Coordinated shunting terminal operations in railway stations and port rail terminals
Coordinated shunting operations in railway stations and port rail terminals

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GLOSSARY OF ABBREVIATIONS

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<th>APERAK</th>
<th>Application error and acknowledgement message</th>
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<tr>
<td>CODECO</td>
<td>Container gate-in/gate-out report message</td>
</tr>
<tr>
<td>COPRAR</td>
<td>Container discharge/loading order message</td>
</tr>
<tr>
<td>FTP</td>
<td>File Transport Protocol</td>
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Coordinated shunting operations in railway stations and port rail terminals

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>HPA</td>
<td>Hamburg Port Authority</td>
</tr>
<tr>
<td>PCS</td>
<td>Port Community System</td>
</tr>
<tr>
<td>RFTMS</td>
<td>Railway Freight Transport Management System</td>
</tr>
<tr>
<td>RNE</td>
<td>RailNetEurope (<a href="http://www.rne.eu">www.rne.eu</a>)</td>
</tr>
<tr>
<td>RU</td>
<td>Railway Undertaker</td>
</tr>
<tr>
<td>SMTP</td>
<td>Simple Mail Transfer Protocol</td>
</tr>
<tr>
<td>SOAP</td>
<td>Simple Object Access Protocol</td>
</tr>
<tr>
<td>TAF TSI</td>
<td>Telematic Applications for Freight – Technical Specification for Interoperability</td>
</tr>
<tr>
<td>TMS</td>
<td>Transport Management System</td>
</tr>
<tr>
<td>TOS</td>
<td>Terminal Operation System</td>
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<tr>
<td>TT ID</td>
<td>Train Transport ID</td>
</tr>
<tr>
<td>UN/EDIFACT</td>
<td>United Nations rules for Electronic Data Interchange for Administration, Commerce and Transport</td>
</tr>
<tr>
<td>UNTDID</td>
<td>United Nations Trade Data Interchange Directory</td>
</tr>
<tr>
<td>WG</td>
<td>Working Group</td>
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<tr>
<td>XML</td>
<td>Extensible Mark-up Language</td>
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**GLOSSARY OF TERMS**

<table>
<thead>
<tr>
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<th>Definition</th>
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<tr>
<td>Long distance train</td>
<td>This train circulates in a rail corridor using the public rail infrastructure.</td>
</tr>
<tr>
<td>Platform</td>
<td>This is a particular wagon with the characteristics to transport containers.</td>
</tr>
<tr>
<td>Shunting train composition</td>
<td>This train circulates between the port terminals and the shunting yard station.</td>
</tr>
<tr>
<td>Shunting yard</td>
<td>This is the place where coupling and decoupling operations of wagons are made in a freight station.</td>
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1 INTRODUCTION

Many trains circulating in railway freight corridors have lengths longer than 700m, and usually operate in freight stations directly connected to these corridors during its voyage. However, containers transported in the MoS shall be loaded in or discharged from the rail wagons or platforms (as they will be named in this report) in the container yards of different port terminals, or even in the same port. In order to create a long distance train composition to circulate in the corridor, it is necessary to consolidate the different platforms coming from different port terminals, and even coming from other long distance trains in places known as shunting yards at origin and to distribute at the destination Shunting yards are commonly operated by the National Rail Infrastructure Manager outside the port area, although other possibilities exist (i.e. HPA is handling one of the biggest shunting yards in Europe for the consolidation and distribution of wagons and platforms to different port terminals, ADIF is beginning to privatise the operation of the freight stations including the shunting operations, etc.).

The fact that both shunting operations and container loading/discharge operations are made by different companies and at different locations, generates miscommunication problems and delays as the details of the platforms and containers that arrive at the port terminals are unknown, inaccurate and lack relevant data. Currently, the information received by the terminals is based on the information of the long distance train composition but it is not adjusted to the shunting train composition generated at the shunting yard and arriving at the port terminal. This problem is happening during the first and last mile of the rail transport chain. Movements between two container terminals of a shunting train composition are also common. In this case, the order of the platforms with the containers arriving may also be changed at the shunting yard and it is mandatory to separately provide precise information of the containers to be handled to each terminal operator.

Currently, the information for the shunting train compositions is manually handled and it is not reliable and precise enough for the needs of railway port terminal operators. A more precise and reliable information is required for the planning of the operations. For example, it is important to know in advance:

- The length of the shunting train composition in order to plan the available spaces in the terminal;
- The details of the containers to be loaded to or discharged from the platforms and;
- The weight and the destination of the containers, etc.
1.1 OBJECTIVE OF THE INITIATIVE

The lack of reliable information for the loading and unloading operations for the shunting rail compositions arriving at the container terminal and the calculation of the space necessary for their operations has a significantly negative impact in the efficiency of the terminal. Time will be lost, more handling operations will take place and more errors will happen during the discharge and loading processes. These problems are also affecting all the actors involved in the complete railway supply chain (shipping companies, railway operators, railway undertakings, terminals, ports, road hauliers waiting for the movement of containers ...).

The objective of the initiative is to conduct a study that takes the form of a pilot action to prepare, create and/or adapt different systems to better conduct shunting operations. Furthermore, this initiative is expected to achieve a smoother interface between port operations and railway corridors, simplifying combined transport and the connection of MoS with the railway corridors. The partners and pilots in this initiative have been selected to identify the requirements for:

- Supporting shunting operations in RFTMS (used by railway undertakings);
- The PCS to become the preferred and more convenient platform to exchange the information to better organise these operations;
- The Port Railway Infrastructure Management System (usually managed by the Port Authority) to make an appropriate supervision of the rail infrastructure and;
- The Terminal Operation Systems (used by terminal operators) to handle the container loading and discharge process better.

1.2 SCOPE

The scope of this document is to:

1. Present the functional requirements because of the analysis (procedures, flows ...) carried out.
2. Identify the software developments implemented and related to the prototypes of the initiative.
3. Explain what the software product(s) will, and, when necessary, will not do when they will be finally implemented after the end of the action.
2 REPORT FOR THE PROTOTYPE AND PILOT “COORDINATED SHUNTING OPERATIONS IN RAIL STATIONS AND PORT RAIL TERMINALS IN VALENCIA” – PARTNER(S) RESPONSIBLE FOR THIS REPORT: “CONTINENTAL RAIL”

2.1 INTRODUCTION: MAIN PROBLEM IDENTIFIED AT THE BEGINNING OF THE PROJECT

The aim of the prototype is testing a tool that enables the RFTMS of Continental Rail to provide the rest of the actors (PCS, Port Authority Railway Infrastructure Manager, Port Terminal(s) etc.) with the same information created for long distance trains with data adapted to the manoeuvres done at the shunting yard for each one of the sub-convoy created for attending the port container terminals.

Therefore, this prototype consists on the development and adaptation of the RFTMS with the following two main goals:

1. Adapting the information of the RFTMS for long-distance trains to the manoeuvres trains that effectively run between the shunting yard and the port terminals.
2. Enable the RFTMS to share this information with the Port Authority and the port terminal(s).

2.2 MAIN OBJECTIVE AND STATUS OF THE PROTOTYPE

The prototype consists of a new development in the RFTMS to be able to provide separated information of the shunting rail compositions created at the shunting yard for distributing the wagons with the containers to be discharged and for the containers to be loaded to the different container terminals of the port.

