operations

Several European shunting freight terminals operate at a scale and capacity comparable to the Ravenna Freight Terminal, providing relevant benchmarks for infrastructure and operations. A short list is presented hereafter:

1. Freight Terminal of Leipzig-Wahren, Germany

- **Size:** Mid-sized terminal with dedicated shunting areas for mixed cargo.
- **Operations:** facilitates single-wagonload traffic and intermodal transfers. Incorporates modern shunting locomotives and digital control systems for wagon sequencing.
- **Key Features:** integration with Leipzig's regional logistics hub and multimodal infrastructure.

2. Győr-Sopron Terminal, Hungary

- **Size:** covers over 850,000 m², handling approximately 10-12 trains daily.
- **Operations:** focuses on mixed freight, including industrial goods and bulk materials. Features mechanized shunting operations and railcar inspection facilities.
- **Connectivity:** located on the Trans-European Transport Network (TEN-T), linking Eastern and Central Europe.





3. Rotterdam Rail Service Center, Netherlands

- **Size:** approximately 500,000 m².
- **Operations:** designed for intermodal and bulk cargo handling, supporting high-frequency train schedules. Shunting operations focus on optimizing connections with maritime traffic at the Port of Rotterdam.
- **Key Features:** advanced cargo tracking systems and integration with the Betuweroute freight corridor.

4. Munich Riem Freight Terminal, Germany

- **Size:** covers around 780,000 m², handling up to 20 trains per day.
- **Operations:** specializes in containerized cargo, with shunting yards for mixed goods trains. Equipped with automated stacking cranes and advanced signaling systems.
- **Connectivity:** directly linked to the German rail network and a central node for intermodal distribution in Bavaria.
- **Digitalization features** are being studied, concerning simulation of operation (Digital Twins) and process optimization (shunting algorithms).

Regulatory and Safety Compliance

The whole terminal is compliant to National Agency for rail Security (ANSFISA) prescriptions

Analysis of the main ICT Solutions

No complete shunting system is currently operational. The level of automation is limited and processes are performed through manual operations enabled by emails and phone call. However, the IT system design is in progress and expected to be acquired, upon tender, soon. The system should include the optimization services as well.

In addition, it is worth mentioning that in 2019 the Port Authority started the project for the creation of the Port Digital Twin that should become the virtual picture of the real infrastructure. The project aims not only to represent the physical and static structures (docks, bodies of water, seabeds, roads, railways), but





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also should dynamically integrate all the data that comes directly from the sensors present in the field (fixed sensors, but also from vehicles, ships or devices that perform specific surveys). The final goal is to have a tool supporting the decision-making processes of the authority and the local community.



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PP2 – Adriafer – Port of Trieste

General Information

Company name:	Adriafer S.r.l.
Trading name:	
Legal form:	S.r.l.
VAT/Tax ID number:	01033440320
Date of establishment:	2002
Registered office:	Riva Tommaso Gulli 12 – 34123 - Trieste
Main operational headquarters:	Porto Franco Nuovo, Palazzina Trazioni SNC – 34123 - Trieste

Contact Information

Phone:	0406732511
Email:	adriafer@adriafer.com
Website:	www.adriafer.com
Official electronic mail address:	adriafer@adriafer.com
Legal Representation:	CEO Dott. Maurizio Cociancich

Other Data

Safety certificate (type and number):	EU - 1020240132
Other relevant certifications:	

Main Activities

Types of services offered:	Shunting activities and mainline traction services
Geographical area of operations:	Friuli Venezia Giulia
Annual freight tonnage transported:	1.250.000 tons
Number of trains operated daily:	30
Main business partners:	Ecco-Rail, Sangritana, Alpe Adria

Social and Environmental Responsibility

Sustainability policies:	None
Environmental certifications:	ISO 45001
Quality and other certifications:	ISO 9001



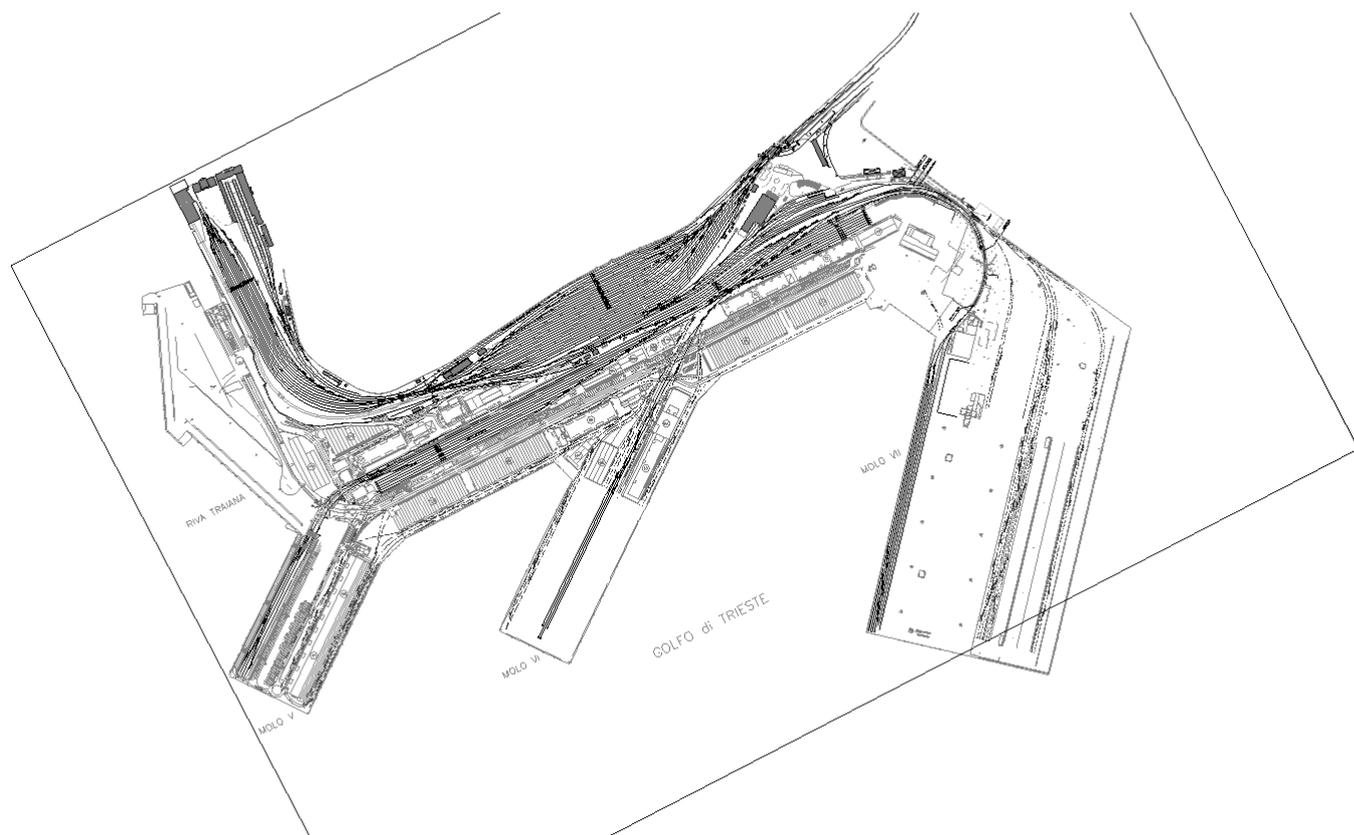


Figure 4: Synoptic Map of the railway infrastructure of the port of Trieste



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Analysis of the operational railways process:

We will report about the port node of the “Porto of Trieste”. The port node is divided into different areas (station, rail yard and terminals) where, for all the shunting operations, is involved only one shunting company as sole manager that is Adriafer S.r.l.

There is one main Railway Station (Trieste Campo Marzio) that is a head station connected to the RFI infrastructure only partially automated. Connected to the station we have a rail yard (with not electrified switches) linked itself to the three different maritime terminals (Pier V, Pier VI and Pier VII). Adriafer rail yard is also connected to a secondary hub from which is possible to reach another terminal located in the Trieste Industrial Zone (HHLA PLT Italy) and different parking tracks (Aquilinia Station).

Arriving train:

- Primary shunting process: After arriving in the station the train is parked in the arrival track until the terminal has the scheduled slot free. At that point the shunting team attaches to the rolling stock to the shunting loco and initially pull in a dedicated shunting track and then push it through the gate of the custom clearance for the custom check.
- Secondary shunting process: In the rail yard the train is left to another shunting team that again pull and then push the rolling stock in the terminal’s tracks where they detach and leave the train for the terminal’s unloading operations.
- To reach the secondary hub there is a different process and the material goes straight from the station to the hub like a standard train without shunting and there, at the hub’s tracks, another shunting team introduce it in the terminal through another custom gate.

Departing train:



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- Secondary shunting process: When the terminal has concluded the operations on the train a first shunting team pull the train in the rail yard and then push it on a track where a second shunting team wait for them.
- Primary shunting process: The shunting team attaches to the train and pull it from a custom clearance gate to a shunting track than they push it in a precise departure track.
- To leave the secondary hub there is a different process. There is only one shunting team that pull the train from a custom clearance gate to an exchange track. They detach from it and leave. In a second moment a standard train is done to reach the departure station.



Flowcharts of operations:

ARRIVAL:

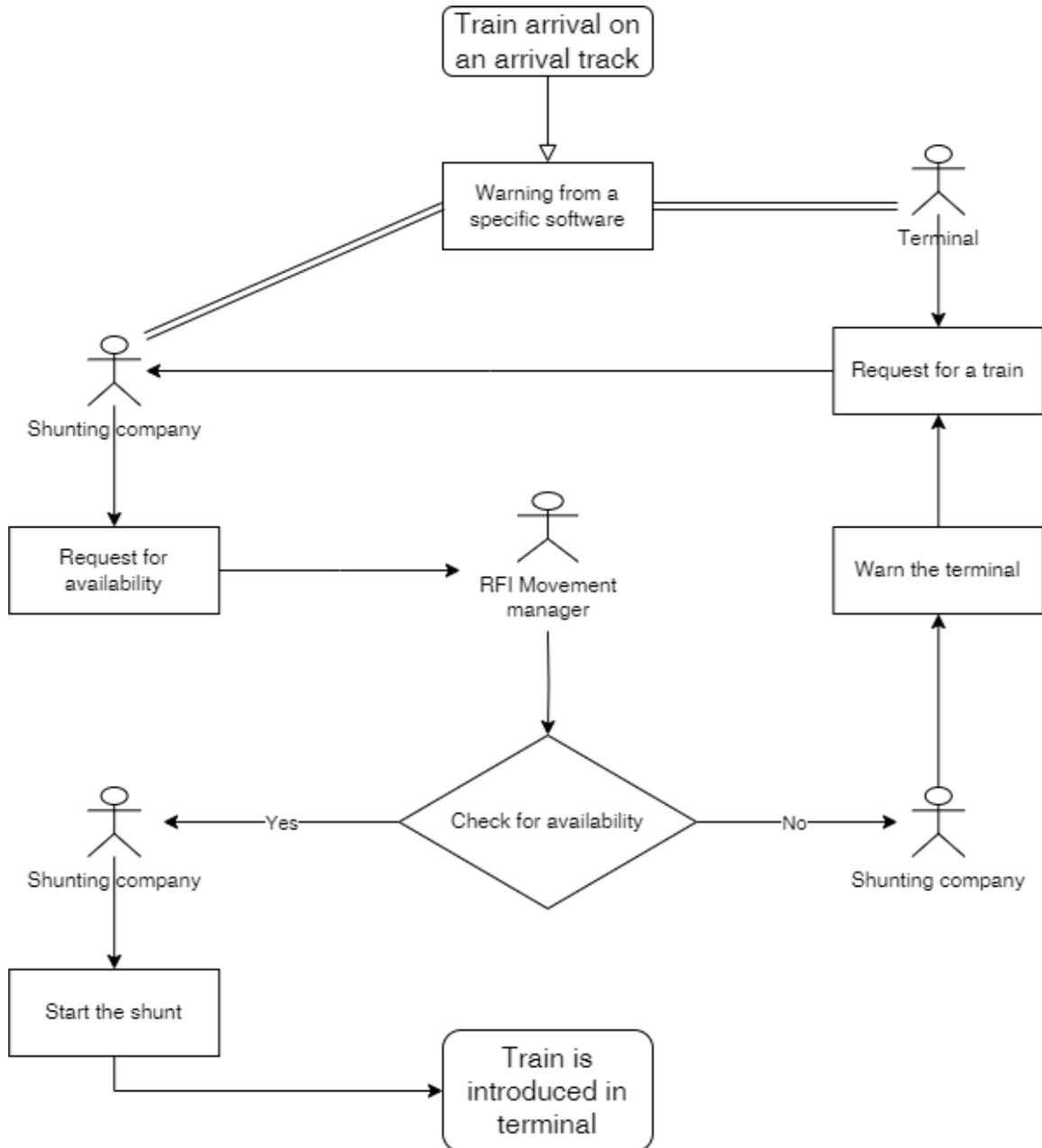


Figure 6: Schematic representation of Adriafer train arrival operational process



DEPARTURE:

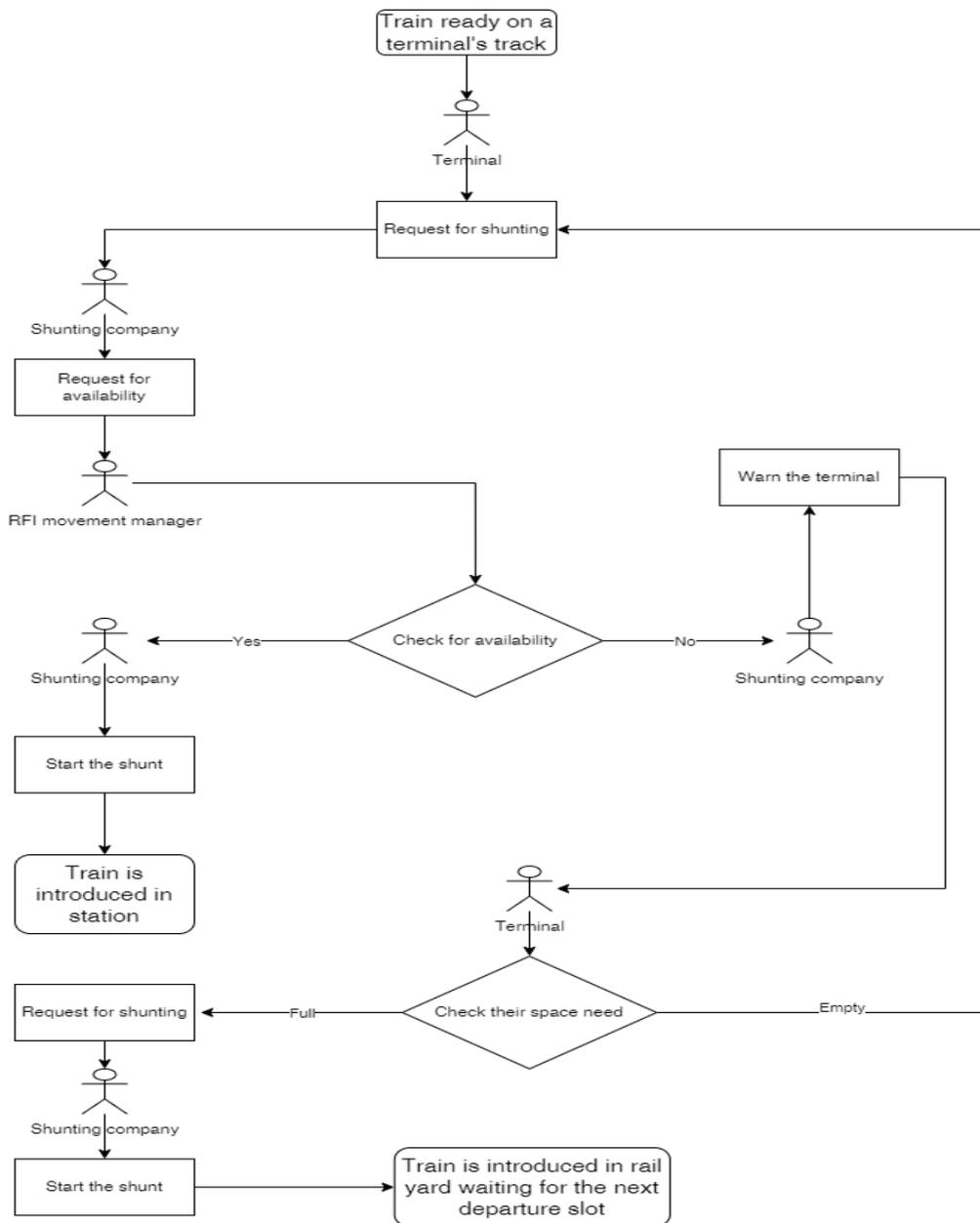


Figure 7: Schematic representation of Adriafer train departure operational process



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Average timelines for each process phase

ARRIVAL

STEP	TIME
From the arrival to the request of the terminal	Variable according to the needs of the terminal
From the request to the start of the shunt	1,5h
Shunt	1,5h

DEPARTURE

STEP	TIME
From the readied train to the request of the terminal	Variable according to the needs of the terminal
From the request to the start of the shunt	1h
Shunt	1,5h

Issues and Bottlenecks

Identification of main criticalities in current processes

We have two main different issues in this process: the first one is related to coordination inefficiencies brought about by information exchange problems and the second one is a capacity issue caused by infrastructural limitations.

