
Collaborative project GA-777594

OptiYard - Optimised Real-time Yard and Network Management

Deliverable 4.3

Validated models and simulator

Task leader for this deliverable: Riccardo LICCIARDELLO (DICEA)

Due date of deliverable: 31/07/2019

Actual submission date: 09/09/2019

Dissemination Level		
PU	Public	✓
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Document status		
Revision	Date	Description
1	11/06/2019	First draft for Task 4.3 contributions.
2	19/08/2019	Complete draft for WP4 review
3	05/09/2019	Circulation among TMC members for validation

Report contributors		
Name	Company	Details of Contribution
Riccardo LICCIARDELLO	DICEA	Content manager, Deliverable Leader
Miloš ZAŤKO	SIMCON	Construction and validation of models, main contributor

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

This document reflects only the author's view and the JU is not responsible for any use that may be made of the information it contains

Executive Summary

This short report accompanies the validated models for the Česká Třebová and Trieste yards. The models are the ones used in the demonstration.

It is connected with OptiYard's Task 4.4 "Validation of non-optimised models and simulator". The purpose of the validation is to provide WP5 with models and simulator whose results are proven to represent physical reality correctly, in order for optimisation modelling to be performed on a sound basis. Therefore, the object of validation here is not the final decision support system including the optimisation model - addressed in WP6 - rather the "non-optimised" simulators of the Česká Třebová and Trieste yard-systems and interacting network in several scenarios comprising typical operational situations based on past experience and field data. The validation process comprised the following steps that are described in this Deliverable:

- check of real-world field data provided by operators;
- processing of field data needed for comparison with simulation outputs;
- processing of input data needed for validation simulations;
- definition of outputs needed for validation (e.g. KPIs, ETA/ETD, etc.);
- design of simulation scenarios;
- development of test simulations, with possible iterations;
- comparison of simulation outputs with field data;
- assessment and quality check of results;
- possible feedback on model and software structures.

Table of contents

Executive Summary	3
Table of contents	4
Abbreviations and acronyms	5
1. Scope and purpose	6
2. Validation of yard model: Česká Třebová	7
2.1. Field data: description and processing.....	7
2.2. Simulation scenarios and outputs.....	8
2.3. Comparison of simulation results with field data	9
2.4. Conclusions for the Česká Třebová case	10
3. Validation of yard model: Trieste	13
3.1. Field data: description and processing.....	13
3.2. Simulation scenarios and outputs.....	13
3.3. Comparison of simulation results with field data	14
3.4. Conclusions for the Trieste case	15
4. Compatibility with RailTopoModel	16
5. Overall conclusions and recommendations.....	16
6. References	17
Annex A Comparison Simulation vs. Real data for marshalling yard Česká Třebová	18
Annex B Comparison Simulation vs. Real data for yard Trieste Campo Marzio	71

Abbreviations and acronyms

MY	Marshalling Yard
GIS	Geographic Information System
CAD	Computer-Aided Design

1. Scope and purpose

This short report accompanies the validated models for the Česká Třebová and Trieste yards. The models are the ones used in the demonstration.

It is connected with OptiYard's Task 4.4 "Validation of non-optimised models and simulator". The purpose of the validation is to provide WP5 with models and simulator whose results are proven to represent physical reality correctly, in order for optimisation modelling to be performed on a sound basis. Therefore, the object of validation here is not the final decision support system including the optimisation model - addressed in WP6 - rather the "non-optimised" simulators of the Česká Třebová and Trieste yard-systems and interacting network in several scenarios comprising typical operational situations based on past experience and field data. The validation process comprised the following steps that are described in this Deliverable:

- check of real-world field data provided by operators;
- processing of field data needed for comparison with simulation outputs;
- processing of input data needed for validation simulations;
- definition of outputs needed for validation (e.g. KPIs, ETA/ETD, etc.);
- design of simulation scenarios;
- development of test simulations, with possible iterations;
- comparison of simulation outputs with field data;
- assessment and quality check of results;
- possible feedback on model and software structures.