The specific objectives established for the prototype have been the following:

- The RFTMS has to be ready to quickly register the coupling and de-coupling operations carried out with long distance trains and shunting train compositions.
- The RFTMS has to be ready to register loading/unloading containers in the shunting yard wherever these operations take place.

Taking into account the adaptations required in the RFTMS, a prototype has been successfully developed and prepared to conduct the first pilot tests at the port of Valencia. Further details of the design of the prototype are given in section 2.4.
2.3 **SCOPE OF THE PILOT**

The pilot carried out by Continental Rail has taken the following aspects into account:

1. Continental Rail has a RFTMS that is already able to share information with the PCS. However, the information shared at this moment is only linked with long distance train compositions circulating in the main corridor and not particularised to the different shunting train compositions arranged at the shunting yards.

2. This situation made the data useless for the port infrastructure manager and the terminals as the information was only valid when the train arrived at the shunting yard. The conditions and order of the new shunting train composition was completely different after it was manipulated there.

3. However, the information of the shunting train compositions is highly relevant for the port infrastructure manager for its supervisory functions and for the port terminal for planning their loading/unloading operations.

4. Sometimes, container loading and discharge operations can also happen at the shunting yard when it has cranes and equipment for handling containers, consequently, the RFTMS should be designed for registering these loading and unloading operations at the shunting yard.

5. As all the data is already registered in the RFTMS, it will be used to facilitate the registration processes of new train compositions carried out in the shunting yard. These modifications of the composition have been classified into three categories:
   
a. **Transfers**: Before closing a defined train voyage in the RFTMS, the system will easily allow the user to “transfer” the data of the train composition (wagons, platforms and containers) to a new train voyage according to the operations carried out at the shunting yard.
   
b. **Splits**: Before closing a defined train voyage in the RFTMS, the system will allow to “redistribute” the train composition (wagons, platforms and containers) over several different train voyages according to the operations carried out at the shunting yard.
   
c. **Joins**: Once a train voyage is created in the RFTMS, the system will allow the “adding” of new platforms and containers that were previously allocated in previous train voyages according to the operations carried out in the shunting yard.

Transfer and split operations in the shunting yard are mainly used to distribute the platforms coming from the long distance train to the different shunting train compositions that will go...
from the shunting yard to the different port terminals. Join operations are mainly used to consolidate the platforms coming from the different shunting trains compositions coming from the port into the long distance train composition.

2.4 TECHNICAL DESCRIPTION OF THE PROTOTYPE AND PILOTS CARRIED OUT

2.4.1 SPECIFICATIONS

For the creation of the prototype, the following requirements have been taken into account:

- When assigning new work orders to a train voyage, all work orders received from the same container operator need to be listed separately and should be able to be sent separately to each of them through structured formats. To this end, all work orders will have a Railway_Operator_Code to distinguish it. Although this requirement is already supported by the RFTMS, it is also required in the management of shunting operations for creating new train compositions.

- *Transfer and split operations* have many similarities on the registration process so they will be handled in the same way. The RFTMS user will be able to access to this new functionality using a new option included in the “Sending documentation” step. The implementation of these operations is designed for not saving anything on the database until all the registration process has finished. If the user quits the process without finishing it, the transfer or split operation will not be registered. At the end of the process, the original train voyage (the one from which we are transferring or classifying the platforms) will be automatically finished, changing its condition to “04-Finished” and the new train voyage compositions will be updated.

- Access to the *join operation* is introduced as a new option during the “Voyage definition” step. As it happens for splits and transfer operations, nothing will be registered on the database until the process is finished. If the user quits the process without finishing it, the *join operation* will not be taken into account. At the end of the process the new train voyage composition (the one on which we are transferring platforms from other trains) will be classified as “send to terminal”, changing its condition to “02-Send to terminal”.

- The following steps have been defined for the pilot demonstration and assessment of the shunting operations during the B2MoS project:

  1. Before registering the split and transfer operations, the user will need to **create the different voyages for the shunting train compositions** that will go from the shunting terminal to the port terminal or terminals.
2. The user will select the transfer/split option during the “Sending Documentation” step of the long distance trains.

3. To register the shunting operation, the user will select the shunting train compositions that will be involved in the transfer or split operations from the long distance train from a list of shunting train compositions pending to be send to the terminal.

To do this, the user will choose between the shunting train voyages that are on the condition “01-Created”. If only one shunting train composition is selected, the operation will be considered a transfer, but if several shunting train compositions are selected, the operation will be considered a split.

4. Management of platforms: All platforms related to the long distance train will be shown to the user and he will assign them to the correct shunting train composition from the previously selected ones that will be available in a select box. If there is only one shunting train composition, an option will appear to directly transfer all the platforms. Once the platforms have been assigned to the new shunting train compositions, the user will be able to change the order of the platforms in these train compositions, include other platforms and change the terminal operator that will handle the platform and/or container. The application will also provide options to remove a particular or all the platforms from a particular shunting train composition. Once that all platforms have been reassigned, the RFTMS will show an option for checking the platforms and assure that they comply with the maintenance rules (in function of the existing distance to the new destination). If this safety check is successful, a new link will be displayed to continue with the process. If not, corrective actions will need to be made to the non-compliant platforms.

5. Management of Containers: The container management is separated from the platforms management due to the complexity of handling platforms and containers at the same time from a user and application point of view. The management of container will allow for a visual representation of all the related data on a single screen.

The different shunting train compositions will be shown with the platforms and the containers carried out. At this point, the RFTMS will allow the user to register the unloading or loading of containers that may have taken place at the shunting yard (at those shunting yards with appropriate handling equipment). Once the
Containers are reallocated as wanted, the application will enable to close the process.

6. Finish the long distance train voyage. In the process the long distance train voyage will be finished and the transfer and split changes registered in the shunting train compositions.

To finish the long distance train voyage the user will use the option “Confirm Unloading” of the RFTMS. If the system detects that the long distance train composition has been transferred or splitted in shunting train compositions, a message will be shown to indicate it. The real time of arrival of the long distance train shall be registered and all the platform and container records updated following a similar process as the one used for long distance trains without shunting operations. The RFTMS system will confirm that the platforms and containers have been transferred or splitted to the shunting trains compositions.

- The following steps have been defined to create joins for the long distance train:

1. The user will select the option join shunting train compositions in the Voyage Definition step of the long distance train.

2. A list of potential train compositions to link with the long distance one being defined will be shown.

3. Potential train composition on phase “Finished-04” and with an arrival date between the dates specified by the user will be shown and the user will be able to select one (the functionality of the application allows to pick up on or several train voyages).

4. Management of Platforms: At the top of the screen, the long distance train voyage is shown as well as the selected shunting train voyage numbers. The joint list of platforms coming from the shunting train compositions that are not yet assigned to a long distance train is also shown. The user can select the platforms to include in the long distance train. Once the platforms have been selected, the user is able to change their order or to add new platforms. The application will also allow the deletion of all the platforms assigned to the long distance train composition or transferring all the platforms from a particular shunting train composition with a simple click. After the platforms related to the long distance train have been transferred, the application will proceed to their validation (i.e. detection of issues related to the maintenance of the rolling stock). If the maintenance validation is correct, a new link will be shown up to continue with the process. If not, corrective actions will need to be made for the non-compliant platforms.
5. Management of Containers. The management of containers is made on a different screen due to the complexity of handling platforms and containers at the same time from a user and application point of view. (i.e. due to the possibility of having several shunting train compositions to be transferred to a long distance train to join them).

