OPTIYARD Newsletter

Optimised Real-time Yard and Network Management

Issue 2, November 2019

Foreword

The Shift2Rail Funded IP5 project OptiYard which started on the 1st October 2017 with a duration of 24 months has just successfully been completed in September 2019.

The 13 OptiYard partners have been working on providing decision support tools to yard managers that consider the surrounding network.

What is Optiyard?

- It defines an improved information and communication process
- It simulates intelligent real-time yard operations
- It provides automated optimisation algorithms for yard management
- It uses a technical demonstrator in the form of a fully functional software module

The final conference of the project, held at UIC in Paris on 25 September 2019, was the opportunity to share the results of the two case studies (Trieste Campo Marzio, Italy and Česká Třebová, Czech Republic) and to share the prospects of innovation raised by the project.

This newsletter sums up the main results achieved by the OptiYard Consortium. All project documents and deliverables can be found on the OptiYard website at: https://OptiYard.eu/downloads/.

Shift2Rail

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 777594

FACTS AND FIGURES

Total Budget
1,5€ million
(1,5€ million funded)

Duration
24 months

Project Start Date
01/10/2017

Project End Date
30/09/2019

Partners
13 from 7 countries

Grant agreement
n° 777594

PROJECT COORDINATOR

International Union of Railways
UIC

WEBSITE

WP2 - Data Analytics addressing current data handling capabilities as well as identifying new data models needed for the yard management system optimisation

Leading partner: University of Newcastle Upon Tyne

There is a great potential for better coordination and making better informed decisions regarding the operational departure times for freight trains from yards. The development scenario includes both automation – mostly regarding information processing and communication – and optimisation/simulation – primarily regarding timetable calculation, yard capacity calculation and handling time estimation. The benefits from the improved scenario will be shared by the railway undertakings, the infrastructure manager and the railway system as a whole.

This innovative approach enables stakeholders to optimise the use of the network capacity and yard resources whilst enhancing client satisfaction through delivery of accurate and timely information.

For more information, please refer to deliverable D2.2 on Draft Recommendations for Improved Information and Communications for Real-Time Yard and Network Management (https://bit.ly/2N4DlAM).

WP3 - Development of Specifications that apply to the new optimisation modules

Leading partner: University of Leeds

OptiYard produced an output at TRL levels 3-4. The deliverables of the project will support future IP5 efforts by providing a framework environment within which processes for both real-time yard operations and real-time network operations can be optimised. These results (and subsequent optimisation tools) may then be integrated into on-going and future IP5 projects that will further develop these tools for application at higher TRL levels.

For more information, please refer to deliverable D3.2 on Functional and Technical Specification for the OptiYard Simulation Environment (https://bit.ly/35ccHOi).

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WP4 - Dual Modelling of the yard & network environments

Leading partner: SAPIENZA Università di Roma, DICEA department

The validation of the non-optimised simulation models was documented using the comparison of real historical data and simulation output.

In both case studies the data on infrastructure, processes, timings, locomotive and wagon characteristics were modelled in detail. The implementation proved to be successful: considering as constraints the inbound and outbound arrival/departure times, the simulations modelled operations in a way as to handle all inbound wagons delivering them to the outbound trains after performing the correct sequence of operations. The very few exceptions were probably due to dispatching decisions dictated by information that was not available for the simulations. In any case, the missing detailed modelling of such specific situations is judged not to be a drawback in the use of the developed simulation models for the subsequent demonstration phase of OptiYard, where it is important to have realistic modelling of the majority of operations and the possibility to model perturbed and disrupted scenarios realistically. This is ensured in the simulation models for Česká Třebová and Trieste.

For more information, please refer to deliverable D4.3 on Validated models and simulator (https://bit.ly/35oUnS3).

WP5 - Process Optimisation

Leading partner: Institut français des sciences et technologies des transports, de l'aménagement et des réseaux (IFSTTAR)

The design and implementation of the closed-loop framework for yard management is a major contribution of OptiYard to the state of the art, showing how an optimised system could be deployed in practice. This design paves the way for the optimisation of yard processes on the one hand, and the integration of yard and network management on the other.