2. Validation of yard model: Česká Třebová

2.1. Field data: description and processing

Data about the modelled marshalling yard Česká Třebová were delivered and collected on-site in several steps. It was necessary to enter the data for each subsystem of the simulation model (resource, customer and control subsystem).

The infrastructure data for marshalling yard Česká Třebová was delivered in shapefile format (geospatial vector data format for GIS software). In the first step, a conversion into a CAD format was necessary, including the differentiation of the meaning of each geometric object (track, switch). To be able to compute the useful length of tracks, additional data (not included in the shapefile) were added in the second step, e.g. signals or limits.

The infrastructure model used for simulation does not include any slope profile due to the lack of data.

Simplifications in the simulation model were made regarding wagons with humping restrictions. These wagons are sorted normally as any other wagons without restriction. The main reason was to simplify this process, as it is too complicated and not useful for the purposes of this model to prepare an algorithm for solving every possible situation addressing the shunting of wagons with humping restrictions from inbound to outbound trains.

The vehicle movement (train and shunting unit) is modelled utilising continuous simulation with employment of differential equations. The computation takes into account the engine power characteristics as well as the parameters of the infrastructure the vehicle is moving on (e.g. curve radii, slopes, maximum speed allowed, etc.).

Real data of each wagon type (Eas, Falls, Habis...), i.e. weight, length over buffer, number of axles and so on, are used for modelling. Therefore, the train composition is modelled at a high level of detail.

The train handling was prepared and parametrized according to data collected on site.

The train handling includes the sorting over the hump. There are two simplifications. The model does not consider restrictions that are forbidding the sorting of wagons over the hump (no humping). All wagons in inbound train are sorted over the hump into sorting tracks. In real operation, such wagons are separately shunted by shunting locomotive from inbound trains to outbound trains. In the simulation model, there is no need to utilize the shunting locomotive for the transfer of wagons between the two track groups in the marshalling yard – all incoming wagons are humped over the hill and run to sorting tracks. Nevertheless, the goal to sort all wagons of an outbound train is reached.

The second simplification in the process of wagon sorting is related to the movement of cuts down the hill. During this process the movement dynamics of the cuts is not modelled. The model uses an average speed for the three different stages of cut movement (pushing the trains over the hump, cut movement down the hill and cut movement in sorting tracks).

The process of sorting the train over a hump is modelled in a simplified way. The movements, like pushing trains over the hump, running cuts down the hill and rolling of cuts into the sorting tracks, are using only average speed for computation of movement duration.

2.2. Simulation scenarios and outputs

The following simulation scenarios were conducted within work package 4:

- **Scenario 1 – Default configuration (real week operation 10.4. – 14.4.2018)**

Modelling of real operation based on data from 10.4.2018 to 14.4.2018

- **Scenario 2 – With Delays (based on Default configuration)**

On the Thursday, there are two inbound trains delayed, trains 45732 and 59754. Both inbound trains are assigned a simulated delay of 2 hours, compared with the arrival time in the real week (Default Configuration).

- **Scenario 3 – Broken down hump locomotive ZC1 (based on Default configuration)**

On the Thursday, the hump locomotive ZC1 is simulated as broken down for 1 hour, between 4:30 and 5:30.

- **Scenario 4 – Additional Trains (based on Default configuration)**

On the Thursday, there are three additional inbound trains arriving:

62133 – Fictive

- Entry time into simulation model is at 4:15:00 from direction Prague.
- The wagon list is the same as with the original train 62133 operating on the Thursday.

Fictive_01

- Entry time into simulation model is at 2:30:00 from direction Brno.
- The wagon list is fictive.

Fictive_02

- Entry time into simulation model is at 3:10:00 from direction Olomouc.
- The wagon list is fictive.

Due to the higher number of incoming wagons for the relation *Most nové nádraží příjezd*, it was necessary to take into operation an exceptional outbound train 62134 with departure time at 2:21:00 on the Friday.

Simulation scenario 1 is comparable with real operation. All other scenarios were artificially created to model some examples of degraded operation in marshalling yard Česká Třebová.