Analysis of causes of inefficiencies or delays

For the first instance the main problem is that many information aren't real time information but is sent via mail between the various operators (terminal, RU, Shunting Manager) mainly through mailing lists. Having an open access platform where all relevant stakeholders can visualize real time data relevant for that train can speed up this process. On this regard, from 2015 the Port Network Authority of the Eastern Adriatic Sea (PNAEAS) has undertaken the development of its own Port Community System which currently still needs integration with the different stakeholders' software suites and Management Systems.



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The second instance, i.e. infrastructure limitations, can only be overcome through modifications of the infrastructure by automating (electrify) the switch tracks.

Analysis of the Business Process:

Infrastructure and Resources

Description of available rail infrastructure

The node is divided into different bundles of tracks.

Station:

- 5 recovery tracks
- 9 movement tracks
- 10 arrival/departure tracks
- 13 parking tracks
- 2 shunting tracks

Rail yard:

- 26 parking tracks
- 3 shunting tracks

Terminal (each):

- 4 parking tracks

Secondary hub (HHLA PLT ITALY):

- 3 parking tracks
- 1 shuntin track

FREESTE

- 3 parking tracks

Terminal:



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4 parking tracks

List and characteristics of resources used

For the shunting in all the node we have available many diesel locomotive (daily used plus backup) with personnel 24/7 divided into 3 shifts. For every shift we have 3 people in the control room. We have different Motorola communication devices.

Costruttore	HENSCHEL
Modello	DHG700C
N. servizio	509
Tipologia	Diesel – idraulica
Anno di costruzione	1973
Anno revamping	2017

Costruttore	HENSCHEL
Modello	DHG700C
N. servizio	510
Tipologia	Diesel – idraulica
Anno di costruzione	1975
Anno revamping	2019

Costruttore	HENSCHEL
Modello	DHG700C
N. servizio	511
Tipologia	Diesel – idraulica
Anno di costruzione	1977
Anno revamping	2020

Costruttore	HENSCHEL
Modello	DHG700C
N. servizio	512
Tipologia	Diesel – idraulica
Anno di costruzione	1976
Anno revamping	2019



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Costruttore	HENSCHEL
Modello	DHG700C
N. servizio	513
Tipologia	Diesel – idraulica
Anno di costruzione	1978
Anno revamping	2018

Costruttore	Krauss Maffei GmbH
Modello	V100
N. servizio	V100.101
Tipologia	Diesel – idraulica
Anno di costruzione	1962
Anno revamping	2020

With this setting we shunt about 7500 trains per year. Other than that we have many ancillary shunting movements to manage the rail yard or wagons damages.

Environmental Aspects

Environmental impact of current shunting operations (In term of CO2 per year)

All our diesel locomotive combined use 167.553 liters of gasoline/year. This translate into 362.970 kg of CO2 eq.

Any ongoing sustainability initiatives

Adriafer's commitment to the creation of intermodal logistics that is intelligent, green and integrated is realised through the promotion of unique initiatives in the Italian railway panorama; in the near future it aims to be one of the first railway shunting companies to experiment with alternative energy shunting locomotives with the aim of responding to the increasingly pressing need for an 'ecological transition'



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capable of reducing the carbon footprint of the transport sector, which is responsible for almost half of today's CO2 emissions in Europe.

Adriafer is working towards a gradual reduction of polluting emissions so that the aims of reducing air pollution and, more generally, respect for the environment can become a reality. In fact, in the near future, it aims to be one of the first railway shunting companies to experiment with alternative energy locomotives, an initiative in line with the European 'Green Deal' that wants 'drastically less polluting transport' by 2025 with the interest of converting some of the shunting vehicles from diesel to LNG (Liquid Natural Gas) and thus reducing CO2 emissions by 20% and completely eliminating other pollutants (Nox and PM). After that, it wants to aim for complete decarbonisation by experimenting with hydrogen-powered locomotives, the 'keystone' in the energy transition challenge. In order to achieve this, it has signed a framework agreement with the 'Giacomo Ciamician' Interdepartmental Centre (an interdepartmental structure of the University of Trieste focused on research, technology transfer and support for decision-making and cultural aspects on energy, transport and environmental issues).

Benchmarking with Similar Operations

Comparison with best practices from other intermodal or port nodes

General best practices in EU ports

Several best practices are being implemented across European ports to improve shunting and rail operations:

- Digitalization initiatives to maximize infrastructure potential and improve efficiency
- Implementation of data sharing systems and real-time information for better capacity planning and traffic flow management
- Focus on intermodal connectivity, linking sea and inland ports with efficient rail networks
- Prioritization of ERTMS (European Rail Traffic Management System) implementation to improve technical interoperability



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- Efforts to address cross-border issues like differences in traction energy, train length, train controlling systems, and operational rules

Kijfhoek Shunting Yard (Netherlands)

Kijfhoek is considered one of the most advanced shunting yards in Europe, serving the Port of Rotterdam, which is the busiest port in Europe.

Some key aspects of its operations include:

- Use of a hump for efficient roll-in operations, where cars are pushed up and then roll down into classification tracks by gravity
- 43 classification tracks available, with 37 currently used by Deutsche Bahn
- Optimization efforts using advanced algorithms like Simulated Annealing to create efficient shunting schedules
- Capability to handle large problem instances and create solutions where over 95% of cars depart with the first possible train, minimizing delays
- Research shows that performance decreases significantly when available classification tracks drop below 29

Best practices related to digital solutions

European ports are implementing various digital solutions to improve shunting efficiency and overall rail operations. Here are some key developments:

Digital Twins

Several European ports are adopting digital twin technology to enhance their operations, including shunting efficiency:

4. Port of Antwerp-Bruges:
 - Launched APICA, a digital twin system that monitors the overall situation within the port's boundaries.



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- Represents information from different geographic layers, including railways.
 - Reports updated daily data on traffic flow, both maritime and inland.
 - Aims to evaluate and optimize activities, as well as control port operations in real-time.
2. Port of Rotterdam:
- Developed an IoT cloud-based platform in collaboration with IBM, Esri Cisco, and Axians.
 - Implemented a digital twin to enhance berth safety, combining hydrodynamic calculations and weather forecasting.
 - Predicts vessel dynamics during their stay in the port, improving location management.
3. Port of Barcelona:
- Developing a digital twin to calculate emissions produced by vessels entering or exiting the port.
 - Aims to automate the computing of port emissions and analyze their dispersion in the city.
 - Plans to create an open API with a user interface for data accessibility.

Other Digital Solutions

European ports are also implementing various other digital initiatives to improve rail operations and shunting efficiency:

- Digitalization efforts to maximize infrastructure potential and improve overall efficiency.
- Implementation of data sharing systems and real-time information platforms for better capacity planning and traffic flow management.
- Development of cloud-based software platforms for tracking train positions and managing shunting operations.
- Integration of different software systems to enable real-time information exchange among stakeholders.

These digital solutions aim to address several key aspects of port operations:

- Improved decision-making through real-time data and predictive modeling.
- Enhanced coordination between different stakeholders in the port ecosystem.



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- Optimization of rail infrastructure usage and shunting operations.
- Better management of environmental impacts and safety concerns.

Regulatory and Safety Compliance

Every single movement in the node is strictly tied to the national regulation of the Italian institution Ansfisa. Every locomotive is under this rule (management, repair, ecc.) and every operator has the specific qualification and related certificated training.

For node emergency case we have node shared safety program known to the different performers and so for internal emergency. Periodically the procedures were revised and some formation is made to inform every figure in charge of its management.

Analysis of the main ICT Solutions

The main software that we use internally is a cloud based platform from the software house Binary System that we use to identify the positions of the different trains within the yard, to trace every single shunt and that we use to manage our employees. This software needs in every of his part a manual data entry. We cannot collect data automatically from the moving train/wagons. After the data collection the system can manage different data output. This software is shared among all the actors in order to inform them of the position of their trains.

It also exists for the entire node a software called Sinfomar that register the movement of train related to their custom clearance needs. The system registers when a train is ready to enter or exit the rail yard to be introduced in the Italian freight circuit. The system records each stage of documentation collection to finally notify when a train can be moved.

We are trying to interface the two systems described above in order to have real time info and know exactly where a train is and his precise documentation status. To do this kind of interface we need to exchange info with direct pop up in cloud and specific notes on video and we need to export data in exchangeable shared format.



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The main difficult is to make speak one to each other the two systems. Different software house with different needs and different programming system.

Cost Structure Considerations

Every shunt involves different costs, fixed and variable, with about a 70/30 ratio. The fixed cost can be simplified in locomotive and personnel (even if not all the personnel receive the same identical paycheck). The variable one is the fuel consumption which depends on the length of the route, the waiting time and mainly form the weight of the loaded wagons. Clearly the heavier are the train and more will be the consumption.

The length of every single route within the nodes can't be calculated and in the same way we can't calculate the waiting time. We can calculate the minimum and the maximum one but it's impossible to build a tariff for every possible route. What we can hypothesize instead is the weight of the train or single wagon and that's the reason why we have different tariff for every kind of shunt.

If we speak about a complete train from the station we can calculate the route, we can hypothesize his weight and also the waiting time. If we speak about empty wagons movement we know that the shunt will be easier, faster and less fuel consuming. The same for the shunting of single wagons.

With this in mind, adding the fixed cost, we are able to build the tariff. Here an extract:

Primary and secondary shunting	From 775€ to 800€/train
Primary and secondary shunting for the secondary hub	1.400€
Single wagon shunting	150€
Empty train movement	500€

As above said we have many differente variable in the caculation of the costs so it's extremely difficult to speak of a precise profitability of the shunting. We can arrange to simulate that but nothing more.

To optimize the costs we have only a few possibilities. Decrease the fuel cost (depends on external factors), decrease the waiting time (optimizing the shunting and the interface with all the actors involved) or decrease the personnel costs (involve social issue).





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We can also try to increase the number of shunting in order to spread more the more onerous fixed cost but, as per the fuel, that number depends on external factors.



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PP3 – AIN – Škrljevo Railway Station

General Information

Company name:	Air, Maritime and Railway Traffic Accident Investigation Agency
Trading name:	AIN
Legal form:	Body governed by public law
VAT/Tax ID number:	40956403978
Date of establishment:	April 25, 2013
Registered office:	Lonjička 2, 10000 Zagreb, Croatia
Main operational headquarters:	Lonjička 2, 10000 Zagreb, Croatia

Contact Information

Phone:	+385 1 8886 830
Email:	alana.vukic@ain.hr
Website:	www.ain.hr
Official electronic mail address:	info@ain.hr
Legal Representation:	Alana Vukić, Director

Main Activities

Types of services offered:	Independently investigation of accidents and incidents in air, maritime and railway traffic
Geographical area of operations:	Croatia

Škrljevo



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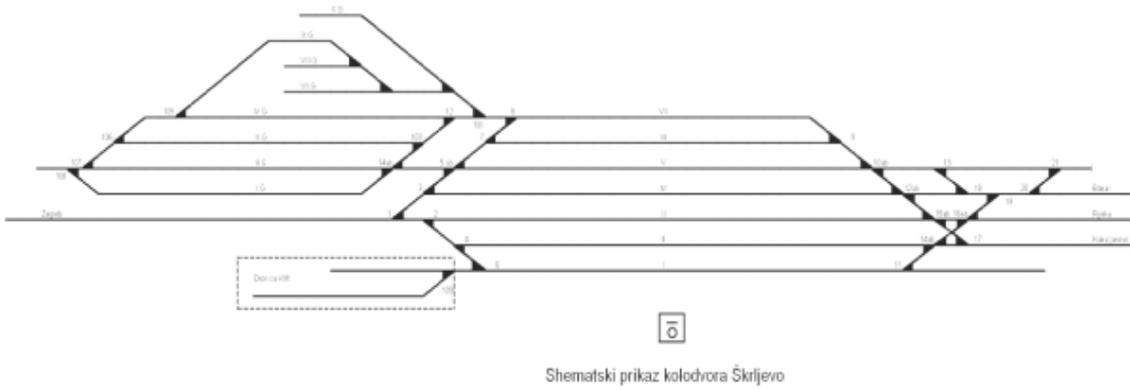


Figure 8: Synoptic Map of the railway station of Škrlevo



Figure 9: Map of the Škrlevo railway station and operational area



Analysis of the operational railways process:

Station Škrljevo is an intermediate station on the scheduled section of the single-track electrified railway Zagreb - Rijeka, it is a scheduled station for the single-track electrified line Škrljevo-Bakar, located at km 641+242, at an altitude of 263 m. From station Drivenik to station Rijeka and from station Škrljevo to station Bakar are in decline of 25‰. The station is open for the reception and dispatch of passengers and wagon shipments. For the reception and dispatch of passengers, the station has a passenger waiting room in the reception building, a platform between the reception building and the first track and a platform between the first and second tracks with a length of 105 meters. For loading or unloading wagon shipments, and for receiving, dispatching and assembling trains, the station has receiving-dispatching, handling, garage and extraction, and protective tracks.

Stakeholders involved in rail shunting operations: Croatian Railway Undertakings, Infrastructure Manager

Current Rail Shunting Processes

Arriving train:

Technical train inspection, 1 wagon inspector, 20 minutes

Commercial train inspection, 1 train driver, 20 minutes

Processing of transport documents, 1 transport salesperson, 10 minutes

Maneuvering tasks, 1 operator, 2 maneuverers, 20 minutes

Total duration of previous and main operations 40 minutes

Departing train:

Maneuvering jobs, 1 operator, 2 maneuverers, 20 minutes

Train list and document processing, 1 train driver, 20 minutes

Technical train inspection and braking test, 1 wagon inspector, 40 minutes

Total duration of main and final operations 60 minutes



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Arriving/departing train

Getting train information, 1 train driver, 5 minutes

Commercial train inspection, 1 train driver, 10 minutes

Processing of transport documents, 1 transport salesperson, 10 minutes

Maneuvering jobs, 1 operator, 2 maneuverers, 10 minutes

Brake test and final processing of documents 5 minutes

Total duration of previous, main and final operations 20 minutes

Issues and Bottlenecks

Two trains arrive at station Škrljevo 24 hours a day for partial processing and 4 trains if necessary for complete processing. 8 trains depart from station Škrljevo during 24 hours after complete renovation.

In the timetable at the station Škrljevo, the busiest period is between 01.22 and 01.51, in which period 2 trains arrive. The average minimum train arrival interval is: 29 minutes. In station Škrljevo, the busiest period is between 9.35 and 10.10, in which period 2 trains leave. The average minimum train departure interval is: 35 minutes.