The long distance train composition will be shown with the assigned platforms. The application will allow the selection of any container and load it on a certain platform. When the application uploads the data registered, it will assure that the containers selected are compatible with the platforms selected (this check is made similarly to the one applied to regular trains). When assigning containers to different platforms, the application will allow the user to move the containers from one platform to another or to unload all the containers loaded. The application will also allow the assignation of new containers (whenever those containers have the same terminal operator code, origin and destination). The application will allow multiple selection of containers, and, as long as these containers do not belong to any other voyage, they will appear as “non assigned containers”. Once all the containers have been assigned, the user will be able to close the voyage.

6. Closing the process

The changes carried out on the voyage will be uploaded to the database, the composition will be updated with the platforms selected for the voyage and the containers loaded on the platforms. The voyage will change to the state “02-Send to terminal”. Once the long train composition finishes the step “Create Voyage”, it will be move to the step “Close Voyage”.

2.4.2 NEW FUNCTIONALITIES INTRODUCED FOR TRANSFERS AND CUTS IN THE PILOT

This section intends to show the new functionalities introduced for creating transfers and splits of the long distance train during the shunting operations and to obtain the shunting train compositions, which will be notified to the container terminal and the port railway infrastructure manager through the port community system:

- Create a new procedure “Travels_dataCuts” and a view at the DB “ViewV_Travels04”
- Introduce a new link button in the page “SendDocumentation.aspx” for transfers/splits
Coordinated shunting operations in railway stations and port rail terminals

Figure 1. “Send Documentation” screenshot

- New screen/page named “TravelCutsList.aspx” where voyages with the following criteria will be shown:
  - Voyages on state '01-Created'
  - Voyages without a locomotive assigned
  - The date of departure should be later than the date of arrival of the long distance voyage we are managing.

If one voyage is selected, the operation will be considered a transfer. If several voyages are selected, the operation will be considered a split. The application will allow the selecting of one or several voyages.

Figure 2. List of travels created without composition screenshot
• New screen/page “TrainPlatformsCut.aspx” where the platforms will be managed. If the operation is a transfer, we will be able to assign all the platforms with “Transfer everything” link button or manually choosing the platforms and updating the data. After the platforms are transferred to the new voyage, the user will be allowed to change their order, add new platforms, remove platforms or remove all of them. The user will also be able to change the destination terminal and having a view of the state of the train when updating the data.

Figure 3. “Train platform cuts travel management” screenshot
For the split operation (transferring platforms to several voyages), the option “Transfer everything” is not shown, as long as the user has to choose between different new trains. The rest of the options remain the same as for transfers but with multiple shunting train compositions.

Figure 4. "Split operation" screenshot
Whenever there are platforms assigned to a voyage, the application will allow the user to reorder them using the same processes as the ones followed for regular trains (as shown in the following picture).

![Platform order for a travel screenshot](image)

**Figure 5.** “Platform order for a travel” screenshot

It will also allow the adding of new platforms (in case they are not already assigned to the voyage) following the same process as the one set up for regular trains.
Coordinated shunting operations in railway stations and port rail terminals

Figure 6. "Adding additional platforms for a travel" screenshot

The link button to validate the process will only be shown when all the platforms have been assigned to the voyage.

Figure 7. "Link button to validate the process" screenshot

After the user validates the data, the application will carry out a check for the maintenance conditions of the platforms assigned to the travel, following the same conditions than for regular trains.

A maintenance report will be displayed and unless the check is not successful (black color), the system will display a link to continue with the container process.
Coordinated shunting operations in railway stations and port rail terminals

Figure 8. Information about train cuts management

- A new screen/page “CNsTrainCut.aspx” has been created where the user can manage the containers that they want to transfer. At the beginning of the screen, the selected shunting train voyages will be displayed, and below the long distance train voyage from which the user is transferring the platforms and containers. On the long distance train voyage, the list of containers will appear and through a select box, the user will be able to select the voyage and platform where it will be transferred.

Figure 9. List of containers and platforms screenshot
When the user clicks on the update data link button, the application will load the container with the assigned platform using the same logic used than in the regular trains. If there are containers on the voyage, the system will the used to classify them inside the platform (if there is more than one container); we will be able to remove the container or to remove all the containers of the voyage.

Figure 10. "Containers assigned to a platform" screenshot

If the user selects “Continue”, the application will warn that once the process is confirmed, the containers will not be able to be moved.

- The modification of the webpage "UnloadingConfirmation.aspx". Here we will be informed that we have come from a transfer/split process.
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Figure 11. “Unloading confirmation” screenshot

If the operation is a transfer:

- The shunting train composition will be updated. The departure terminal will be the arrival terminal for the long distance train. The platforms and the order of the shunting train composition will be updated as registered during the process. The shunting train composition is assigned to a new voyage. New data records will be created in P_TRAVELS_PLATFORMS with the platforms assigned to the shunting train composition.
- The original containers (those loaded on the long distance train) will continue on the table P_PLATFORMS_CONTAINERS. Those containers that were not selected will be deleted from the database. The containers selected will be inserted at P_PLATFORMS_CONTAINERS with the new voyage and the Transport Orders will be updated with the new voyage identification.
- The long distance train will be finished with the same procedure applied for regular trains.

If it is a split:

- The composition of the long distance train voyage becomes to the state “available”; it updates its loading and unloading terminals with the logic used for regular trains. A new shunting train composition is automatically generated for each split with a voyage number C_XXXX, where the numbers XXX are sequential. These shunting train compositions are assigned to the new voyages with the platforms related to them. The departure terminal will be the arrival terminal for the long distance train. New data records will be created in the P_TRAVELS_PLATFORMS table.
- The containers and the close-up of the voyage will be the same as in transfers.
2.4.3 NEW FUNCTIONALITIES INTRODUCED FOR UNIONS IN THE PILOT

This section intends to show the new functionalities introduced for creating joins in the long distance train during the shunting operations from the previous generated shunting train compositions, notified previously to the container terminal and the port railway infrastructure manager through the port community system:

- New link button option on the screen/page “ComposeTravels.aspx” for joining voyages.

![Figure 12. “Composing travels” screenshot](image)

This option will appear only if the voyage is in the status created.

- New screen/page called “TravelList_Union.aspx” where the voyages fulfilling the following criteria will be shown:
  - Voyages on state “04- Finished”
  - The initial date of the voyage fulfills the criteria set up.

![Figure 13. “Travel list union” screenshot](image)

This page will provide a quick search of the train voyages required
• New screen/page “TrainPlatformsUnion.aspx” where the platforms will be managed. It will allow transferring all the platforms of a selected voyage to the new voyage with a button link. If the user wants to select the platforms manually, he can do that and then click on the button link “Update”.

Figure 14. “Train platforms union” screenshot
Once there are platforms assigned to the voyages, the application will allow the user to re-order them on a new screen/page, following the same procedure than the one set up for regular trains.

It will also the user to allow add new platforms (in the case they are not already assigned to a voyage), on a new webpage, with the same procedure as the one set up for regular trains.