For more information, please refer to deliverable D5.2 on Yard Optimisation Algorithm, Network Decision-Support Tool and Integration Framework (https://bit.ly/2KCwC11).

It is important to highlight that the simulation is based on real operation, performed by rail yard operators who are already continuously optimising the MY operation by implementing mainly heuristics methods based on their own experience. In comparison to that, a first-in first-out experience would represent the MY operation performed by a non-experienced operator.

However, the short time window of the optimised and non-optimised MY simulation does not enable to draw conclusions at a global level from the KPI assessment. Some indicators show a positive development (e.g. track blocked time of the departure yard in Česká Třebová) and other show a slightly negative development (e.g. mean wagon transit time in Česká Třebová). Reasons for the positive or negative development of the KPIs at a global level cannot be directly attributed in an unequivocal manner to an improvement of the MY operation but to the interrelation of single KPIs with a combination of positive and negative effects. An example of that is the increase of the travelled kilometres of shunting locomotives in the optimised scenario in Trieste as a result of a greater number of trains served. The difficulties to draw global conclusions from the KPIs due to the short time window are amplified in the case of Trieste due to the inclusion of waiting times in the simulation of the non-optimised scenario to avoid deadlocks.

For more information, please refer to deliverable D6.3 on Socio-Economic Impact Assessment of Innovative Real-Time Yard and Network Management (https://bit.ly/2rgjFD8).

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Summary of main achievements

The yard simulation software developed in WP4 is one of the achievements of the OptiYard project as it is a tool dedicated to the end user/yard operator. It is a user-friendly tool that provides a Human Machine Interface (HMI) which facilitates operations. It is an operational and a quality requirement that is expected by end users.

Another achievement is the method used in WP5 to demonstrate that real time management is possible, and also to give the end user the keys to do so taking into consideration their yard or network specific parameters. This is an essential part of the tool designed for the end user. For that purpose, the Consortium steered an analysis of the state of the art on optimisation algorithms for yard management and connection between yard and network management. The content of this milestone which is the detailed description of the yard optimisation algorithm is reported in D5.2.

WP6 dealt with the results, the business cases and the KPIs. WP6 partners primarily designed the specifications corresponding to the concrete field needs of the end users to ensure the relevance of the optimisation tool. These specifications were based on the Consortium experience, and in particular the two partners ČD Cargo and Adriafer (yard end users of Česká Třebová and Trieste). Both demonstrators, Česká Třebová (Czech Republic) and Trieste (Italy), tested and validated the yard simulation software based on operational data and provided a proof-of-concept showing that the results of the optimisation can reach those obtained in a real-world context.

The work performed in OptiYard showed that the closed loop between the simulation and the optimisation module works in an effective manner. The project outputs highlighted the KPIs that should be focused on an optimisation process. The end user can use the module to optimise the resource schedules (shunting locomotive and yard personnel) and the shunting movements of the locomotives which are the main gains that can be reached in the yard operations.

That leads us to conclude that:

1. Algorithms and microsimulation models capable of functioning in real-time were developed, and physical interaction between optimisation and yard microsimulation was established;
2. The algorithms/models on yard-network management interaction are a good input and can be used in further development projects;
3. Automatic support of yard management could become a key part of balancing the optimisation needs of all stakeholders towards an optimised rail freight system, thus bringing benefits to all, including society which would ultimately reap the social and environmental benefits of fewer goods on the roads.

List of Deliverables

All OptiYard public deliverables can be downloaded on the OptiYard website at: https://optiyard.eu/downloads/.

WP Nº	Work Package Title	Deliverable Nº	Deliverable Title
WP1	Management	D1.1	Project Management and Quality Assurance Plan
WP2	Data Analytics	D2.1	Definition and selection of suitable methods for real-time data analytics
		D2.2	Recommendations for improved traffic management, improved information and communication channels across parties involved
WP3	Specification of the OptiYard Simulation Environment	D3.1	Definition of a suitable simulation environment
		D3.2	Functional and technical specification for the OptiYard simulation environment
WP4	Modelling	D4.1	Yard and network simulation model
		D4.2	Yard simulation software for WP6
		D4.3	Validated models and simulator
WP5	Process Optimisation	D5.1	Optimisation of information and communication methods
		D5.2	Yard optimisation algorithm, network decision-support tool and integration framework
WP6	Business Cases - Feasibility & Simulation Tests	D6.1	Business Case specifications and plans
		D6.2	Business Case Feasibility and Simulation Test of the virtual yard/terminal software
		D6.3	Socio-Economic Impact Assessment of innovative real-time yard and network management
WP7	Dissemination, Communication and Results Exploitation	D7.1	Data Management Plan
		D7.2	Dissemination, Communication and Exploitation Plan
		D7.3	Report on Dissemination, Communication and Exploitation activities