Analysis of the Business Process:

The station Škrljevo is provided with an electro-relay signal-safety device of the type SpDrL 30 LORENZ with a built-in automatic track block device according to stations Meja and Sušak Pećine and the AS device that ensures a high level of traffic safety on the railway and in the station. On the railway line Škrljevo-Bakar, insurance was implemented using a signal-safety device type Siemens EI SpDr S – 64 in station Šoići with built-in inter-station dependency. In addition to the entrance and exit signals, the station Škrljevo is also equipped with maneuvering signals for the protection of the railway carriageway, which are installed in front of the exit signals and in front of the switchback areas they protect. The 1st track is a manipulation track used for loading or unloading wagon shipments, depositing shunting locomotives, wagons intended for loading or



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unloading, and technical maintenance of wagons. The group of tracks from the 2nd to the 6th track constitutes a receiving-dispatch group of tracks that is used for the entry, exit, passage or crossing of trains. Exceptionally, in case the station is congested, 1. can be used for receiving and dispatching trains or the 7th track with the observance of special precautions, considering that these tracks are not equipped with main signals, the state of occupancy is not controlled by a block device, and on the 1st track, the voltage in the overhead line is regularly switched off. The garage group of tracks consists of tracks from tracks 9 to 13 and tracks 15 to 17. The 10th, 11th and 12th tracks (1st, 2nd and 3rd garages) are used for depositing wagons, the 13th track (4th garage) is used for depositing wagons that they are also waiting to be sent to the workshop for wagons that remain in the station for a long time. The 9th track (the 9th garage) serves the needs of HŽ (unloading of bulk material, accommodation of vehicles, wagons, machines and equipment of units working on the construction, overhaul and maintenance of railways and railway facilities). Three provisionally built and unfinished tracks (7th, 8th and 10th garage) separate from the 9th track.



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PP4 – ERF – Port of Marghera

General Information

Company name:	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
Trading name:	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
Legal form:	S.p.A.
VAT/Tax ID number:	00337760276
Date of establishment:	21/12/1973
Registered office:	Via della Pila, 119/5 – 30175 - Venice
Main operational headquarters:	Via del Commercio, 16 – 30175 - Venice

Contact Information

Phone:	+39.041.921950
Email:	amministrazione@erf-spa.it
Website:	www.erf-spa.it
Official electronic mail address:	amministrazione@erf-spa.it
Legal Representation:	Ing. Pietro Vitali

Other Data

Safety certificate (type and number):	EU - 1020230187
Other relevant certifications:	ISO 9001:2015

Main Activities

Types of services offered:	Shunting activities and other services linked to
Geographical area of operations:	Veneto
Annual freight tonnage transported:	2.015.531 tons
Number of trains operated daily:	16
Main business partners:	North Adriatic Sea Port Authority System

Social and Environmental Responsibility

Sustainability policies:	None
Environmental certifications:	None
Quality and other certifications:	ISO 9001:2015



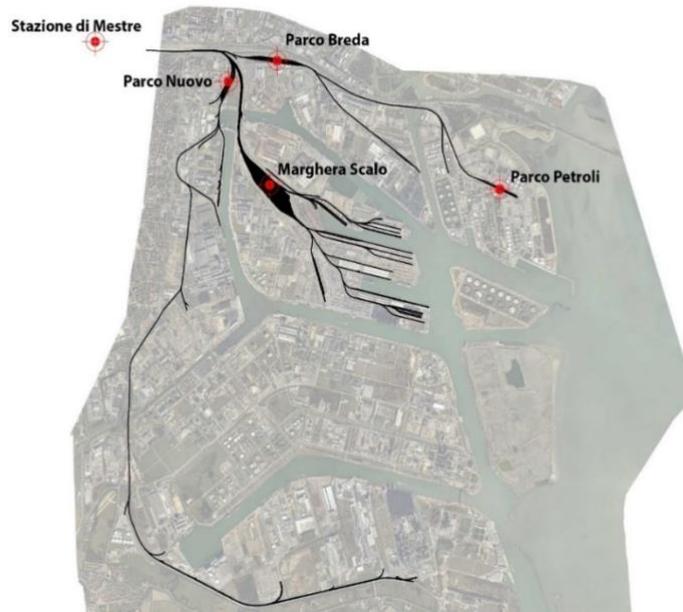


Figure 10: Port of Marghera Railway infrastructure

Analysis of the operational railways process:

Venezia Marghera Scalo Railway District consists of railway tracks which link both maritime terminals and industrial companies (belonging to the Port Area managed by the Port Authority System of the North Adriatic Sea) to the railway yards and Venezia Marghera Scalo Railway Station.

Venezia Marghera Scalo Railway Station is part of the national railway infrastructure managed by RFI as the National Infrastructure Manager and it is used only for freight traffic. It consists of a Main Marshalling Yard of 12 railway tracks (3000 V DC overhead contact line deliver energy to locos), where trains arrive and depart and convoys of railway vehicles are given to and taken by Railway Undertakings.

Considering the length of each single track, n.1 and n. 2 have a comparable length to the European module of 750 m while the length of the other tracks is always greater than the so called “commercial” module of 550 m.



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In the plant there are also an East Railway Yard (13 railway tracks of variable length from 80 to 600 m) and a West Railway Yard (5 railway tracks of about 390 m long each) both managed by Esercizio Raccordi Ferroviari di Porto Marghera S.p.A. as “Gestore Unico” (Single Shunting Operator) of Venezia Marghera Scalo Railway District shunting services and linked to the Main Marshalling Yard.

In Venezia Marghera Scalo Railway District there are also three other railway yards (Figure 1):

- Parco Breda Yard: directly linked to Venezia Mestre Station, it consists of 10 tracks of variable length (from 340 to 612 m)
- Parco Nuovo Yard: it consists of 8 tracks of variable length (from 200 m t 400 m);
- Parco Petroli Yard.: it consists of 4 tracks of variable length (from 374 m t 444 m).

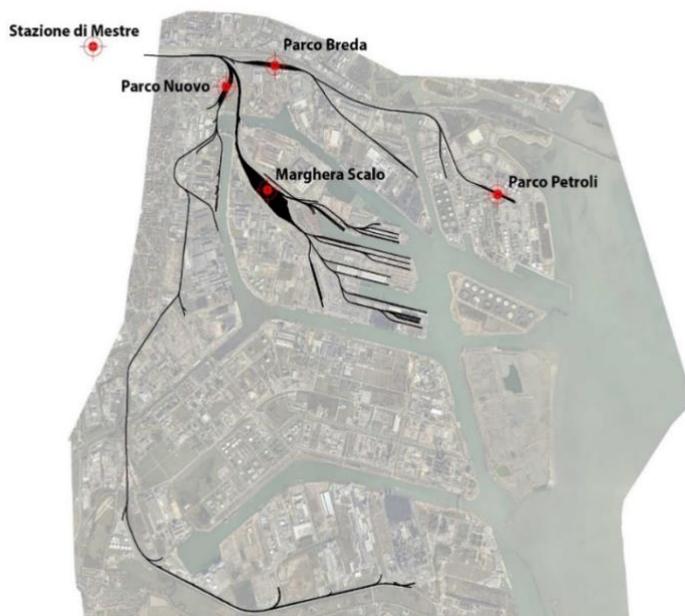


Figure 11: Venezia Marghera Scalo Railway District – Railway Yard positions

Figure 1 –

The Railway Siding Main Line make up the connecting backbone for the entire Marghera Scalo Railway District connecting the railway yards one to each other and also with Venezia Marghera Scalo Railway Station. Both Terminals (4) and Industries (12) operating in Venezia Marghera Scalo Railway District (Figure 2) receive and send goods by railway through the Railway Siding Main Line operated by Esercizio Raccordi Ferroviari di



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Porto Marghera S.p.a.: freight trains arrived in Venezia Marghera Scalo Railway Station are delivered to them by Esercizio Raccordi Ferroviari di Porto Marghera S.p.a. as Single Shunting Operator and vice versa.

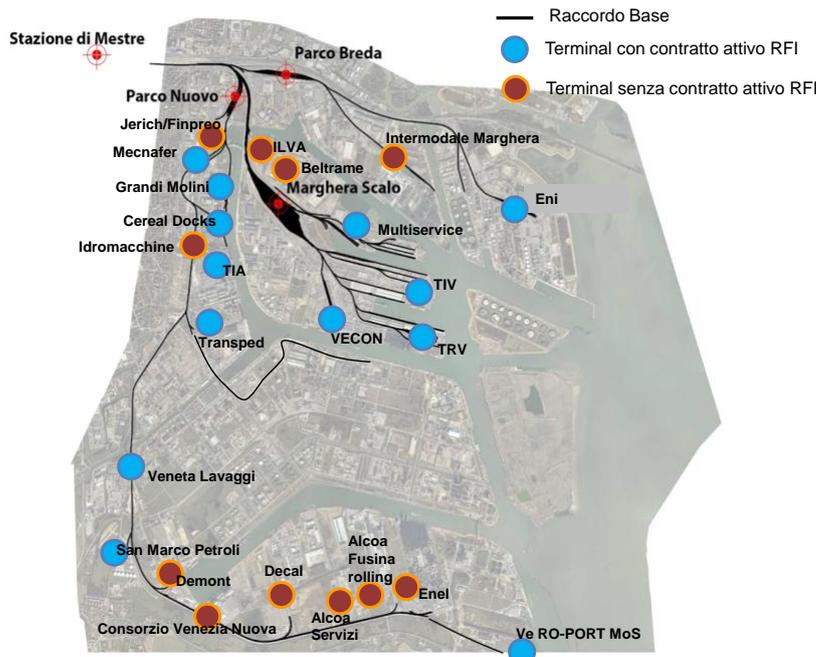


Figure 12: Venezia Marghera Scalo Railway District – Operating Terminals and Industries

Figure 2 -

As Single Shunting Operator, Esercizio Raccordi Ferroviari di Porto Marghera S.p.A. assumes the functions relating to the marketing and operation of the railway service.

The term "shunting" means any movement of traction vehicles or vehicles that normally takes place within a service location, with the exception of the starting of a train that has received the departure order and for the entry of an arriving train to the normal stopping point.

In the regulatory lexicon of railways: any movement of railway rolling stock with or without locomotives carried out at shunting speed and within service locations such as railway stations, marshalling yards, movement stations or industrial junctions.



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In this case Esercizio Raccordi Ferroviari di Porto Marghera S.p.A. carries out a type of maneuver called “Single Maneuver” (MU): traction of a railway convoy aimed at the terminalisation of departing trains or arriving trains from/to the Venice Marghera Scalo railway station, since, in agreement with RFI, the pick-up and delivery platforms coincide with the 12 arrival and departure platforms of the station itself.

Two types of Single Maneuver are thus defined:

- 1 Push MU: MU with origin the VEMAS Station and destination the gate of a connected company or the dock of a port terminal operator;
- 1 Pull MU: MU with destination the VEMAS Station and origin the gate of a connected company or the dock of a port terminal operator.

Below is a schematic representation of the railway connection and the main actors involved (Figure 3).



Figure 13_ Schematic representation of the railway connection and main actors involved

Arriving train:

- 1 Push MU: MU with origin the VEMAS Station and destination the gate of a connected company or the dock of a port terminal operator.

If the Terminal is not ready to receive the convoy, it is parked on one of ERF’s track and it will be push into the Terminal later.

Departing train:



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- 1 Pull MU: MU with destination the VEMAS Station and origin the gate of a connected company or the dock of a port terminal operator.

If pulling happens too earlier so not to be parked in one of VEMAS’s tracks, the convoy is positioned on one of ERF’s tracks and moved to one of RFI’s tracks later.

Flowcharts of operations:

ARRIVAL

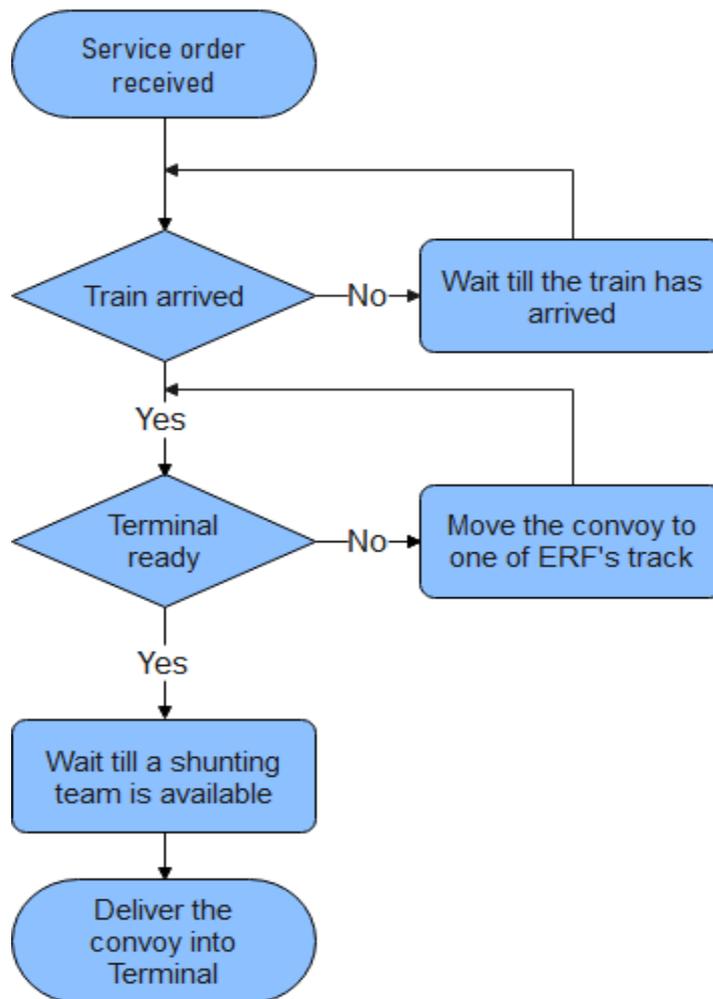


Figure 14: Schematic representation of train arrival operational process



DEPARTURE

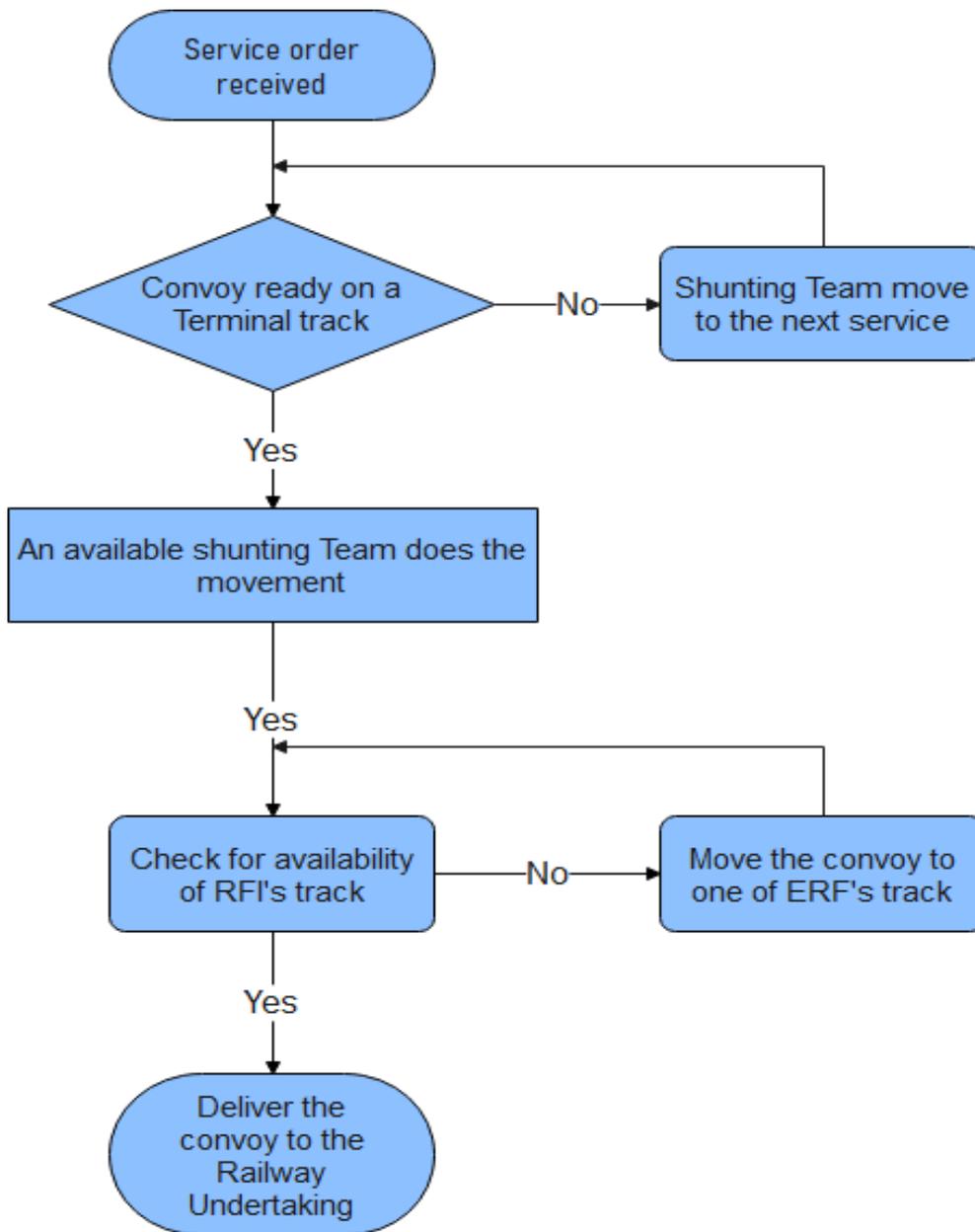


Figure 15: Schematic representation of train departure operational process



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Average timelines for each process phase