After completing this process, the application will run out a test for the maintenance conditions of the platforms assigned to the travel, with the same logic conditions than for regular trains.

It will display the same maintenance messages for all the voyages and, if there is no black color (that means that maintenance rules have not been successful), the system will show a link button to continue with the containers process.

Figure 15. ”Platforms union management for the travel” screenshot
Coordinated shunting operations in railway stations and port rail terminals

- New screen/page “TrainCNsUnion.aspx” where the user can manage the containers transferred. On the top of the webpage, the user will view the long distance train and below it, they will see the shunting train compositions he wants to join. In the voyage/s to join, the user will see the containers being moved, and on a select box the platform to where we want to transfer the container.

![Figure 16. "Train containers Union" screenshot](image)

When we click on the update button, the application will assign the container with the selected platform and in the corresponding position (by default, the platform and the container position will be the same as the one assigned in the shunting yard composition). The user will be also able to remove the container or to remove all the containers of the voyage.

There is also an option to assign available Work Orders with the terminal operator than the long distance train voyage (same origin and destination), this option has been prototyped because the voyage will proceed to the state “02-Send to terminal”. Once the user finishes the join they will not be able to Access the current screen/page “ListWO.aspx”, as long as this
screen/page is on the step “01-Created”. (On the stage 02, it is allowed to assign new work orders, but individually not with a multiple selection).

- New page/screen "WOListUnion.aspx"

![Figure 17. "Available list of unions for the travel" screenshot](image)

If the user selects the available work orders, with the same terminal operator than the train, they will appear down the webpage grouped under the frame “NOT ASSIGNED CONTAINERS”), due to the fact that those work orders do not belong to any of the voyages selected for the join.

![Figure 18. "Not assigned containers" screenshot](image)
These containers can be assigned to the platform selected by the user, and the application will check out that the composition is respecting the available space on the platforms (with the same logic scheme than for regular trains). If the user does not assign the Work Order to any platform, the work order will be deleted when closing the join.

When all the containers have been assigned (or not) to the platforms, the user will proceed to click the “Continue” link button. The application will advise the user that the union process is going to be finished and the changes are going to be registered on the database. The following changes will be carried out:

- The composition will be updated. The data related to the platforms and its order inside the composition will be updated with the data registered during the process. This will create the associated records on P_TRAVELS_PLATFORMS table according to the new composition.
- The containers assigned will be created on the long distance train voyage on the table P_PLATFORMS_CONTAINERS.

2.5 LIST OF USERS AND ROLE OF USERS INVOLVED IN THE TESTS AND PILOTS

**Railway Operator:** The railway operator has to communicate which are the containers to be loaded/unloaded to a long distance train, in addition to several details of the containers that allow planning the operations (loading, unloading, storage, road admission, road departure) to be done with those containers. The list should be sent digitally to enable sharing it with the rest of the actors of the supply chain. During the pilot, information has been shared with the Railway operator SICSA Rail Transport.

**Inland Terminal:** The Inland Terminal has to send the list of the containers loaded on the platforms in the long distance train. This information has to be sent digitally to enable sharing it with the rest of the actors of the supply chain. During the pilot, information has been shared with the inland Terminals of Puerto Seco de Coslada and Puerto Seco de Azuqueca.

**Railway Undertaking:** The Railway Undertaking has to receive the information of the Railway Operator and the Inland Terminal and has to upload it to its RFTMS. This information is processed to configure the long distance train composition. A development on the RFTMS has been created to pilot the transformation of the long distance trains into several shunting trains to adjust the information to the compositions that port terminals are going to receive at the Port Terminal instead of the long train composition received at the shunting yard. Continental Rail is the railway undertaking that has piloted this development.
Infrastructure Manager: All the safety and circulation details of the long distance trains are created and shared with the Infrastructure Manager electronic tools to enable the circulation of the trains. They are also in charge of the shunting operations to be done at the shunting yard. They receive the composition of the long distance train that they receive from the Inland Terminals and they also have to receive the composition of the different shunting trains that are going to be sent from the shunting yard to the Port Terminals. The infrastructure manager collaborating on this pilot has been Administrador de Infraestructuras Ferroviarias (ADIF).

Port Authority: The Port Authority is responsible of admitting the train at its facilities (as the railway infrastructure manager inside the port). It has to receive the safety and circulation details of the shunting train compositions (from shunting yard to Port Terminal) train. It has also to receive the details of the containers loaded at each train for its statistics. The port authority participating in this pilot test has been the Port Authority of Valencia who has also been in charge of the PCS integration together with Valenciaport Foundation.

Port Terminal: The Port Terminal has to send the list of the containers loaded related with the platforms moved through the shunting train compositions. This information has to be sent digitally to enable sharing it with the rest of the actors of the supply chain. They are also interested in receiving the shunting train composition details (containers and platforms received at their locations) for better planning their operations of container loading and unloading. During the piloting, the information has been shared with the Port Terminals of TCV and Noatum at the Port of Valencia.

2.6 TESTS RESULTS

Although there are benefits for all the actors involved in the supply chain, we have focused our benefit analysis on those related to the operations of the railway undertaking and the port terminals. The main benefits observed have been:

<table>
<thead>
<tr>
<th></th>
<th>Current Situation</th>
<th>New system RFTMS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average time in processing data from the shunting operator to the railway undertaking explaining changes in the train (hours)</strong></td>
<td>1,00</td>
<td>0,16</td>
</tr>
<tr>
<td><strong>Average percentage of errors in processing information sent by shunting terminal (%)</strong></td>
<td>10,00%</td>
<td>0,50%</td>
</tr>
</tbody>
</table>
Coordinated shunting operations in railway stations and port rail terminals

<table>
<thead>
<tr>
<th>Estimated time to process errors in processing information sent by the shunting terminal to the railway undertaking (hours)</th>
<th>0.50</th>
<th>0.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average time in processing correct data sent by railway undertaking by the port terminal (hours)</td>
<td>1.00</td>
<td>0.12</td>
</tr>
<tr>
<td>Average time in unloading/loading the train by the port terminal</td>
<td>3.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Average percentage of errors in processing information sent by railway undertaking about the composed train (%)</td>
<td>7.00%</td>
<td>0.50%</td>
</tr>
<tr>
<td>Estimated time to process errors in processing information sent by railway undertaking about the composed train by the terminal (hours)</td>
<td>0.17</td>
<td>0.17</td>
</tr>
</tbody>
</table>

We estimate that inland terminals, infrastructure managers, railway operators and Port Authorities will also have benefits from receiving structured and standardized information that will lead to a more efficient, but also safe sea-rail combined transport chain.

2.7 MAIN PROBLEMS ENCOUNTERED DURING THE TESTS

We believe that we have created a set of procedures that are unambiguous and clear which will increase the efficiency of the system for transferring containers between sea and rail modes. As in any new business process, we have identified different challenges for the solution designed depending on the nature of the actor. The main problems encountered have been:

- Changes at the railway operations carried out because of market changes forced us to develop the Pilot as flexible as possible as we have realised that clients can ask railway operators and railway undertakings about many different services.
- Several times the railway operator delegates the running of the shunting trains to the infrastructure manager or to a third railway undertaking. This also forced us to make the development even more flexible.
- The lack of standardized information from the different inland terminals is a bottleneck for the railway undertaking that has to adapt the different models used to upload them to the RFTMS.
• There was difficulty in creating a unique train ID that fulfils the requirements of all the actors involved at the port is defaulting the integration of the pilot at the PCS.
• Setting the closing time for every process to be done by each one of the actors is another problem to be solved in the future.