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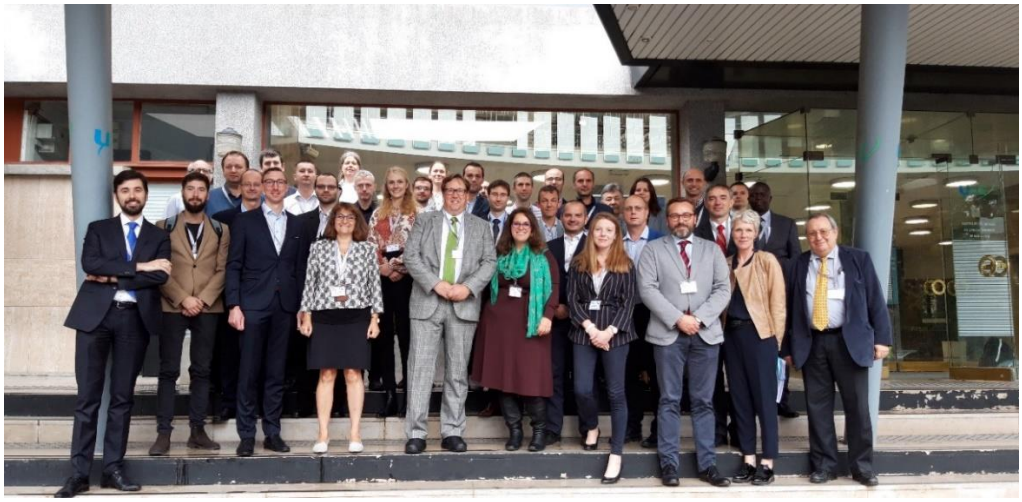
OptiYard Final conference

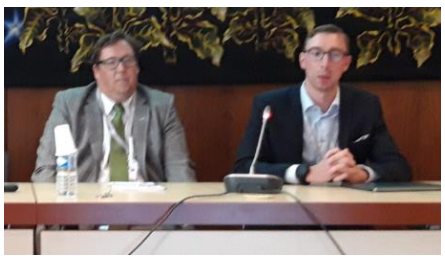
25 September 2019, UIC



On 25 September 2019, the Final Conference of the Shift2Rail JU funded IP5 OptiYard Project took place at the headquarters of UIC (Union Internationale des Chemins de fer) in Paris.

Attended by more than 40 participants from 11 countries across the European railway community and beyond, the OptiYard Final Conference was the opportunity to share the results of the two case studies (Trieste Campo Marzio, Italy and Česká Třebová, Czech Republic) and to share the prospects of innovation raised by the project.

Moderated by Eric Guenther, UIC Project Coordinator, the conference was opened by Sandra Géhénot, UIC Freight Director, and Laura Piani, Shift2Rail JU Programme Manager, highlighting that OptiYard fits into the Shift2Rail programme and answers the Rail Freight Forward (RFF) initiative, the sector strategy to reach the objective of 30% of rail freight in 2030 to increase modal shift.



The conference ended with the presentation of the Shift2Rail JU funded IP5 complementary Project FR8HUB (https://projects.shift2rail.org/s2r_ip5_n.aspx?p=FR8HUB).

Jan Bergstrand, coordinator of the project at Trafikverket, and Nicklas Blidberg from Lindholmen Science Park highlighted the close links between the two projects and the good cooperation established throughout OptiYard's lifecycle.

OptiYard also participated and organised several IP5 Shift2Rail workshops to work in cooperation and share results. Most OptiYard partners are also contributing to other EU-funded projects which will ensure continuity of the work done in OptiYard.

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