ARRIVAL

STEP	TIME
From the arrival to the request of the terminal	Variable according to the needs of the terminal
From the request to the start of the shunt	1,5h
Shunt	Variable according to the position of the Terminal

DEPARTURE

STEP	TIME
From the readied train to the request of the terminal	Variable according to the needs of the terminal
From the request to the start of the shunt	Variable according to the availability of both the Terminal and the Shunting Teams
Shunt	Variable according to the position of the Terminal

Issues and Bottlenecks

Identification of main criticalities in current processes

We have two main different issues in this process:

- The first one is due to the different procedures and tools used for exchanging information;
- The railway infrastructure used to go from the Stating up to the Terminal (which is not National Railway Infrastructure)

Analysis of causes of inefficiencies or delays

For the first instance the main problem is that many information aren't real time ones but is sent via e-mail between the various operators (Terminal, RU, Single Shunting Operator) mainly through mailing lists;



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In some case also by hand documents can be used.

Having an open access platform where all relevant stakeholders can visualize real time data relevant for that train can speed up this process. On this regard, from 2017 the Port Authority System Of the North Adriatic Sea has developed, in collaboration with ERF, its software (SIMA) which currently still needs integration with the different stakeholders' software suites.

The second instance, i.e. infrastructure limitations, can only be overcome through modifications of the infrastructure by automating (electrify) the switch tracks and by installing level crossings protected by barriers.

[Analysis of the Business Process:](#)

Infrastructure and Resources

Description of available rail infrastructure

Esercizio Raccordi Ferroviari di Porto Marghera S.p.A. manages, with the exclusion of Terminals, a network of approximately 45 km of track, divided as follows:

- For approximately 18 km on areas owned by the Municipality of Venice, in particular:
 - Parco Breda: 10 tracks relating to the industrial connections in the northern area of the port,
 - Parco Nuovo: 8 tracks relating to the southern and western areas of the port,
 - Connecting tracks towards the industrial terminals in the northern area of the port,
 - Intermediate part of the sidings from Parco Nuovo towards the terminals located in the southern area of the port;
- For approximately 27 km on areas of state maritime property under the jurisdiction of the former Port Authority of Venice (APV), now the Port System Authority of the Northern Adriatic Sea (AdSPMAS):



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- Venezia Marghera Scalo: a total of 18 non-electrified secondary tracks, located on the sides of the 12 central electrified tracks representing the Venezia Marghera Scalo Station (National Railway Infrastructure), also owned by the maritime state property but given under concession to RFI;
- Connection track between Mestre station and Venezia Marghera Scalo station;
- Connecting tracks from Venezia Marghera Scalo station to the terminals located in the central area of the port;
- Initial part and final parts of the sidings from Parco Nuovo towards the terminals located in the southern area of the port.

List and characteristics of resources used

For the shunting in all the node we have available 7 diesel locomotives (daily used plus backup) with personnel 24/7 divided into 3 shifts. The number of contemporary used locos changes from 1 to 4 according to the number of requests for services.



Locomotive	ID	Mass [tons]	Power [HP]	Number of axles	Kind of vehicle	Owner
HENSCHEL DHG 700 C	31678	54	660	3	Shunting Loco	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
HENSCHEL DHG 700 C	31694	54	950	3	Shunting Loco	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
HENSCHEL DHG 700 C	31695	54	660	3	Shunting Loco	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
HENSCHEL DHG 700 C	31689	54	800	3	Shunting Loco	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
HENSCHEL DHG 700 C	31991	60	660	3	Shunting Loco	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
HENSCHEL DHG 700 C	31994	60	660	3	Shunting Loco	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.
HENSCHEL DH 650 D	26492	64	830	4	Shunting Loco	Esercizio Raccordi Ferroviari di Porto Marghera S.p.A.

By using this kind of organization, we managed about 4400 trains per year considering also movements need to manage the rail yard and wagons damages.

Environmental Aspects

Environmental impact of current shunting operations (In term of CO2 per year)

As a function of the number of train/year and that kind of equipment, we use 144.528 liters of gasoline/year. Which means 313090 kg of CO₂ eq.

Any ongoing sustainability initiatives

We would like to change our diesel loco with some other “green” car but still don’t have any ongoing sustainability initiative because, in this area of transport, there are no valid alternatives to both diesel or diesel-electric locomotives.

Benchmarking with Similar Operations

Comparison with best practices from other intermodal or port nodes



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Several best practices are being implemented across European ports to improve shunting and rail operations:

- DSS to better manage the infrastructure capacity.
- Digitalize the exchanging documents.

Regulatory and Safety Compliance

Following both European and National Regulation ERF operates under its own Single Safety Certificate which means that our safety processes are audited at least every year by the NSA which in Italy is ANSFISA.

Starting from that, during the last years, we exported this “ratio” also to the siding’s operations so to improve the safety aspects to all of those operators that are not already involved in the “railway rules” (“last mile operators”).

Analysis of the main ICT Solutions

ERF uses the SIMA (Integrated System for the Management of the Railway Shunting) IT system developed by The North Adriatic Sea Port Authority. SIMA system optimizes planning procedures efficiency through an optimization of train placement in railway yard and their relative movements.

SIMA IT system retrieves, processes and stores data during the shunting procedures and the wagons positioning operations inside a port area or a railway hub, aiming to support management and real time monitoring of the operations. SIMA2 comprehends the following functional modules:

- Shunting Management
- Shunting Monitoring
- Reporting
- Account management
- Mobile and GPS infrastructure

Once freight trains have arrived at Venezia Marghera Scalo Station they have to be delivered to a specific Terminal. To fulfil both European and national railway norms, Railway Undertakings and National Railway Infrastructure Manager must share some information with the Single Railway Shunting Operator such as: Train number / Time of train arrival / Number of wagons / Type of wagons / State of wagons (empty, load) /



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Wagons condition / Wagons length / Number of axes per wagon / Maximum load / RID / Kind of goods / number on tacks in which in train has arrived / ETA / Time of Arrival.

The main critical aspect is to make information move from one subject to another one automatically by interfacing software. This is not easy because subjects use different software developed by different software houses.

Cost Structure Considerations

The costs are evaluated by the Port Authority System, and they are as low as possible to increase traffic of goods by rail. The cost for each single shunting movement depends on the number of cars composing the convoy and the position of the Terminal (length if the route) considering the cost of the personnel involved in the shunting and the cost of the fuel consumption. Costs are also evaluated in order not to penalize Terminals that are located very far from the station (see the table below).



TARIFFA MANOVRA UNICA PER CONVOGLIO X (MU)																						
Fascia	Raccordato/Terminalista	MU.1 X<=5 carri	MU.2 5< X <=10	MU.3 X >10 carri	SCONTI SU MU (per Cliente)																	
A	ACCIAIERIE D'ITALIA	€ 440	€ 605	€ 770	<table border="1"> <thead> <tr> <th colspan="2">Volume</th> <th>Nuovi servizi**</th> </tr> <tr> <th>Carri termin./mese</th> <th>Euro/carro</th> <th>Euro/manovra</th> </tr> </thead> <tbody> <tr> <td><150</td> <td>€ 0,00</td> <td rowspan="5">25% (sulle prime 25 manovre, nel caso ne vengano effettuate 100 in un anno)</td> </tr> <tr> <td>151-300</td> <td>-€ 4,50</td> </tr> <tr> <td>301-600</td> <td>-€ 9,00</td> </tr> <tr> <td>601-1200</td> <td>-€ 13,50</td> </tr> <tr> <td>>1200</td> <td>-€ 18,00</td> </tr> </tbody> </table>	Volume		Nuovi servizi**	Carri termin./mese	Euro/carro	Euro/manovra	<150	€ 0,00	25% (sulle prime 25 manovre, nel caso ne vengano effettuate 100 in un anno)	151-300	-€ 4,50	301-600	-€ 9,00	601-1200	-€ 13,50	>1200	-€ 18,00
	Volume					Nuovi servizi**																
	Carri termin./mese					Euro/carro	Euro/manovra															
	<150					€ 0,00	25% (sulle prime 25 manovre, nel caso ne vengano effettuate 100 in un anno)															
	151-300					-€ 4,50																
	301-600					-€ 9,00																
601-1200	-€ 13,50																					
>1200	-€ 18,00																					
B	CARBONES	€ 462	€ 627	€ 792	<p>** nuova O/D o nuova merce</p> <table border="1"> <thead> <tr> <th colspan="2">Orario del servizio/Maggiorazioni</th> </tr> </thead> <tbody> <tr> <td>Orario di servizio ordinario</td> <td>Lun. dalle 6:00 alle 21:00 del Sab. Dom dalle 08:00 alle 16,00</td> </tr> <tr> <td colspan="2">Orario ampliato su richiesta e autorizzazione di RFI</td> </tr> <tr> <td>Maggiorazione straordinario</td> <td>Nessuna</td> </tr> <tr> <td>Maggiorazione giorni festivi</td> <td>Nessuna</td> </tr> </tbody> </table> <p>Condizioni di prenotazione/annullamento</p> <p>Penale per la richiesta di annullamento entro le ore 16:00 del giorno precedente il servizio richiesto: € 200</p> <p>Penale per la richiesta di annullamento oltre le ore 16:00 del giorno precedente il servizio richiesto: 100% della tariffa</p> <p>Valore soglia della merce oltre la quale ERF necessita di assicurazione da parte del Cliente con rinuncia di rivalsa, per la parte eccedente il valore soglia, nei confronti di ERF: € 30.000</p>	Orario del servizio/Maggiorazioni		Orario di servizio ordinario	Lun. dalle 6:00 alle 21:00 del Sab. Dom dalle 08:00 alle 16,00	Orario ampliato su richiesta e autorizzazione di RFI		Maggiorazione straordinario	Nessuna	Maggiorazione giorni festivi	Nessuna							
	Orario del servizio/Maggiorazioni																					
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	Orario ampliato su richiesta e autorizzazione di RFI																					
	Maggiorazione straordinario					Nessuna																
Maggiorazione giorni festivi	Nessuna																					
C	GRANDI MOLINI ITALIANI	€ 484	€ 649	€ 814																		
	INTERMODALE MARGHERA																					
	MECNAFER*																					
	CONSORZIO VENEZIA NUOVA																					
	ENI																					
	IDROMACCHINE																					
D	INTERPORTO RIVERS VENEZIA	€ 506	€ 671	€ 836																		
	MAGAZZINI GENERALI DI VENEZIA																					
	METALRECYCLUNG																					
	SAN MARCO PETROLI																					
	TRANSPED																					
	VENETA LAVAGGI*																					
ALCOA TRASFORMAZIONI	€ 506	€ 671	€ 836																			
VENICE RO PORT MOS																						

* solo per servizi finalizzati al trasporto

Tariffa ALTRE OPERAZIONI DI MANOVRA ORDINARIA (AO)		
AO.1	Pesatura di 1 carro (Err.+0,25%)	€ 22,00
AO.2	Scarto/aggiunta carro o gruppi contigui di carri	€ 104,50
AO.3	Traslezioni tra binari	€ 203,50
AO.4	Scomposizione o composizione no MU (a Parco/a Terminal)	€ 82,50
AO.5	Traino locomotore treno	€ 82,50
AO.6	Operazioni su materiale rotabile (Sgancio/Aggancio locomotore, Rimozione/Applicazione segnali)	€ 16,50

Tariffa ALTRI SERVIZI (AS)		
AS.1	Lettera di Vettura Elettronica	€ 27,50
AS.2	Prestazioni particolari di una squadra di manovra su richiesta, riordini, attese (base 30')	€ 220/h
AS.3	Operatore di scorta a convogli o macchine operatrici autonome	€ 66/h
AS.4	Giacenza di un carro sulla infrastruttura di competenza ERF***	€ 22/giorno
AS.5	Servizi di verifica e formazione treni, in terminal e in stazione	da definire con le IF****

*** per soste di carri non destinati a fornitura dal primo giorno, franchigia di 1 settimana quelli destinati a fornitura
**** in base alle Procedure d'Interfaccia stipulate

Figure 16: Operational cost structure

So, the cost for each shunting movement is composed by two different parts:

- A fixed part which corresponds to the cost of the personnel involved in the service (about 80%).
- A variable part which corresponds to what has been reported before (about 20%).