2.8 FURTHER WORK NECESSARY FOR THE IMPLEMENTATION OF THE PROTOTYPE

The main issues to be solved before the implementation of the prototype were mentioned before, creating a unique train ID that fulfils the requirements of all the actors and setting the closing time for each process that each actor has to do.
3 REPORT FOR THE PROTOTYPE AND PILOT “STANDARDISATION AND IDENTIFICATION OF SHUNTING TRAIN INFORMATION DURING ITS CIRCULATION WITHIN THE PORT INFRASTRUCTURE” – PARTNER(S) RESPONSIBLE FOR THIS REPORT: “PORT AUTHORITY OF VALENCIA AND FUNDACIÓN VALENCIAPORT”

3.1 INTRODUCTION: MAIN PROBLEM IDENTIFIED AT THE BEGINNING OF THE PROJECT

The study taking the form of pilot action carried out by the Port Authority and Valenciaport Foundation has been focused on introducing a set of standardisation and interoperability measures based on the work being carried out by Continental Rail for shunting operations.

These standardisation and interoperability measures will facilitate the adoption of the data exchange and information sharing in sea-rail combined transportation by railway undertakings and prepare the valenciaportpcs.net platform, the PCS of the Port of Valencia. This offers effective solutions and clear guidelines to the rest of the port community companies involved, namely container terminals, railway transport operators and shipping agencies, as well as to other railway undertakings for operating in an interoperable environment at the Port of Valencia.

The execution of the pilot in the Port of Valencia during this initiative has been particularly relevant to gain a better insight on how the shunting operations between the shunting yard and the container terminals at the port impact the sea-rail combined transportation. Moreover, it gathers sharing of data for better planning, ordering, executing and reporting these operations among involved stakeholders.

In the Port of Valencia, the shunting yard is outside the port area at five kilometres away while inside the port there are two rail freight stations located in two container terminals, namely TCV and Noatum. There are currently four different railway undertakings (Continental Rail, Logitren, RENFE and Tracción Rail) and more than ten railway operators. More than 50 shipping agencies are involved in sea-rail combined transport operations.

The following maps show the associated infrastructures (port and shunting yard).
Railway traffic in Valenciaport has raised 30.2% from January to August 2015 compared with previous year figures. Freight moved by rail reached 1.68 million tonnes, which means a rail share of 7.07% in front of a road share of 92.93%. In terms of container volume, a total of 89,111 TEUs were moved during the first eight months, this represents an average of 366 TEUs per day or an equivalent length of more than 2.2 km of train compositions per day.
Coordinated shunting operations in railway stations and port rail terminals

Up to now, railway undertakings were only concerned about the long distance train compositions and not all the movements and shunting operations were considered in their RFTMS systems. This situation caused a lack of information and a discoordination on the port rail leg between the shunting yard and the container yard as well as a lower quality, precision and reliability of the information reported by the railway undertakings to the port rail infrastructure manager, which in this case is the port authority. The design of the prototype and the execution of the pilot have been focused on solving these two shortcomings.

The identification of the train has also been a difficult challenge to solve and there is not a common understanding of the identification of the train. Although the concept of rail voyage exists for the involved stakeholders, its identification is different and each company (railway operator, railway undertaking, railway infrastructure manager, port infrastructure manager and terminal operator) are using its internal voyage number. Additionally, it has to be taken into account that there will be different rail voyages for the long distance trains and the shunting trains. Therefore, it will be also relevant to know which train compositions each party is referring to when identifying a voyage of a train.

3.2 MAIN OBJECTIVE OF THE PROTOTYPE

The objective of the prototype and work carried out by the Port Authority of Valencia and Valenciaport Foundation has been to widen the functionalities of the recently created valenciaportpcs.net rail service and adapt them to the unclear needs raised by shunting operations to effectively cope with the sea-rail container combined transportation.

To reach this objective, the work carried out in this initiative has been focused in defining the standards to be used for the exchange of information among the port community stakeholders as well as achieving the technical, semantic and organisational interoperability conditions to achieve an effective data sharing among involved stakeholders.

Using the well-known United Nations Trade Data Interchange Directory (UNTDID) as the main standard reference and the message implementation guidelines used in container terminals for COPRAR (Container discharge/loading order message), CODECO (Container gate-in/gate-out report message) and APERAK (Application error and acknowledgement message), new guidelines have been produced and adapted for handling containers and platforms compositions in rail taking into account both long distance and shunting train operations.

In order to achieve the maximum technical interoperability, the structure of these messages have been defined for both UN/EDIFACT and in XML formats. The PCS valenciaportpcs.net
platform will also offer possibilities to send these messages from the TMS, TOS and RFTMS systems using SOAP, FTP and SMTP protocols, as well as to edit and handle these messages through the applications provided by the platform.

After the execution of the pilot during this initiative, clearer and common business processes have been concluded for the exchange of data in the seaport and rail domains. This is a major outcome, as it will facilitate the implementation of the solution after the finalisation of the pilot.

The business processes that have been defined and agreed during the pilot are splitted in a loading procedure and a discharge procedure. These procedures are explained below:

**Loading procedure of trains at the port**

1. The rail transport operator will create a single container loading list of the long distance train composition according to the transport orders it has received from its customers.

   The train-loading list will be shared with both the railway undertaking and the container terminal using a COPRAR message, a template Excel sheet or introducing the containers directly in the application offered by the valenciaportpcs.net platform.

   The railway undertaking will use this container-loading list to prepare the different shunting train compositions, while the container terminal will use this information to prepare and plan the loading process of the containers according to the gate-out orders received from the shipping lines or their agencies.

2. The railway undertaking will prepare the reports for the railway infrastructure manager of the different shunting train compositions that will depart from the shunting yard to the container terminal for loading the containers.

3. The container terminal will receive the shunting train composition and start the container loading process. After the containers loaded on the shunting train are registered in its TOS, a message with the confirmation of the container loaded in the platform is generated.

   The message used for reporting the confirmation of loading a container is CODECO.

   This has been a major improvement of the procedure achieve during the initiative as, initially, it was foreseen to use the COARRI message (Container discharge/loading report message).

   The COARRI message presented the challenge of uniquely identifying the shunting train and it was hindering the proper handling of the data shared.
During the pilot, it has been proved that it is preferable to report the loading of the container individually. The advantages are that the:

- CODECO message is already used by container terminals to report their gate-out operations to the shipping lines, so this approach will minimise the costs and time involved in changing their systems.
- CODECO message is reporting the loading of the container into a given platform, independently of the shunting train that is arriving at the terminal eliminating the need of unifying the identification of the train, which was perceived as impossible to achieve.

The handling of CODECO messages instead of COARRI in the valenciaportpcs.net have been one of the elements introduced in the valenciaportpcs.net platform during this initiative. This information is particularly useful to the railway undertaking as it could avoid the current mechanism of manually review the train composition and manually report the containers loaded in the train reducing costs and time associated to these manual processes.

4. The railway undertaking uses the information reported by the container terminal to complete the shunting train compositions and join them into the long distance train in a similar way as the one explained by Continental Rail in its pilot.

The possibility of retrieving the information of the containers loaded in the platforms by the railway undertaking can also reduce the time and increase the reliability of the data to be reported by this company to the rail infrastructure manager for the shunting train. Less time to complete the different administrative formalities to get the authorisation of shunting train to circulate can also potentially reduce the waiting time for the train to depart from the container terminal obtaining important cost savings.

**Discharge procedure of trains at the port**

1. The railway undertaking will create a single container discharge list for the long distance trains composition arriving at the shunting yard.

   The discharge list will be shared with the corresponding railway operators and all the container terminals using a COPRAR message, a template Excel sheet or introducing the containers directly in the application offered by the valenciaportpcs.net platform.

   The container terminal operator will use this list to determine and plan the containers that will be discharged in their yard according to the gate-in orders received from the shipping lines or their agencies.

2. The railway undertaking will split or transfer the platforms and containers to the shunting train compositions following the same approach as the one used by
Coordinated shunting operations in railway stations and port rail terminals

Continental Rail for its pilot and it will prepare the reports for the railway infrastructure manager of these shunting train compositions that will depart from the shunting yard to the container terminal for discharging the containers.

3. The container terminal will receive the shunting train composition and start the container discharge process. After the containers discharged from the shunting train are discharged from its TOS, a message with the confirmation of the containers discharged from the platform is generated. The message used for reporting the confirmation of discharge the container is CODECO, following the same considerations as the loading process.

4. The container, after executing the discharge operation, confirms the discharge of the container from the shunting train.

As explained before this initiative, the foreseen message to use was COARRI but it was decided in the pilot to use CODECO message as this message can be used for the individual confirmation of the discharge of the container to many parties.

5. The railway undertaking uses the information reported by the container terminal to ensure that all foreseen containers have been discharged. Before the departure of the shunting train composition, it reports to the rail infrastructure manager the train composition for departure to get the authorisation for circulation.

The application of standards and the consecution of a good level of interoperability at technical, semantic and operational domains have been major achievements in the pilot. This experience has helped to greatly simplify the procedure.

Additionally, the prototype created in this initiative has allowed the testing and adjusting of the user interfaces designed for railway undertakings whose RFTMS systems are not yet connected to the valenciaportpcs.net platform.

It has also helped to identify the need for a future electronic reporting system for the port authority to better comply with its functions of rail infrastructure manager and assist it in the management of train movements in its area of competence.

3.3 SCOPE OF THE PILOTS

Once the prototypes were finished and the Valenciaport Rail Transport Working Group designed the approach for the pilot, a pilot phase was started to test and assess the solution designed during this initiative.
The scope of the pilots have been to assess, refine and simplify the procedures of exchanging data regarding container loading and discharge operations in rail transportation taking into account the shunting operations. To this end, the pilot has considered the planning, ordering, execution and reporting phases of the following players: railway transport operators, railway undertakings, terminal operators, shipping lines & agencies and rail infrastructure managers in the Port of Valencia.

The prototypes created and activities developed by Continental Rail, Port Authority of Valencia and Valenciaport Foundation have facilitated the pilot exercise, following a living lab approach, as a conceptual verification of the solution among different experts on the subject, and afterwards utilising and assessing the prototypes created in a real environment.

3.4 TECHNICAL DESCRIPTION OF THE PROTOTYPE AND PILOTS CARRIED OUT

The pilot has allowed the assessment of different elements of the prototype that are summarised below:

1. Confirmation of individual train loading and discharge operations by container terminals. During the pilot, the capacity of the container terminals to notify loading and discharge operations on shunting trains using the CODECO message has been tested. To introduce this possibility, it has been necessary to change the guideline of the CODECO message, the handling of this message in the PCS messaging engine as well as the structure of the tables in the database to store the new data coming from these confirmations related to rail operations (i.e. wagon number, position in the wagon, etc.).

The two container terminals in the port handling rail operations have also participated in the pilot and they are sending the container loading and discharge confirmations with this message.

2. Testing of the interfaces and tools created in Valenciaportpcs.net to prepare the shunting train compositions for those railway undertakings that do not have this functionality embedded into their rail freight management systems. The interface created shunting train compositions by a railway undertaking to be sent to the container terminal is shown below.
The main data elements included in the shunting train composition are:

- **Header level**: Railway Undertaking identification details; Container Terminal Operator identification details; Train identification (voyage number); Departure date; Departure station; Arrival date; Arrival station.

- **Container level**: Container number; Container type; Full/empty indicator; Gross weight (including container tare weight); wagon/platform identification, composition sequence and container position in wagon; railway transport operator identification details, customer identification details, shipment and container movement references, loading terminal/station, discharge terminal/station, origin terminal/station, destination terminal/station.

To facilitate the creation of a shunting train composition, an Excel sheet template can also be used to load all the relevant data. This template is illustrated below.
3. Assessment of the procedures defined for exchanging the information for shunting operations.

This assessment has been carried out by the railway working group stakeholders and includes all terminals and railway undertaking working at the port.

3.5 LIST OF USERS AND ROLE OF USERS INVOLVED IN THE TESTS AND PILOTS

The users involved in the tests and pilots are terminal operators (NOATUM and TCV), railway undertaking (Continental Rail), railway transport operator (SICSA) and port infrastructure manager (Port Authority of Valencia) and PCS operator (Port Authority of Valencia).

3.6 TESTS RESULTS

The results of the pilot have helped to identify and solve many uncertainties and issues that were unknown before which will be key to successfully implementing the service and better coordinate shunting operations in railway stations and port rail terminals after the finalisation of B2MoS.

The results of the pilots have helped to review, adjust and validate the procedures to follow and to orchestrate them among all involved participants. Additionally several possibilities for improvement and some technical bugs have been identified that have been solved during the pilot or left to its future implementation before the start-up of the solution after the pilot concludes. The improvement possibilities and bugs identified are the following:

- A single container-loading list including all the containers assigned to a long distance train could be more effective than the creation of different container loading lists generated by the same railway transport operator for the same long distance train but submitted to the different container terminal operators involved in the loading process. This possibility will simplify and reduce the time and efforts in container

*Figure 22.* Information about shunting train composition included in an Excel file
Coordinated shunting operations in railway stations and port rail terminals

segregation and consolidation activities carried out by railway transport operators and railway undertakings. However, it would require that the PCS platform automatically split the lists for each terminal according to the information provided in the gate out orders submitted by shipping lines & agencies.

- The same applies for a single discharge list including all the containers coming from the long distance train and the use of the gate in orders submitted by shipping lines & agencies to know the terminal where the discharge operation shall take place.
- During the pilot, it has been identified that, although container terminals have started to send CODECO messages after loading or discharge containers in the shunting train, this information is not being registered properly in valenciaportpcs.net platform under certain circumstances. This bug will need to be solved before the start-up of the solution.
- A lack of functionality has been identified for the railway undertakings and railway operators to be able to feed their internal systems with a report of the containers loaded and discharged on the platforms along the different shunting trains operating at the port.

The best effective way to introduce this new functionality would be to introduce a web service that allows machine-to-machine communications to request the report of containers loaded or discharged in a long distance train by providing the train voyage number assigned in the container loading or discharge list.