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PP6 – Sangritana – Terminal Saletti

General Information

Company name:	Sangritana S.p.A.
Trading name:	Sangritana
Legal form:	Joint Stock Company
VAT/Tax ID number:	02357300694
Date of establishment:	26/11/2012
Registered office:	Camera di Commercio Chieti-Pescara
Main operational headquarters:	Lanciano

Contact Information

Phone:	+3908725481
Email:	segreteria.sangritana@sangritana.it
Website:	www.sangritana.it
Official electronic mail address:	sangritanaspa@pec.it
Legal Representation:	Maxmilian Di Pasquale

Other Data

Safety certificate (type and number):	Single Safety Certificate IT1020210095
Other relevant certifications:	License n.72 issued by the Ministry of Transport

Main Activities

Types of services offered:	Freight Transport, shuntings, logistic services
Geographical area of operations:	Adriatic Line
Annual freight tonnage transported:	1114369 (2023)
Number of trains operated daily:	10
Main business partners:	Adriafer

Social and Environmental Responsibility

Sustainability policies:	--
Environmental certifications:	--
Quality and other certifications:	--



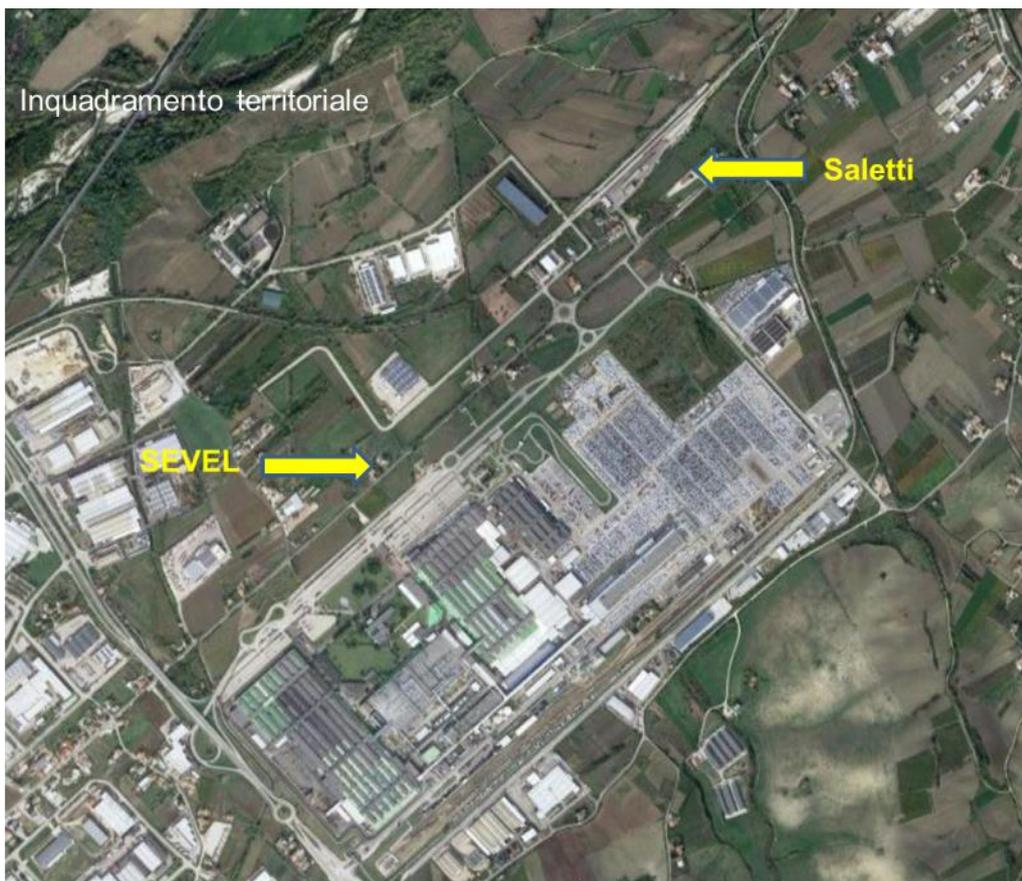
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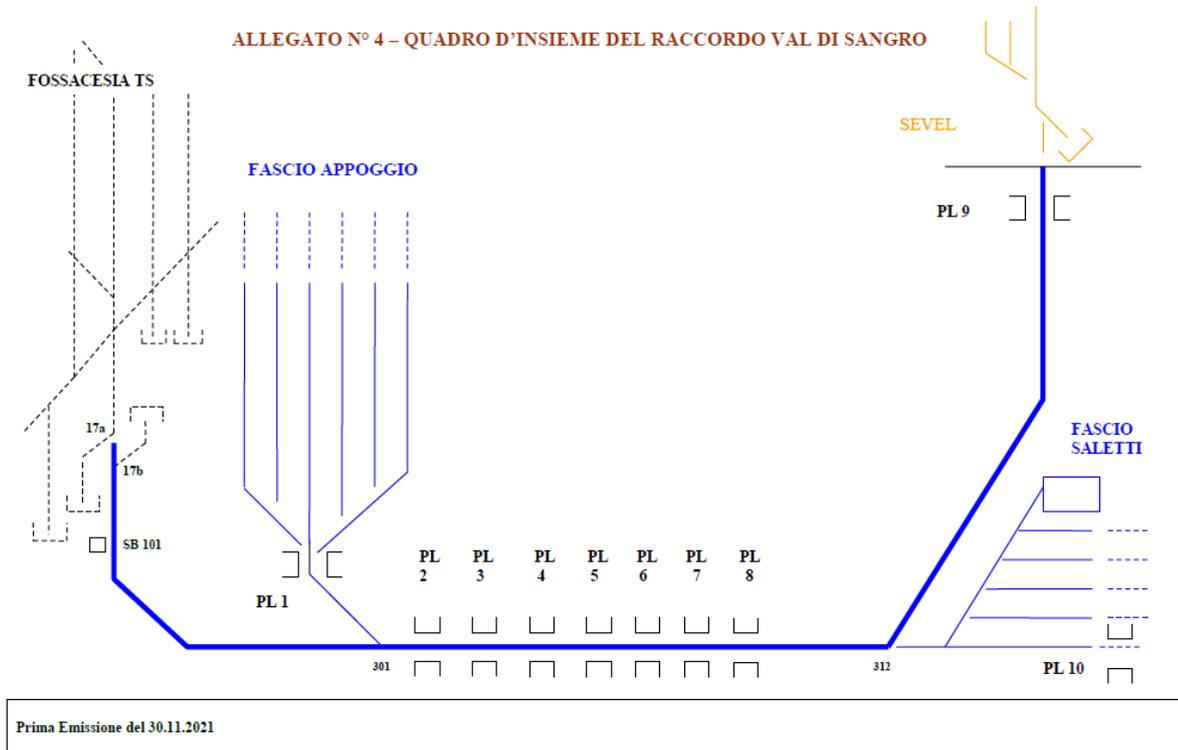




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Inquadramento territoriale





Analysis of the operational railways process:

The Val di Sangro railway junction was built by the Abruzzo Industrial Consortium (ARAP) and has been managed since 1999 by TUA S.p.A. through a 40-year agreement. TUA acts as the Infrastructure Manager and has contracted shunting services with Sangritana, which acts as the rail shunting management body. All shunting on the siding is carried out by Sangritana.

The siding is interconnected to the Adriatic line of the national rail network at the Fossacesia T/S station.

There are currently 3 freight yards operating in the Val di Sangro junction:

1. SEVEL junction
2. Saletti terminal
3. “Freight yard “pickup and delivery”



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The first two freight yards are fully operational while the third one serves only as a track bundle for short stop of wagons. In more detail, the SEVEL freight yard is a private yard of the Stellantis group and is used only for shipping light vehicles produced at the plant while the Saletti terminal is a public yard that is currently used for company trains or conventional or intermodal multiclient trains. Currently, the operating model of shunting activities is as follows:

SEVEL siding within the SEVEL siding there are 4 loading ramps with tracks capable of accommodating about half the length of trains (as of today the maximum length of trains on the Adriatic line is 575 meters loco included) whereby all rail convoys are broken down into 2 parts and placed on the loading tracks, then they are reassembled and made ready for the to exit the SEVEL siding and be transferred to Fossacesia T. S. where they are placed on the 4 tracks intended for freight transport for later departure for various Italian and foreign destinations. Conversely, empty trains arriving at Fossacesia are taken over by Sangritana and transferred to the SEVEL siding to be loaded again. If needed, empty wagons arriving in Fossacesia are parked in the pickup and delivery bundle before being transferred to the Sevel siding and being loaded. Inside the SEVEL siding, maneuvers are also carried out for the discarding of waste wagons and the reintegration of repaired wagons.

Saletti Terminal

There are 3 tracks in the Saletti terminal for loading and unloading freight convoys.

Convoys arriving in Fossacesia are transferred to the terminal, where convoy breakdown maneuvers take place to facilitate loading and unloading activities, subsequent reassembly maneuvers and transfer to Fossacesia.

In case of need, the pickup and delivery bundle is used for temporary parking of both full and empty wagons. Finally, at the Saletti terminal there is a workshop for the maintenance of both wagons and locomotives for which the maneuvers of taking and returning wagons from the workshop are also added. Currently, the railroad companies operating to and from Fossacesia are: Sangritana, Mercitalia, CFI and Captrain Italia.



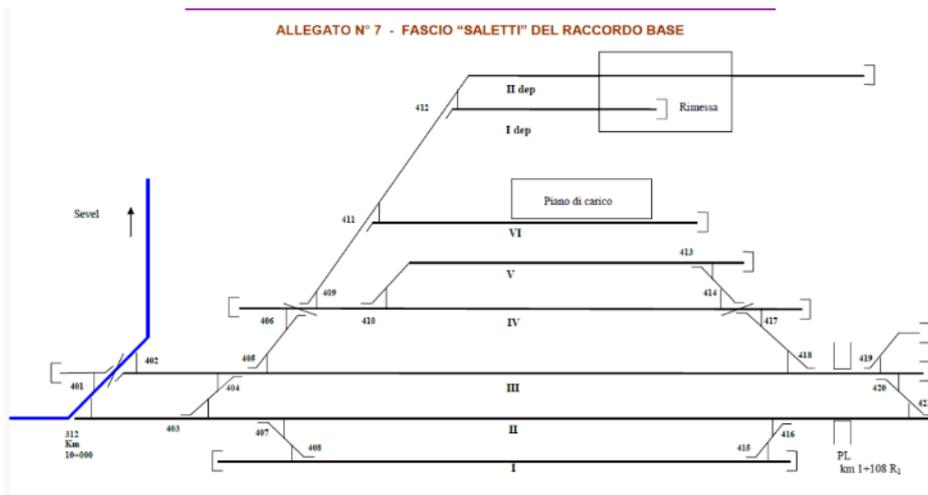
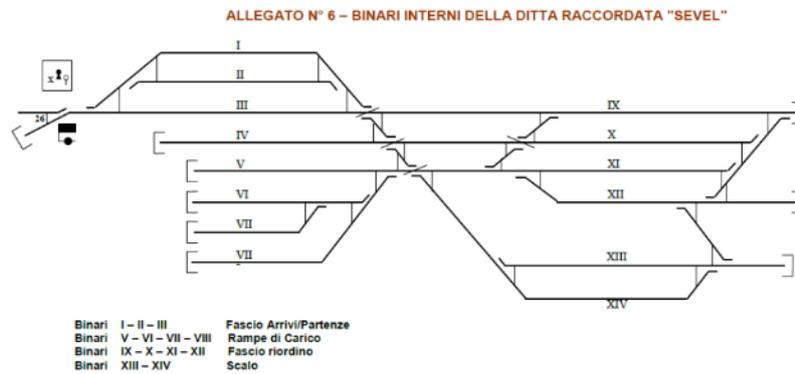
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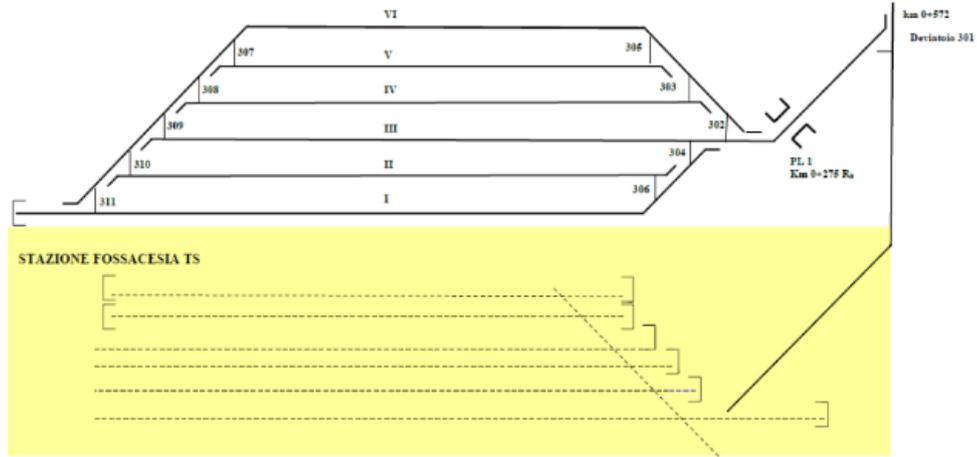
The customers are: Stellantis, Amadori, Honda, Sit Logistics.

The wagon keepers: Transwaggon, Ermewa, MFD, Sitfa, GEFCO Operators who load and unload are GN Logistics and Autostrade Stakeholders involved in rail shunting operations: TUA, Sangritana, GN Logistics, Stellantis, CIMA Repairs, Railways Company, wagons owners

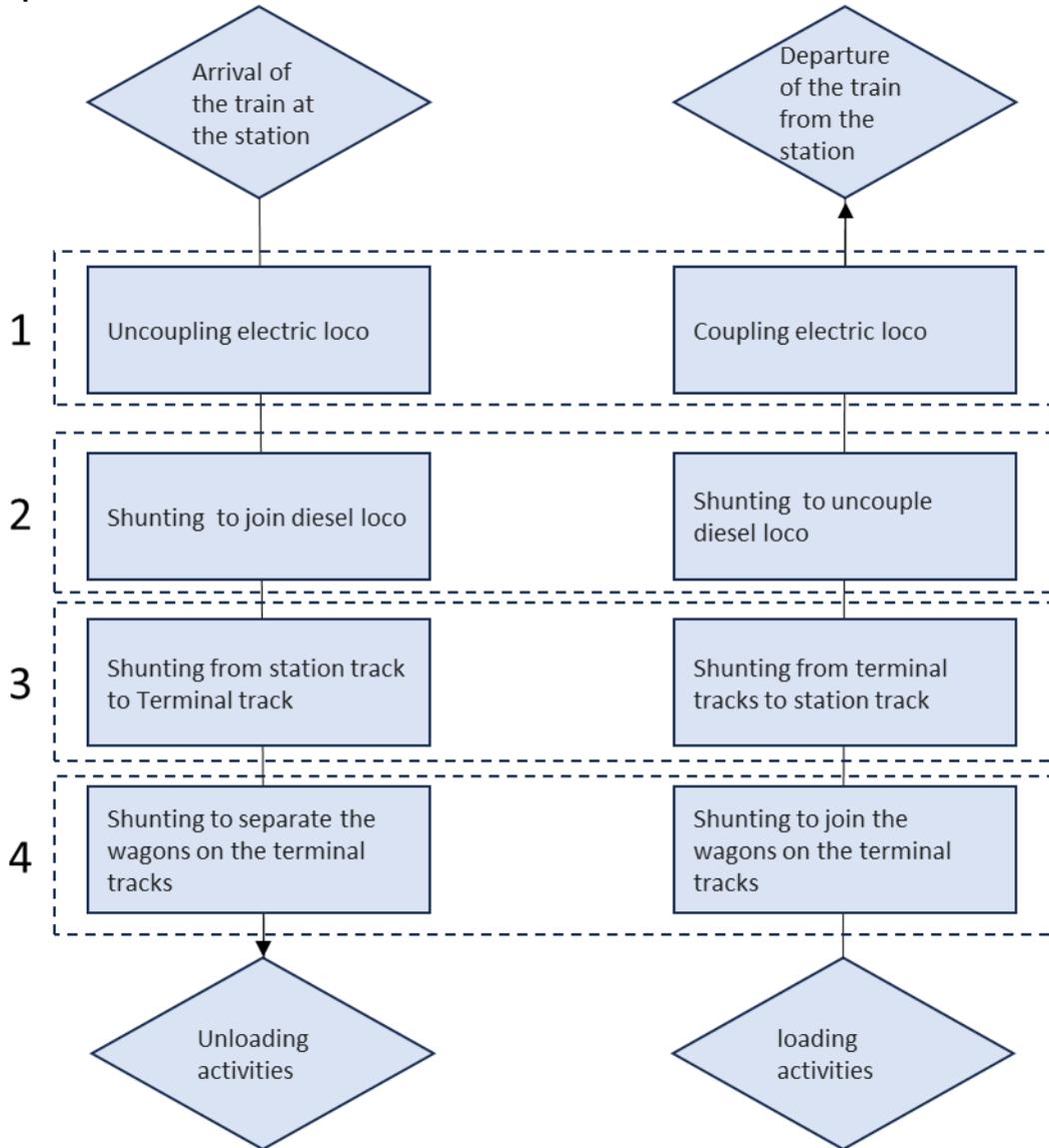
Schematic mapping of existing processes:



ALLEGATO N° 5 - FASCIO APPOGGIO DEL RACCORDO BASE



Flowcharts of operations



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Average timelines for each process phase:

1 – 5 min

2 – 5 min

3 – 25 min

4 – 1 min

Issues and Bottlenecks

- Identification of main criticalities in current processes: shunting activities vary greatly in duration and are affected by many external factors
- Analysis of causes of inefficiencies or delays: busy station platforms, interference between shunting activities with arrival and departure of trains, delay in production of dispatch documents, delays in perturbation of SEVEL's entrance gate, state of infrastructure not good



Italy – Croatia



PP7 – Port Authority of Šibenik – Port of Šibenik

General Information

Company name:	Port of Šibenik Authority
Trading name:	Port of Šibenik Authority
Legal form:	Public
VAT/Tax ID number:	HR98609040957
Date of establishment:	02.12.2004.
Registered office:	Vladimira Nazora 53, Šibenik
Main operational headquarters:	Vladimira Nazora 53, Šibenik

Contact Information

Phone:	+385 22 218 001
Email:	vinko@portauthority-sibenik.hr
Website:	https://portauthority-sibenik.hr/
Official electronic mail address:	info@portauthority-sibenik.hr
Legal Representation:	Paško Dželalija, General Manager

Other Data

Safety certificate	Law of safety and interoperability of railway system
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(type and number):																									
Other relevant certifications:	NA																								
Main Activities																									
Types of services offered:	<p>The port activities for which the Port Authority grants a concession on the existing facilities of the port substructure (infrastructure) and port superstructure (suprastructure) are:</p> <ol style="list-style-type: none"> 1. mooring and unmooring of ships, yachts, fishing, sports and other ships and floating objects; 2. loading and unloading of passengers, vehicles and cargo; 3. other economic activities for which a concession is granted in the port area are: <ul style="list-style-type: none"> - providing services to passengers, - quality and quantity control of goods, - agency and forwarding activities, - harbor towing, - port machinery service, - load securing, - use of substructure, superstructure and seawater facilities, - supply of ships. 																								
Geographical area of operations:	Port of Šibenik (Obala hrvatske mornarice 4, Šibenik)																								
Annual freight tonnage transported:	<table border="1"> <tr><td>2013</td><td>356.955</td></tr> <tr><td>2014</td><td>399.270</td></tr> <tr><td>2015</td><td>481.905</td></tr> <tr><td>2016</td><td>424.871</td></tr> <tr><td>2017</td><td>485.367</td></tr> <tr><td>2018</td><td>351.870</td></tr> <tr><td>2019</td><td>280.908</td></tr> <tr><td>2020</td><td>273.620</td></tr> <tr><td>2021</td><td>175.466</td></tr> <tr><td>2022</td><td>168.907</td></tr> <tr><td>2023</td><td>106.175</td></tr> <tr><td>2024</td><td>45.507</td></tr> </table>	2013	356.955	2014	399.270	2015	481.905	2016	424.871	2017	485.367	2018	351.870	2019	280.908	2020	273.620	2021	175.466	2022	168.907	2023	106.175	2024	45.507
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2020	273.620																								
2021	175.466																								
2022	168.907																								
2023	106.175																								
2024	45.507																								
Number of trains	At this time 0 (related to the current freight)																								



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operated daily:	
Main business partners:	Luka Šibenik d.o.o.