3.7 MAIN PROBLEMS ENCOUNTERED DURING THE TESTS

The major difficulty faced during the tests has been the impossibility to have a unique identification of the train compositions. This fact has obliged to re-design the solution during this initiative, as initially its design was too much dependent to identify a train composition with a unique voyage identification.

The creation of a Train Transport ID is still an open issue that is being defined by the WG 10 of the TAF TSI project and consequently it will not be adopted in the short term. The Train Transport ID will be required by all functions of the TAF TSI and will be defined together by the RUs under the umbrella of RNE and the TAF TSI.

The objective of this WG is the definition of an additional unique Identifier, which stays the same during all single steps of the business processes in a short/mid/long term approach. This TT ID will accompany the train along its whole “life cycle” while the numbers currently in use for individual operations will stay in use, but there will be always a strong relationship to the TT ID.
The introduction of the TT ID will be for sure very beneficial for linking shunting operations with the rail transport but, nowadays, it is not still widely adopted.

3.8 FURTHER WORK NECESSARY FOR THE IMPLEMENTATION OF THE PROTOTYPE

Further work necessary for the complete implementation of the solution and its start up after the finalisation of the prototype are to:

- Provide the port authority, as rail infrastructure manager in the port, with the necessary tools to improve their activities for authorising the circulation, monitoring the traffic and ensuring the safety of the shunting trains within its area including possibilities to receive and comply with the formalities of reporting shunting train compositions electronically following TAF TSI\(^1\) standards.
- Troubleshoot the bugs and introduce the improvements identified during the pilots.
- Ensure the correct adoption of the solution by all the participants involved in these operations.
- Train departures of the trains are subject to customs supervision and control. To simplify also these activities, introduce new technologies and functionalities to simplify and automate the customs release controls of the containers departing by rail from the port.

\(^{1}\) The aim of TAF TSI is to define the data Exchange between Infrastructure Managers (IMs) and Railway Undertakings (RUs). [http://www.rne.eu/taf-tap_tsi_it.html](http://www.rne.eu/taf-tap_tsi_it.html)
4 REPORT FOR THE PROTOTYPE AND PILOT “COORDINATED SHU\nNTING OPERATIONS IN PORT RAIL TERMINALS IN LUKA KOPER” – PARTNER(S) RESPONSIBLE FOR THIS REPORT: “LUKA KOPER D.D.”

4.1 INTRODUCTION: MAIN PROBLEM IDENTIFIED AT THE BEGINNING OF THE PROJECT

The Container Terminal at the Port of Koper does not dispose of information about train compositions that are coming to the Port. Therefore at the train arrival, physical checks and inventory of the wagons has to be done by Terminal personnel, which takes at least 30 to 40 minutes for each composition. Only after the inventory is made, the TOS in use at the Container Terminal generates the unloading plan so the unloading can take place.

The railway operator on the other hand is often not informed by forwarders if the work order (dispozicija) has been sent to Luka Koper for the containers loaded on the train and bound for the Port. The work order is the basic document to perform loading/unloading services in the Port of Koper. Without the work order, unloading cannot take place.

Lack of information regarding containers transported on trains influences the time needed to unload trains. In particular, in case of arrival of containers without a valid work order, this produces delays in unloading operations. The planners need to contact the forwarder who must send a work order. Relevant delays can occur in particular on weekends and outside regular office hours since forwarders can be out of office.

During the analysis of the existing problems, two possibilities were taken in consideration:

- To receive information from the infrastructure manager
- To receive and exchange information with railway operators.

Since no agreement was achieved with the infrastructure manager, the only possibility is to exchange data with railway operators.

Railway operators present in Koper such as Adria Kombi, Metrans, Adria Transport and Interrail were willing to participate in the prototype by sending information about containers and receiving information about the existence of work orders. At the time, the solution was conceived; some of the railway operators were able to send Excel files to the Container Terminal containing a list of containers headed to Koper, although Excel files did not have the same structure.

Moreover, at the time of the analysis, it was reported that information received from railway operators should be integrated in the TOS Tideworks in use at the Container Terminal to get
the maximum possible benefit for the operations. Nevertheless, since such integration would require additional time and financial resources since data exchange between Luka Koper and railway operators is still not implemented, integrations with TOS were left outside the scope of the present prototype, which means that checkers still have to check the train by manually insert data of each container at train’s arrival.

4.2 MAIN OBJECTIVE OF THE PROTOTYPE

The main objective of the prototype is to reduce the time taken when a train is at the Container Terminal without being operative, so when unloading or loading operations are not taking place. By reducing the unproductive time, free space is gained automatically at the terminal to accept additional trains. Railway operators on the other hand have the possibility to increase the trains’ usage since trains can leave the port sooner.

The time when a train is not operative is needed mostly to make the inventory of the containers on the train, to finalise administrative work (in particular when containers don’t dispose of work orders) and to prepare the unloading or loading plans, which takes about 45-50 minutes.

In cooperation with rail operators, the common goal was to improve performance of the terminal through improved information.

4.3 SCOPE OF THE PILOTS

The scope of the tests and the pilot was to verify the quality of the solution created in the framework of B2MOS and to identify the main problems and suggest possible improvements.

Testing took place in the period from May 2015 and September 2015.

Software testing included white-box and black box testing.

The main aim of the black box testing was to reveal and eliminate errors in the user interface, errors in data transmission as well as to identify the missing or erroneous functionalities.

The main aim of the white-box testing was to reveal errors in data structure and errors in accessing databases, errors in the implementation of web services and inadequate working of the part of the software that is responsible for the minimum list of compulsory data.

Based on test scenarios developed by analysts, the testing took place with the participation of the railway operators. Functionalities of the application TinO and the web-based application Lunaris were examined.
4.4 TECHNICAL DESCRIPTION OF THE PROTOTYPE AND PILOTS CARRIED OUT

The prototype includes the creation of a series of xml messages that support communication between the railway operator and the system TinO, but also the upgrade of Lunaris that could be used by railway operators to exchange the same information. The railway operator will be able to choose whether to generate an xml or to use Lunaris.

This figure shows a series of messages to be exchanged between railway operator and TinO (and the Terminal) as part of the B2MOS solution.

![Diagram of message exchange between railway operator and TinO](image)

**Figure 23.** Messages exchange between TinO and railway operator

The container status inquiry will be sent by the railway operator to receive information about the existence of the work order. The container status receipt will be returning information on work orders. The container list will be sent by the railway operator and will include information on containers loaded on wagons, to which a confirmation message or an error message will be sent from TinO.
Coordinated shunting operations in railway stations and port rail terminals

### Rail discharge (505979/1)

Data: WROCLAW 9:00 PM

<table>
<thead>
<tr>
<th>Iron code</th>
<th>Train call no.</th>
<th>Truck no.</th>
<th>Artist / Densey no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>315490680746</td>
<td>1403240578</td>
<td>302067</td>
<td>447505</td>
</tr>
<tr>
<td>315490680746</td>
<td>110740318122</td>
<td>310069</td>
<td>565975</td>
</tr>
<tr>
<td>319448871545</td>
<td>110740318122</td>
<td>310069</td>
<td>565975</td>
</tr>
</tbody>
</table>