Social and Environmental Responsibility

Sustainability policies:	A new concessionaire came to the port, which plans to introduce a new type of cargo (cement) in the next year, and in the next 5 years it is planned to become a feeder port for container cargo, there are also plans to build two new connecting quays that will definitely increase the competitiveness of the port in regarding port operations and storage capacity.
Environmental certifications:	There are not any certain certifications for port operations, but nature protection is carried out through: <ul style="list-style-type: none"> • The transshipment system is completely closed. • All spillways and wagon loading areas are covered by a dust removal system.
Quality and other certifications:	Quality standards: HRN EN ISO 9001 (HŽ Infrastruktura d.o.o.) HRN EN ISO 9000 (HŽ Infrastruktura d.o.o.) HRN EN ISO 9004 (HŽ Infrastruktura d.o.o.) HRN EN ISO 19011 (HŽ Infrastruktura d.o.o.)





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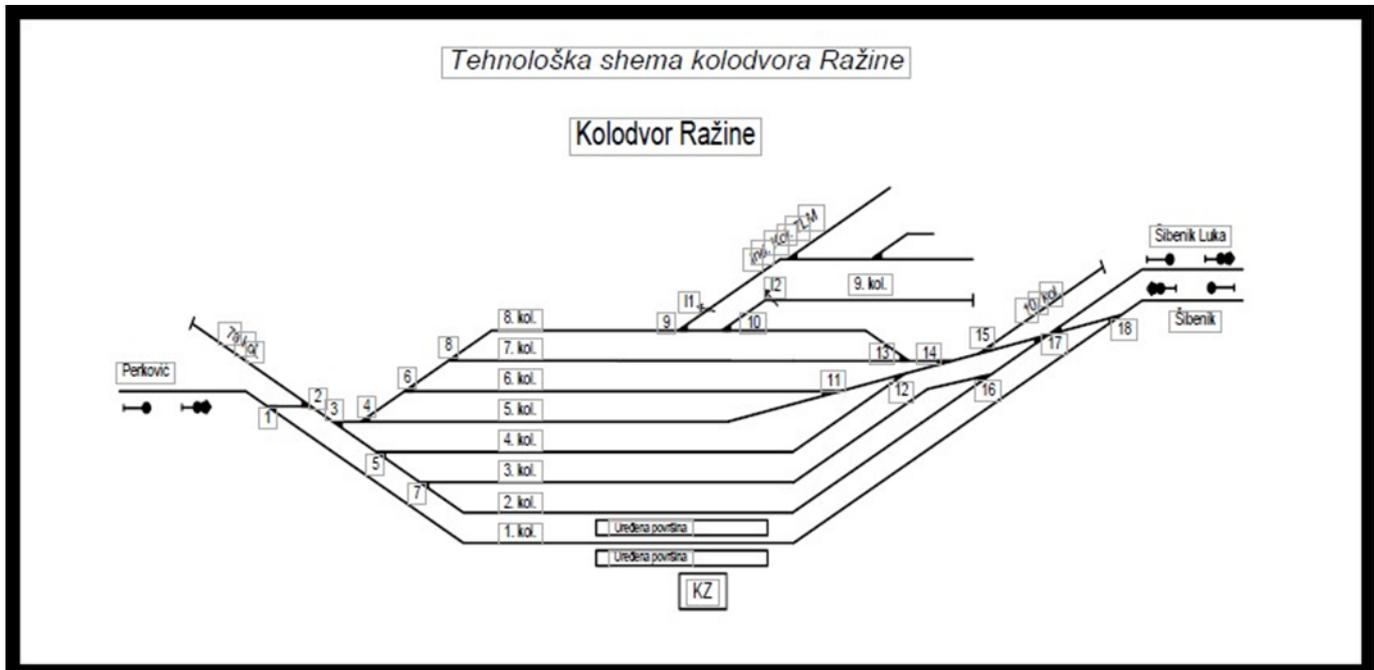
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Analysis of the operational railways process:

The Ražine railway station is located at km 17+646 of the M607 Perković - Šibenik railway and at km 0+000 of the L211 Ražine - Šibenik Luka railway. According to the task of regulating traffic on the M607 line, it is an intermediate station, and for the L211 line, it is a separate and distribution station. It is a shunting station for the shunting of incoming and outgoing goods for the Šibenik station and Port of Šibenik, as well as goods for direct and share trains. In terms of transport services, the station is open for the reception and dispatch of passengers and wagon shipments. The Port of Šibenik shipping company is subordinate to the Ražine railway station, it is located at km 2+945 of the L211 line. The railway station has 3 main and 10 secondary tracks. Track number 1 is the reception-dispatch for trains carrying passengers. Track number 2 is used for freight trains and is also used for the crossing of passenger trains. Track number 3 is the reception-dispatch for freight trains. Track number 4 is a shunting track. Track number 5 is a shunting track. Track number 6 is a shunting track. Track number 7 is used for depositing gross, empty wagons, accommodation of wagons for customs clearance and repair. Track number 8 serves for the delivery and withdrawal of wagons from and to the industrial tracks of TLM and Građe. Track number 9 is a puller and is used for shunting trains. Track number 10 is short for manipulation and is used for loading and unloading wagon shipments.

Track number 11 is a truncated track and is used for depositing railway vehicles. Track number 12 is a truncated manipulative-side track next to the warehouse Track number 13 is a truncated manipulative-front track to the warehouse.

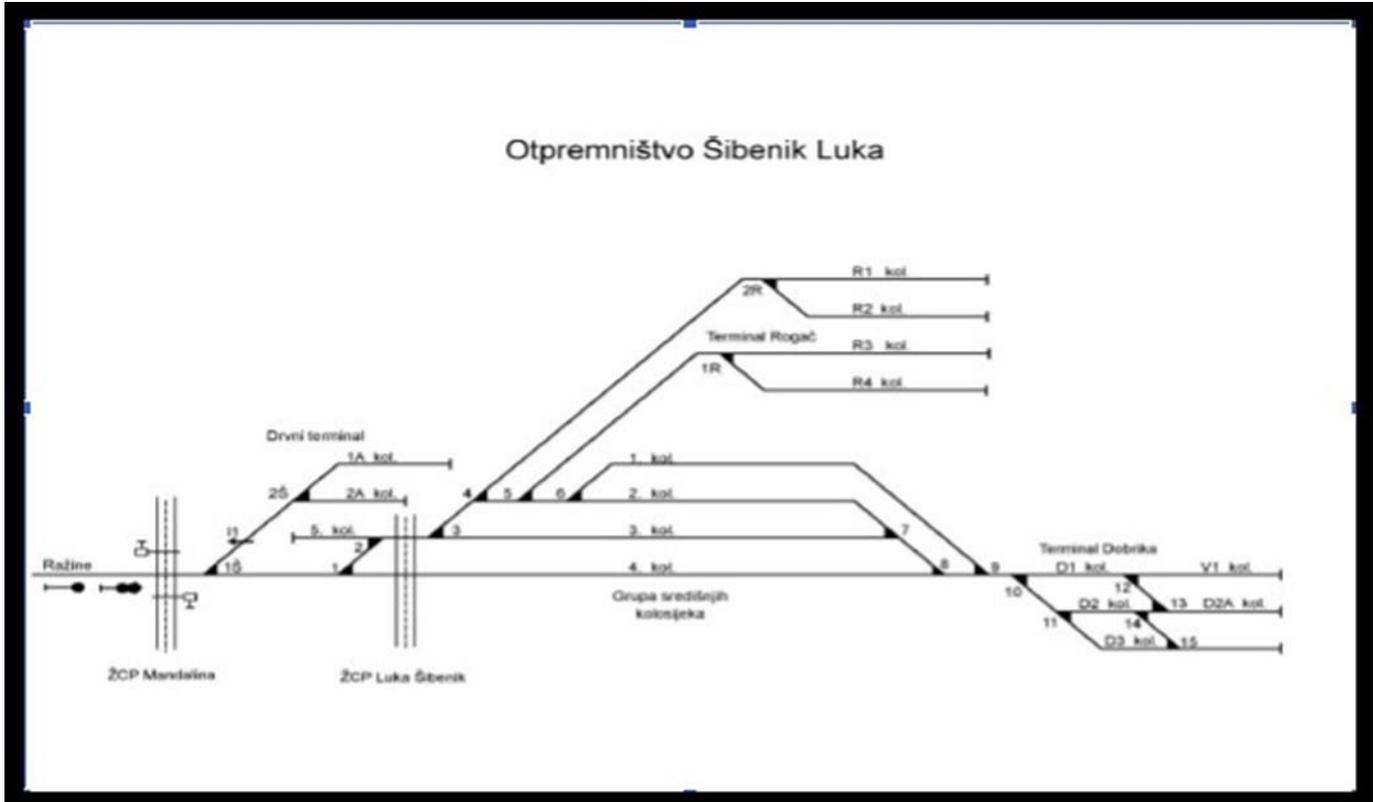




Technical scheme of kolodvor Ražine

The Port of Šibenik shipping line has one track, which is marked as track number 4 and is a direct continuation of the L211 line Ražine - Šibenik Luka. The permissible axle load is 20t/axle and 8t/m. From the shipping line, the group of tracks "Rogač" is separated by turnout number 1, while the group of tracks "Dobrika" and "Vrulja" is separated by turnout number 8. Junction number 1 is located at km 2+600, and number 8 at km 3+133. Turnouts number 1 and 8 are secured and secured with Robel turnout locks. The regular position of turnout number 1 is for driving in the direction and turnout number 8 is for turning. Between the protection signal "A" and switch number 1, the group of tracks "Wood terminal" is separated by switch number 1Š in km 2+265. The regular position of turnout 1Š is for driving in the same direction, it is secured by the turnout Robel lock, which is dependent on slipway I-1, which is locked in the regular position, maneuvering is prohibited. All switches and slips in the shipping department are handled by the shunting staff of the railway carrier (HŽ Cargo).





Technical scheme of shipping of the port of Šibenik

- Stakeholders involved in rail shunting operations

Luka Šibenik d.o.o. , HŽ Cargo d.o.o., HŽ Infrastruktura d.o.o.

- Current Rail Shunting Processes

- Schematic mapping of existing processes. Please use a bullet list as the following example (and outline one or maximum two examples for each process):

Arriving train:

- Primary shunting process description (Station - Tracks)

The port of Šibenik is served from Ražine station, which is also a control station.

the shunting formation is directed to track number 4. First, a braking test is performed and the stopping distance is measured, after which the operator of the shunting informs the traffic officer of the Ražine



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junction. The traffic officer informs the Port of Šibenik, the road crossings and the switch operator and then issues the order and gives permission to drive.

- Secondary shunting process description (Tracks - Terminal)

When ordering a freight train, the shipping department of the Luka Šibenik d.o.o. defines the number of wagons and the terminal where the cargo is loaded/unloaded. Authorized employees of HŽ Cargo receive an order from the transporter for the use of certain switches and slides and bring the wagons to the appropriate terminal.

Departing train:

- Secondary shunting process description (Terminal - Tracks)

After the wagons have been loaded at each terminal, the shunting squad connects the wagons and forms a return column.

- Primary shunting process description (Tracks - Station)

The train dispatcher writes in the phonogram book and telegraphs the permission for the return of the shunting train. The shunting squad is obliged to secure the wagons from self-starting, and the switches must be placed in their regular position. After that, the operator of the shunting is obliged to contact the Ražine station train dispatcher and request permission to drive.

Arriving/departing train

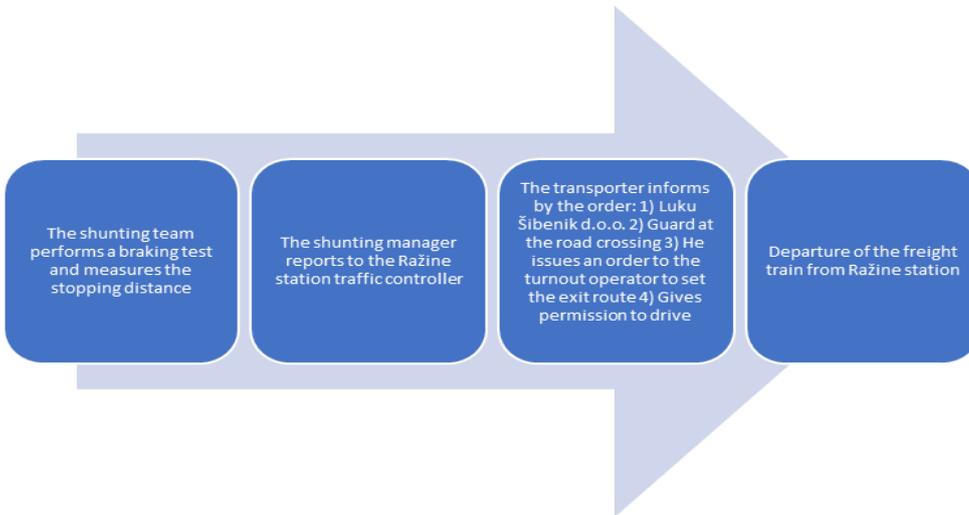
- Single shunting process description (arriving)
- Single shunting process description (departing)



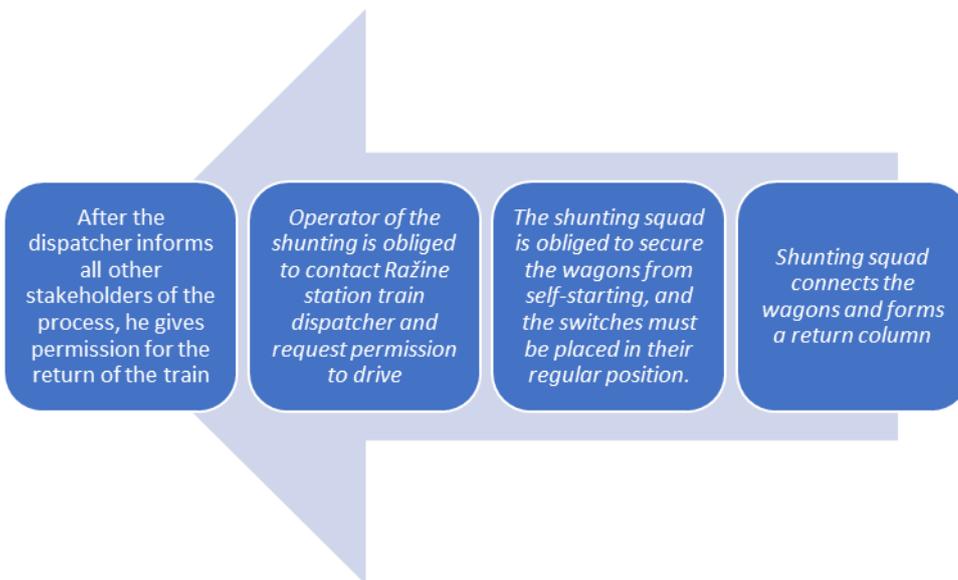
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Flowcharts of operations



Schematic representation of the movement of the train from Ražine to the port



Schematic representation of the movement of the train from the port to Ražine station

- Average timelines for each process phase
- Issues and Bottlenecks



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- Identification of main criticalities in current processes
- Analysis of causes of inefficiencies or delays

Analysis of the Business Process:

Infrastructure and Resources:

Description of available rail infrastructure

Rail infrastructure at the station has not been renovated for many years, the railway is not electrified.

At the port area tracks are completely worn out, in some places they are unusable, and the panels between and around the rails are largely destroyed by long-term use. Currently, due to the appearance of coves and deterioration, parts of the tracks are temporarily repaired in order to meet the minimum criteria for safe work on industrial tracks. The switches are also dilapidated and in very poor condition. The surfaces are mostly uneven with a series of indentations due to the heavy load.

- List and characteristics of resources used (locomotives, personnel, etc.)

Any maneuvering and use of switches is prohibited without the authority of HŽ Cargo staff, traction locomotives are used to turn and stack wagons

- Current shunting capacity
 - Environmental Aspects
 - Environmental impact of current shunting operations (In term of CO₂ per year)

Currently this year, not a single freight train was running from the port, all cargo went by trucks, where the CO₂ footprint is far greater than that where the railway is used

- Any ongoing sustainability initiatives

Currently there are not any initiative ongoing

- Benchmarking with Similar Operations
 - Comparison with best practices from other intermodal or port nodes

In the southern part of the country, the situation at the railway junctions is mostly the same and there are no IT solutions, the only difference is the Port of Rijeka, which has mostly electrified railways and is the



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closest to the interior, and precisely thanks to its favorable geographical position, it is also the most important Croatian port.

- Regulatory and Safety Compliance
 - Assessment of compliance with current regulations

The current regulation is respected (Rules of business of Ražine station from September 1, 2017)

Description of the main disruptive events faced and how are dealt with it

Interference with the means of communication can cause the biggest deviations, especially on the way from the port to the station, because if the shunting manager fails to get in touch with the Ražine station train dispatcher, he must try to do so from the railway crossing, and if that fails after securing the road crossing the train can pass and the shunting team continues driving until the entrance signal of Ražine station. If the entrance signal signals the stop sign and the station staff does not give a forward signal, then the shunting team should stop in front of it and go to the train operator and ask for permission to enter the station, after which the train operator gives him permission to continue driving with the entrance signal. In the case of an accident or some other extraordinary event, the staff of the railway carrier must immediately inform the train operator of the Ražine station. He is also obliged to immediately provide assistance to injured persons if there are any, and he needs to secure the place of occurrence of the event and to comply with the applicable legal provisions in further proceedings.

Analysis of the main ICT Solutions

- IT Systems and Tools
 - Inventory of IT systems and software in use

There are no IT solutions except application for inserting data of the movement of wagons and trains (IST-Transport Information System)

- Level of process automation and digitalization



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The level of automatization is at a very low level, namely maneuvering is carried out with the help of signal flags, a hand lamp and a mouth whistle. Road crossings are mostly secured with a STOP sign, and at one point on the road from the Port to the Station there is a bumper that is operated manually by a guard.

- Interfaces and integrations between existing systems

The means of connection that exist are: Telephone (dispatch line) and telephone signal line (bell signal line)

- Information and Data Flows
 - Analysis of information flows between involved actors

Between actors data of the movement of wagons and trains are shared through the software and informations about arriving are shared through dispatch line.

- Types of data exchanged and formats used

The application (IST) enables the creation and review of traffic records (waybills, train movement records, station operations, timetables, reports and statistics). In addition, it enables operations on trains that precede the run and that monitor and analyze the run (formation, movement, search, dissolution, disbanding, entry, exit, maneuvering

- Any communication or data sharing issues

So far there are no issues in communication and data sharing.

LIST OF KPI:	
Shunting staff per train	Minimum 2 (The conductor and maneuverer)
Average Process time brake test	30 min
Average shunting time per wagon	15 min
Total cycle time (from loading to delivery)	20 wagons cca 7 hours just for loading
Container time in terminal	There aren't container terminals
Train capacity utilisation (% load)	NA
Punctuality of departures and arrivals	Mostly precise (possible delay not longer than 30 min)
Wagon turnaround time	15 min
Number of wagons handled per hour	3
Number of trains operated per day	Currently none
Rate of on-time deliveries	100%
Rate of customer complaints	0



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Freight damage rate	0 (mostly bulk cargo)
Staff turnover rate	Staff is from HŽ Cargo

Other Remarks:

Testing of brakes and stopping distance is carried out at the Ražine station in such a way that the train starts and stops on the rails and after that the stopping distance of the train and the correctness of the brakes are measured. The shunting manager informs the Ražine station train dispatcher about the correctness, the notification is made via the dispatch line. The train dispatcher informs other Luka Šibenik d.o.o., Guard at the road crossing and gives an order to the turnout operator to set the exit route, after everyone has been informed and after they have received the orders train dispatcher gives permission to shunting manager to drive to station/terminal by using dispatch line or bell signal.



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PP 8 – Transagent – Port of Rijeka

General Information

Company name:	TRANSAGENT RAIL D.O.O.
Trading name:	TRARR
Legal form:	LTD
VAT/Tax ID number:	HR28340401133
Date of establishment:	28.10.2013.
Registered office:	Verdieva 6, 51000 Rijeka, Croatia
Main operational headquarters:	Verdieva 6, 51000 Rijeka, Croatia

Contact Information

Phone:	+385 51 325 510
Email:	office.rail@transagent.hr
Website:	https://transagent.biz/rail/
Official electronic mail address:	office.rail@transagent.hr
Legal Representation:	Mr. Tihomir Jandik, CEO

Other Data

Safety certificate (type and number):	Single Safety Certificate (EIN: HR1020230088), ISO 45001 (No. 1710HR775OHS)
Other relevant certifications:	Railway licence issued by Croatian Ministry (EZ: HR0120220001)

Main Activities

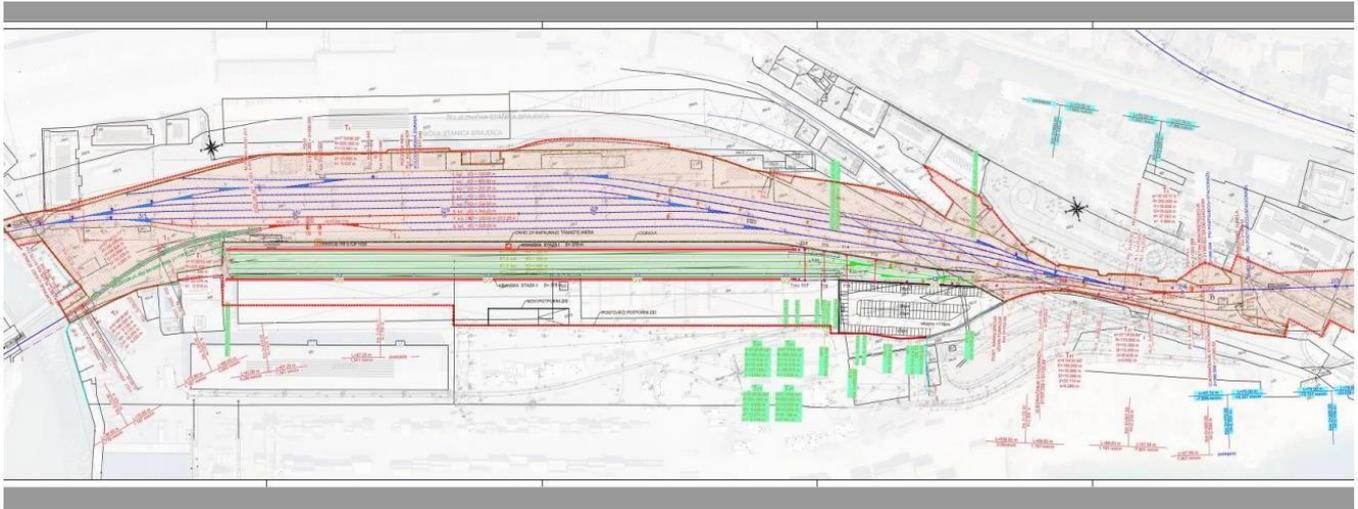
Types of services offered:	4920 - Railway transport of goods
Geographical area of operations:	Croatia
Annual freight tonnage transported:	695.055,00 t (in 2023.)
Number of trains operated daily:	4
Main business partners:	Transagent Ltd., Hupac Intermodal Ltd., Adria Rail Ltd, Railtrans International a.s.

Social and Environmental Responsibility

Sustainability policies:	
Environmental certifications:	Safety advisor certificate (No. 0129/ZIRS/2021), ISO 14001 (No. 1710HR775E)



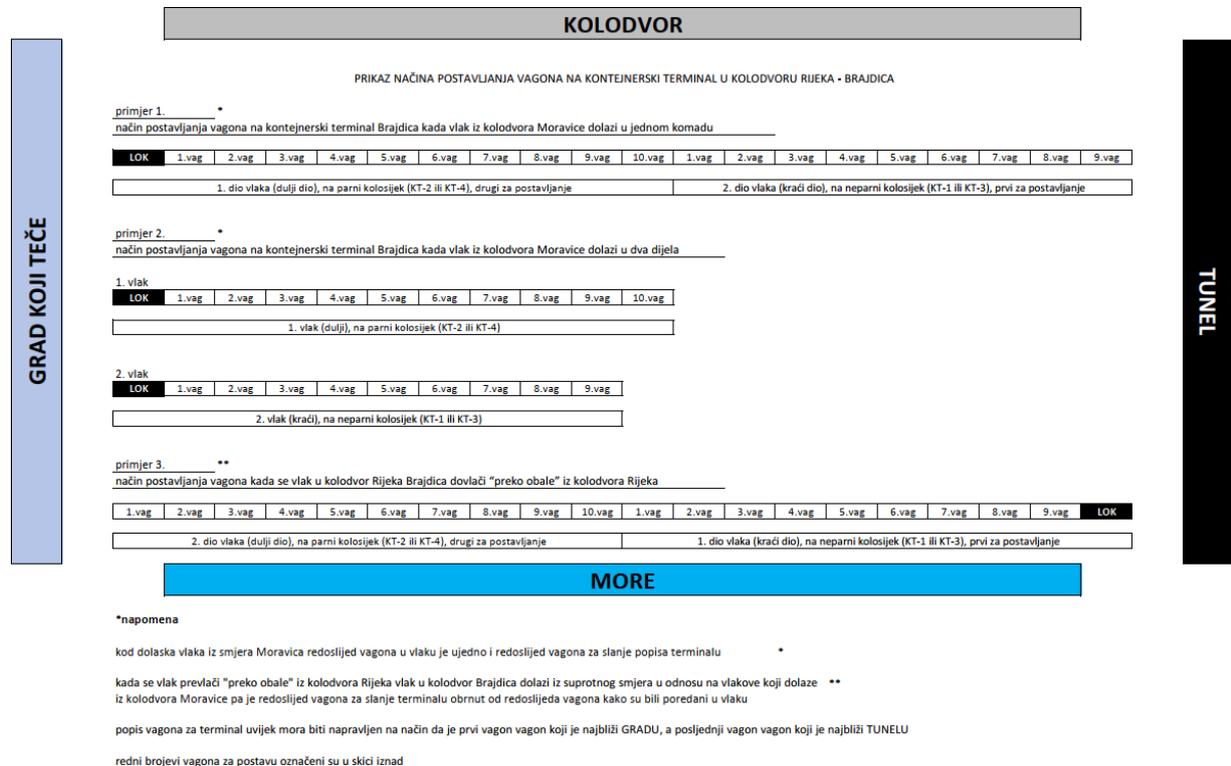
Quality and other certifications: ISO 9001 (No.: 1710HR775Q)



Analysis of the operational railways process:

- General description of analyzed intermodal and port nodes: The railway tracks of the Brajdica Container Terminal (AGCT) connect the railway infrastructure AGCT with the Croatian and European railway network.
- Stakeholders involved in rail shunting operations: Transagent Rail, HŽ Infrastruktura, Container terminal AGCT

Schematic mapping of existing processes.



Kolodvor = station, More = sea, Tunel = tunnel, Grad koji teče = Rijeka



Arriving train:

- Primary shunting process description (Station - Tracks)
- Secondary shunting process description (Tracks - Terminal)

Kod dolaska vlakova.

Prethodne radnje												
OPERACIJA	Radnik – izvršitelj	Broj izvršitelja	Vrijeme trajanja operacija u minutama									
			10	20	30	40	50	60	70	80	90	
Tehnički i komercijalni pregled vlaka, Rail PRO	Pregledač vagona	1		20								
Obrada prijevoznih dokumenata	Transportni komercijalist	1		15								
Glavne radnje												
Manevarski poslovi	Pregledač vagona i manevristi	1 2				20						
Ukupno trajanje prethodnih i glavnih operacija				40 minuta								

Prethodne radnje = previous actions, Operacija = operation, Tehnički I komercijalni pregled vlaka, Rail,PRO = technical and commercial inspection of train, Rail PRO, Obrada prijevoznih dokumenata = Processing of transport documents, Radnik – izvršitelj = worker- executor, Broj izvršitelja = executor number, Vrijeme trajanja operacija u minutama = duration of operations in minutes, Pregledač vagona = wagon examiner, Transportni komercijalist = transport commercialist
 Glavne radnje = main actions, Manevarski poslovi = shunting operations, Pregledač vagona I manevrist = wagon examiner and shunner, Ukupno trajanje prethodnih i glavnih operacija = total duration of previous and main operations.

Departing train:



- Secondary shunting process description (Terminal - Tracks)
- Primary shunting process description (Tracks - Station)

Kod odlaska vlakova

Glavne radnje													
OPERACIJA	Radnik – izvršitelj	Broj izvršitelja	Vrijeme trajanja operacija u minutama										
			10	20	30	40	50	60	70	80	90		
Manevarski poslovi	Pregledač vagona i manevristi	1	30										
		2											
Završne radnje													
Popis vlaka i obrada dokumenata, Rail PRO, tehnički pregled vlaka i proba kočenja	Pregledač vagona	1			40								
Ukupno trajanje glavnih i završnih operacija			70 minuta										

Glavne radnje = main actions, Operacija = operation, Manevarski poslovi = shunting operations, Pregledač vagona I manevrist = wagon examiner and shunner, Radnik – izvršitelj = worker- executor, Broj izvršitelja = executor number, Vrijeme trajanja operacija u minutama = duration of operations in minutes, Završne radnje = final actions, Popis vlaka I obrada dokumenata, Rail PRO, tehnički pregled vlaka I proba kočenja = train list and document processing, Rail PRO, train technical inspection and braking test, Pregledač vagona = wagon examiner, Ukupno trajanje glavnih I završnih operacija = total duration of main and final operations

Arriving train:

- Primary shunting process description: 20 min

Departing train:

- Primary shunting process description: 30 min

Arriving/departing train

- Single shunting process description (arriving): 15 min



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- Single shunting process description (departing): 15 min

Issues and Bottlenecks

- Identification of main criticalities in current processes: weather conditions, railway closure, available workforce, incorrect time and personnel management, occupancy of all railway tracks in the station
- Analysis of causes of inefficiencies or delays: All deviations from the agreed technological process cause the mentioned problems

Analysis of the Business Process

The reception building of Rijeka Brajdica railway station is located at km 2+923 single-track electrified railway M603 Sušak Pećine – Rijeka Brajdica as terminus station and as the starting station of single-track non-electrified railway line L212 Rijeka Brajdica - Rijeka, which starts at km 2+923.