### Template of Activity 3 Report

<table>
<thead>
<tr>
<th>Information</th>
<th>Container ID</th>
<th>Weight (kg)</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>315490680746</td>
<td>1403240578</td>
<td>302067</td>
<td>447505</td>
<td>ELEKTRO BODÓW KG i KGÓŁ</td>
</tr>
<tr>
<td>315490680746</td>
<td>110740318122</td>
<td>310069</td>
<td>565975</td>
<td>ELEKTRO BODÓW KG i KGÓŁ</td>
</tr>
</tbody>
</table>
Coordinated shunting operations in railway stations and port rail terminals

**Figure 24.** Lunaris – module for railway operators

**Message RLPO (Container list):**

```xml
<xml version="1.0"?>
<RLPO
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 xmlns="http://www.actual-it.si/XSD/Razvag"
>
 <Message>
   <Header>
     <MessageId>f11a62a-621b-4f3a-bda1-786e63647a49</MessageId>
     <Customer>METR</Customer>
     <Sender>METR</Sender>
     <Recipient>LUKA</Recipient>
     <Created>2015-07-23T12:35:33</Created>
     <OrderNumber>10</OrderNumber>
     <PortOrderNumber xsi:nil="true"/>
     <Version>1</Version>
   </Header>
   <Payload>
     <TrainDirection>IN</TrainDirection>
     <TrainId>158UDKOP80267</TrainId>
     <Action>CRT</Action>
     <RailCall>42001</RailCall>
     <ETA>2015-07-24T0:33:27</ETA>
     <ETD>2015-07-25T0:33:27</ETD>
     <POL>SKOJA</POL>
     <RailOperatorCode>S</RailOperatorCode>
     <PortTerminal>KT</PortTerminal>
     <DeliveryTrack>22</DeliveryTrack>
     <Waggons>
       <WaggonNumber>335445760572</WaggonNumber>
       <WaggonStatus>F</WaggonStatus>
       <SequenceNumber>1</SequenceNumber>
     </Waggons>
   </Payload>
</RLPO>
```
<Containers>
  <ContainerNumber>MRKU8005168</ContainerNumber>
  <ContainerStatus>E</ContainerStatus>
  <PositionOnWaggon>A</PositionOnWaggon>
  <ContainerSize>20</ContainerSize>
  <ContainerType>DRY</ContainerType>
  <ContainerHeight>86</ContainerHeight>
  <ContainerTare>2300</ContainerTare>
  <Line>MAE</Line>
  <Booking />
  <Seal xsi:nil="true" />
  <DispositionNumber>4363893</DispositionNumber>
  <SpecialContainerCode />
</Containers>

<Containers>
  <ContainerNumber>MRKU8037530</ContainerNumber>
  <ContainerStatus>E</ContainerStatus>
  <PositionOnWaggon>B</PositionOnWaggon>
  <ContainerSize>20</ContainerSize>
  <ContainerType>DRY</ContainerType>
  <ContainerHeight>86</ContainerHeight>
  <ContainerTare>2300</ContainerTare>
  <Line>MAE</Line>
  <Booking />
  <Seal xsi:nil="true" />
  <DispositionNumber>4363893</DispositionNumber>
  <SpecialContainerCode />
</Containers>

<Containers>
  <ContainerNumber>TRIU5090273</ContainerNumber>
  <ContainerStatus>F</ContainerStatus>
  <PositionOnWaggon>C</PositionOnWaggon>
  <ContainerSize>40</ContainerSize>
  <ContainerType>DRY</ContainerType>
  <ContainerHeight>86</ContainerHeight>
  <ContainerTare>3800</ContainerTare>
  <Line>MSC</Line>
  <Booking>631-9060</Booking>
  <Seal>MBX034358</Seal>
  <DispositionNumber>4361594</DispositionNumber>
  <SpecialContainerCode />
  <Cargo>
    <Description>AUTOMATIC TELLER MACHINES</Description>
    <Weight>12000.00</Weight>
    <IMDGClass xsi:nil="true" />
    <UNNumber xsi:nil="true" />
    <RID xsi:nil="true" />
    <CustomsStatus />
    <CustomsNumber>15HU10122021A99354</CustomsNumber>
  </Cargo>
</Containers>
</Waggons>
</TrainInstructions xsi:nil="true"/>
</Payload>
</Message>

**Message RLPA (Confirmation of the container list)**

<RPLO xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:xs="http://www.w3.org/2001/XMLSchema"
      xmlns="http://www.actual-it.si/XSD/Razvag">
4.5 LIST OF USERS AND ROLE OF USERS INVOLVED IN THE TESTS AND PILOTS

The following organisations participated in the piloting:

- Luka Koper, d.d. (Container Terminal and IT Development), who participated to conceive the solution and validate the results;
- Actual IT d.d. (external expert), who participated to conceive the solution, design the prototype, prepared the test scenarios and tested it;
- Adria Transport, participated to testing;
- Metrans, participated to conceive the solution and test it;
- Adria Kombi, participated to conceive the solution and test it.

4.6 TESTS RESULTS

The prototype has received great interest and involvement of railway operators, who benefitted the most from the solution. They agreed to a set of data to be exchanged with the container terminal that could enable smoother operations at the port of Koper. The introduction of xml messages enables railway operators to be informed in advance about the status of containers for which they are organising transportation and therefore will minimise or eventually void the number of containers without proper working disposition. According to estimations about 1% of containers, using railway is arriving to the port without a disposition, which is negatively influencing the time needed in Koper to start unloading operations. In fact, containers without dispositions create delays that range from 30 - 62 minutes.

On the other hand, the missing information about a valid rail gate IN orders has a significant effect on discharging of all those containers that transport the perishable goods and even more
for goods subject to IMDG regulation. Without a valid discharge order, such containers cannot be discharged and eventually this will cause a delay in train departure schedule that will have a huge impact on all train schedules. With the on time information regarding the preannouncement of containers with a valid order, the container terminal and the rail operator can save between one and two hours. Furthermore, the rail operator will have the right information about the container, the cargo inside a container hours or days before the train arrives at the Port of Koper. With the right information, a rail operator can mitigate the risk of denied discharging of the container and can include a freight forwarder or a shipper to deal with possible problems before the problems actually exists.

4.7 MAIN PROBLEMS ENCOUNTERED DURING THE TESTS

Problems encountered during testing were related to the peculiarities of information systems of railway operators. It was necessary to adapt the solution to the capability of railway operators to accept messages, but it was also necessary to adapt the solution to availability of data. The prototype was designed to work as if it was in the real world. The main problem was the migration of all production data to the pilot environment. Firstly, all the data regarding containers arriving by vessels or truck had to be identified and successfully migrated. After the migration phase was over, we designed different test case scenarios in collaboration with rail operators and Container Terminals to mimic the real world. A huge effort and a large amount of time was also spent to configure all other systems, for example TOS, to be in harmonization with the PMIS pilot.

4.8 FURTHER WORK NECESSARY FOR THE IMPLEMENTATION OF THE PROTOTYPE

Before the full implementation of the solution, the border cases have to be verified. Moreover, in collaboration with Luka Koper, it will be necessary to set business rules and a communication plan. Adaptations will also be needed for other applications that enable communication between the railway operators and Luka Koper. Furthermore, to get the main benefit from the solution, which will influence the time needed to perform planning operations, adaptation of the TOS system in use at the Container Terminal will be necessary to support the import of received data from railway operators.