The Rijeka Brajdica railway station is located 3 meters above sea level.

At the Rijeka Brajdica station, the tracks from two directions connect, namely:

- from the direction of Sušak Pećine (Kolodvor distance),
- from the direction of Rijeka (station distance)

According to the tasks in carrying out the transportation of passengers and goods Rijeka Brajdica station it is open for receiving and shipping wagon shipments, except for explosive cargo and materials of class 1 RID, and the station is not open for the reception and dispatch of passengers.

Railway M603 Sušak Pećine – Rijeka Brajdica enters Rijeka Brajdica station via block I, and the line L212 Rijeka Brajdica - Rijeka enters Rijeka Brajdica station via block II. Except for the M603 line Sušak Pećine – Rijeka Brajdica, which enters the station across block I, on this side of the station there is also a puller with a useful length of 388 m. The drawbar is connected to all receiving and dispatching points by switch connections with the tracks in the station as well as with the industrial tracks of the container terminal AGCT.



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The extraction track is intended for placing and extracting container trains on and from the industrial tracks of the container terminal AGCT, as well as for other maneuver work that takes place on the block I side.

In Rijeka Brajdica station, the main receiving and dispatching tracks that are electrified are tracks number: 1, 2, 3, 4, 5 and 6, and tracks 7 and 8 are not electrified. Due to the technical performance, the voltage in the train line of the Rijeka Brajdica station is turned on and disconnects with disconnecter number 14 in Sušak Pećine station. Due to the technical performance, there is no possibility of excluding only the Sušak Pećine - Rijeka Brajdica railway section or only the Rijeka Brajdica station, and both the section and the station are switched off at the same time together. In the station on the side of block I via disconnecter number 31, which is located at contact network pole T3 in km 0+067 it is possible to switch off the contact network voltage on the part of the connecting track towards the container terminal tracks from km 0+050 to portal T17/T18 at km 0+287 where the contact network ends at industrial tracks of the container terminal.

At the Rijeka Brajdica station, the tracks are divided according to their purpose:

- main tracks,
- sidings.

There are 8 main tracks in the station and they are used for receiving and dispatching trains, and are necessary for maneuvering and parking, because the station does not have a special group of tracks on which maneuver work would be performed.

The main receiving and shipping tracks are made up of tracks 1 to 8, and the secondary tracks are: 1a and pull-out track.

- List and characteristics of resources used (locomotives, personnel, etc.):
8 electric locomotives, 28 train drivers, 12 wagon inspectors
- Current shunting capacity: 1 diesel locomotive
- Environmental Aspects
 - Environmental impact of current shunting operations (In term of CO₂ per year):
within the legal framework
 - Any ongoing sustainability initiatives: /





- Benchmarking with Similar Operations
 - Comparison with best practices from other intermodal or port nodes: We have no activities in other intermodal ports, so we have no basis for comparison
- Regulatory and Safety Compliance
 - Assessment of compliance with current regulations: A positive assessment of compliance with the applicable regulations is made by issuing a Single Safety Certificate by the Railway Safety Agency for a specified period.
 - For Transagent Rail d.o.o. a Single Certificate of Safety was issued for a period of five years, from 11.04.2023. until 10.04.2028. year.
 - Analysis of safety procedures in place: The analysis of existing safety procedures is carried out through controls over the safe flow of rail traffic by the control workers of the carrier Transagent Rail d.o.o. and Audit of the safety management system by the Railway Safety Agency.

Other Remarks:

Activities include an external claim for a specific rail transport of goods, then an offer is made taking into account all relevant data that form the price. When the external subject accepts the offer, we start with active planning of the execution of that rail transport of goods, which includes working personnel, locomotives, number of wagons, route, monitoring, time period of the rail transport of goods and prediction of potential threats. By anticipating potential threats, we plan alternative solutions. The development of rail transport is extremely monitored. All subjects involved in the execution of rail transport must have all possible data and parameters in real time in order to be able to plan and organize the next steps in the execution of rail transport of goods, and this is only possible with good communication between the subjects



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Analysis of the main ICT Solutions

Fast and high-quality container transport service is the common goal of all entities involved in container management process. The goal is to transport the goods in the shortest possible time, from loading of the container for the supplier to the recipient branch. Consequently, good cooperation from all party in the process of planning, publication and execution of that process is of utmost importance.

Information processes serve this purpose, so it is necessary that all involved parties use them maximum available systems in order to provide the client with all the necessary data in the shortest possible time as soon as possible. Therefore, it is important that the railway operator announces in a time-efficient manner the arrival of the train with all the necessary data for the container handling process. Likewise, the container terminal will provide train and container information to the rail operator which is possibly earlier.

AGCT supports data exchange using the following methods:

- Exchange messages via e-mail, a structured message in several different formats
- Exchange of messages using FTP communication
- Web service with direct access to data using standardized messages
- Web ICS (Intermodal Community System) that allows railway operators to enter train data, railway vehicles and containers and sending orders.

All messages may contain the following information:

- Current object
- Next train arrival
- Arrival of the train
- Arrival/travel of Wagon
- Wagon number
- Route
- Destination



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- City
- The country
- Wagon - container
- Container number
- Information about goods
- Possible equipment (generator for "frigo" container)
- Dangerous cargo
- Bill of lading
- Bill of lading
- Reference number of the reservation of the railway carrier
- PIN - for permission to pick up containers

Attributes from this list are optional, i.e. not all data must be used, but only what is necessary and by agreement between the client and the container terminal.

The wagon delivery points to/from AGCT are AGCT's rail tracks.

Users/Railway Operators coordinate the deployment and withdrawal of railcars to/from the AGCT with AGCT's railway planners, using the telephone and e-mail details provided for contact.

Railway operations can be divided into:

- unloading of containers from wagons.
- loading containers onto wagons

UNLOADING OF CONTAINERS FROM WAGONS

- The railway operator is obliged to inform the container terminal (AGCT) at least 24 hours in advance unloading.
- 24 hours earlier, the railway operator must send an e-mail and send via the railway application notice to AGCT rail planners



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The e-mail attachment must also have an Excel table with the following information:

- Serial number
- Wagon ID
- Number of containers
- ISO container type
- Sender / agent
- Order number
- Date
- Shift
- Ship service identifier

LOADING OF CONTAINERS FROM WAGONS

- The loading of containers on wagons must be preceded by a loading order 24 hours in advance.
- The order for loading the container is sent in the form of an Excel table - by e-mail; which contains at least:

- Number of containers
- Wagon ID
- Ship service identifier
- Type of goods
- Order number
- Reservation number - only for empty containers
- ISO container type
- Food status - only for empty containers (Yes / No)

At least 4 hours before the arrival of the train, the railway operator must send/enter via the IT system a list of containers confirming that all documentation prerequisites for loading have been met containers on wagons.



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In the traffic office of the Rijeka Brajdica station, on the left side of the desk, there is multipurpose telecommunications MPD desk (MultiPurposDispatcher). Purpose of MPD desk is to make telephone communication via LB lines (railway telephony) and ŽAT lines (internal HŽ telephony).

They are connected to the multipurpose MPD telecommunications desk in the traffic office with the following telecommunication lines:

- line 40 - 210 is a business line from Moravica station to Rijeka station on to which all the stations of this distribution section are connected. Referring to this line is done by touching the line icon 40 - 210, after which the icon of the station we want to call is marked, and the counter automatically sends calling code for that station. This line is equipped with the so-called call separator,
- line 41 - 210 is a business line from Moravica station to Rijeka station on to which all the stations of this distribution section are connected. Referring to this line is done by touching the line icon 40 - 210, after which the icon of the station we want to call is marked, and the counter automatically sends calling code for that station. This line is not equipped with the so-called call separator,
- line ZSV 90 - 210 is a bell signal line for the direction of Sušak Pećine to which telephones are connected to the input signal "A" of the station Rijeka Brajdica in km 1+844, telephone box at the entrance signal "C" of Sušak Pećine station at km 0+399,
- the switch line that connects the telephone on block III,
- a line for the needs of SS and TK devices,
- line for the container terminal,
- accident line,

There are the following lines on the wall panel in the traffic office:

- bell signal line for the direction of Sušak Pećine,
- business line 40 – 210,
- business line 41 – 210
- signal line (block I, II and III).



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In the event of a failure of the MPD counter, the induction telephone located on the wall is used in traffic office, which is connected to all telephone lines. In addition to the inductor's phone, there is also a ŽAT phone on the wall.

Inductor telephone devices were installed on block III, and it was connected to its switch line that is included in the register phone.

In the Rijeka Brajdica station, access to the UHF network (radio device), which serves for a fast, understandable, continuous and safe way of transferring information between railway staff inside the station, consists of:

- stationed (fixed) radio device,
- portable (handheld) radio devices.

Stationary (fixed) radio equipment is installed only in the traffic office for the work purposes of train operators.



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The portable (hand-held) radio device is used by the staff of the railway carrier. Radio devices are included in the register phone, and the conversations are recorded. In Rijeka Brajdica station it is made possible, by means of a radio dispatching link whose central office is installed in Rijeka, to establish a connection between the train operator and the locomotive staff on the train.

The radio connection is established through the mediation of the traffic dispatcher in Rijeka by dialing ŽAT number 51 055, and the traffic dispatcher calls using the dispatch center locomotive staff with whom the train operator wishes to establish contact. It is also possible to establish a connection in the reverse direction, i.e. between train drivers and traffic controllers. Conversations made on the radio dispatch link are registered.

The train dispatcher on duty at the Rijeka Brajdica station receives and dispatches telegrams by e-mail. To read (and send) e-mail, they use computer program Microsoft Outlook.

Instant messages sent by e-mail must be in pdf format, must be in the form, size and content that fully correspond to the provisions of the Traffic Instructions records (Instruction HŽI-28).

Pe-29 telegram must have a prescribed header shape, text and information about the sender.

The text of telegrams must be in accordance with the prescribed traffic rules. The text of other telegrams is compiled by the sender according to the content of the communication wants to give in accordance with the regulations of HŽ Infrastructure, that is, in accordance with international regulations. Each telegram must contain the name and surname of the responsible person of the sender.

Records of telegrams are kept in accordance with the provisions of the Instruction on traffic records.

Trains from Sušak Pećine station are accepted at the main reception area shipping tracks 1, 2, 3, 4, 5 and 6, with electric traction vehicles; and on tracks 7 and 8 it is possible to receive trains with diesel traction vehicles.

From the direction of Kolodvor Rijeka, shunting trains operate only with diesel traction vehicles so that their reception is possible at one of all reception and dispatch station tracks depending on the traffic situation and subsequent technological operations that are provided on the track on which it is received. Everything is done on the mentioned tracks where the trains have finished running previous operations. Maneuver work on formation, as well as servicing of industrial tracks is performed by one shunting station



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locomotive of each railway carrier with its shunting personnel. Maneuvering can also be performed in the station by the locomotive of the arriving train. According to the method of execution at Rijeka Brajdica station, maneuvering is done by driving. After completed loading or unloading on the industrial tracks of the container terminal wagons are placed on one of the main receiving and shipping tracks on which main and final operations are performed with the departing train.

Types of data exchanged and formats used: PDF, Word, Excel, emails, phone calls

Any communication or data sharing issues: Possible system crash

Cost structure considerations

- Fixed vs. variable costs ratio: 70%-30%
- Cost per shunting operation or per train (For the primary shunting activities and other services operated in the nodes): 300-600 EUR

Current Key Performance Indicators (KPIs)

LIST OF KPI:	
Shunting staff per train	3
Average Process time brake test	45 min
Average shunting time per wagon	15 min
Total cycle time (from loading to delivery)	2 hour
Container time in terminal	10 min
Train capacity utilisation (% load)	79,5%
Punctuality of departures and arrivals	Maximum possible
Wagon turnaround time	72h
Number of wagons handled per hour	10
Number of trains operated per day	1
Rate of on-time deliveries	76,4%
Rate of customer complaints	21,8%
Freight damage rate	2%
Staff turnover rate	8,3%
Number of infrastructure failures per year	260
Number of vehicle failures per year	81
Average vehicle repair time	44h
Maintenance costs as % of revenue	1%



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Fuel consumption per tonne-kilometre	5,28
CO2 emissions per tonne-kilometre	14,10
% of fleet with low environmental impact technologies	89%
R&D investments as % of revenues	2,1%
Average hours of training per year per employee	36h
% electrified tracks	75%
Average lengths of train in the node	500m

Final Considerations:

As a carrier of railway services, Transagent Rail Ltd. must continuously develop digitalization of business procedures, which is a prerequisite for increasing competitiveness in railway traffic. Pilot activity of the Transagent Rail Ltd. includes upgrading of the IT system in order to harmonize technical and financial indicators and to generate financial indicators from the technical indicators. It means that the user, Transagent Rail Ltd., can see anytime if the technical performances generate profit or loss, all incurred costs, but also show other performances, such as train driver's working hours, energy used, all potential additional costs etc. Improved digital solutions will contribute in increasing efficiency and improving market competitiveness in carrying out the procedures of cargo transportation, which is the company's core activity.

Through the implementation of pilot activities, it will be possible to provide better and more quality services, reduce costs, shorten the duration of the process, better accuracy and reliability, better visibility and effective exchange of timely information and documentation with partners in procedure of transporting goods. Improved performances will result with bigger competitiveness of Transagent Rail Ltd. in domestic and cross-border market.

Transagent Rail Ltd. will carry out its pilot project in cooperation with external experts in order to improve their performances, and the benefits from the realization of pilot activities will have impact on the overall community – from employees, users and clients to the general public. Railway transport is insufficiently represented in the total transport of goods, despite its advantages in terms of economy, safety and the least harmful impact on the environment. Development within the framework of



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digitization and innovation through the implementation of the project to improve the quality and reliability of cross-border rail freight services is a prerequisite for creating a competitive company on the rail freight market and ultimately for encouraging a change in the type of transport.



Conclusions

This deliverable proposes an in-depth analysis of the business processes in the railway nodes identified within the CROSSFREIGHT project, with the aim of highlighting the current dynamics attributable to the different railway nodes in terms of both operational and business aspects. The focus is on operational efficiency, the reduction of inefficiencies and the integration of digital solutions to improve the management of freight flows and shunting operations. Starting from the analysis of the AS IS scenario, the paper highlights the management strategies and main solutions to be adopted. The approach includes a detailed evaluation of existing problems and bottlenecks, a comparison with reference models in other European intermodal nodes and the presentation of the main operational processes in schematic form. The ultimate goal is to contribute to more integrated, sustainable and efficient rail logistics in the cross-border context, thus facilitating greater competitiveness and interoperability of rail freight transport through the integration and development of the pilots in the project. The main problems encountered concern the fragmentation of processes, lack of automation, infrastructural limitations and the absence of integrated digital tools for coordinating shunting operations. These factors contribute to operational inefficiencies, transport delays and poor optimisation of available resources.

Through the comparison with European best practices and the analysis of advanced technological solutions, it was possible to clearly outline the conceptual framework in which to try to make improvements in the management of railway nodes. These include the adoption of innovative ICT systems for the digitalisation of processes, the introduction of real-time monitoring tools to improve the traceability of goods and the planning of operations, and the promotion of greater interoperability between the various actors involved.

The considerations presented are therefore intended to give an integrated representation of the logistics nodes that will be explored within the CROSSFREIGHT project in order to promote integrated and sustainable logistics models.