The evaluation of each scenario was focused on track, personnel and shunting locomotive occupation. For the model validation and comparison with real operation the following evaluations were used:

- During simulation run
 - Observing process animation (position of train, current speed, sorting wagons in proper sorting track)
 - Current occupation of resources (tracks, shunting locomotives)
 - Processing of handling technologies (train service)
 - Log file with conflicts, train delays

- Initialization of outbound trains
- Post-simulation evaluations
 - Occupation and utilization of resources (tracks, shunting locomotives)
 - Waiting time for resources
 - Sorting statistics (number of sorted wagons per hour, sorted trains)
 - Dwell time of train and wagons in the yard
 - Movement dynamics

2.3. Comparison of simulation results with field data

The comparison of simulation-model operation and real operation was conducted for three locations in the marshalling yard, which corresponds to real data delivered by CD-Cargo and Oltis group:

- at arrival
- at hump
- at departure

The arrival of inbound trains in the simulation model exactly reflect the data from real operation.

The inbound trains appear in the simulation model on the respective main line track approximately 3 kilometres before the reception track in marshalling yard Česká Třebová. Depending on the direction from which the train is entering, the entry time into the model is shifted between 6 to 12 minutes sooner than the real arrival time of inbound train in order for the arrival time at the reception track to match the real arrival time as closely as possible.

In the comparison of real and simulation train sorting, on some occasions a different sorting order has been identified. The reason for the difference is unknown. It is assumed that some priority wagons were sorted first. Another reason could be that in real operation, after train preparation for sorting, the process of sorting is not starting immediately (because of the human factor). In the simulation model, the processes are executed immediately when the preceding conditions are fulfilled (preceding activities are finished).

The sorting of internal shunting units coupled in a sorting track or in another part of marshalling yard (maintenance depot, buffered empty wagons) was not modelled (data were not available).

The last part of the comparison focuses on outbound trains. The meaning of departure time in the simulation model refers to the time of the train disappearing into the mainline track (model exit time). The departure time in real operation represents the start of the movement from the marshalling yard towards the main line. The time difference between these two times represents the duration of train movement from the yard to the mainline exit track (different for each direction). In the simulation model, the trains start to move from the yard (departure sidings) based on the real data – departure time, but only the model exit time is saved into the simulation protocol for later evaluation (thus, the place of time measurement is different).

The evaluation of outbound wagon numbers per train in the simulation model and its comparison with reality reveals the consequences of the different sorting order in the model. Logically, in the model, some outbound trains are leaving the marshalling yard with more and some with less wagons

compared with the real operation. To reach a 100% match, it would be necessary to have exactly the same sorting order in the model.

Detailed comparisons can be found in Annex A of this document.

2.4. Conclusions for the Česká Třebová case

The validation of the simulation model of marshalling yard Česká Třebová exposed that it is possible to reach high degree of model accuracy. In fact, for all departing trains except for 2 and in spite of the modelling simplifications, it was possible to ensure the correct departure times with good accuracy (to within minutes) given the correct arrival times. This shows that the timings and process flows are realistic. It was not possible however to match the outbound wagon numbers exactly train by train, since on some occasions the dispatchers made sorting decisions that are apparently irrational and probably due to verbally defined priorities and other constraints for which information was not available. This has led to wagons being left behind by some trains and having to be added to later trains.

We can conclude that the difference between accuracy of the current model and 100% accuracy lies in the modelling of human behaviour during dispatching day-to-day railway operation in marshalling yard and complex rules covering some special handlings of wagons (priority goods, humping restrictions, damaged wagons etc.). Simplifications of the simulation model within this project were focused mainly on special rules defining non-standard wagon handling. Trying to achieve a higher level of accuracy by modelling the adopted operational rules would lead to tight tailoring of the simulation model to fit the single case of marshalling yard Česká Třebová and thus reduce the flexibility of the model. Such an approach has been identified as a potential disadvantage at the current state of the research, since it would lengthen validation times enormously without any particular benefit with regard to the simulations being realistic enough for a successful demonstration phase.

In this respect, during the final phase of implementation of the decision support system with the optimization of resource utilization, it is recommended to extend the logic and algorithms in the optimization module to cover the most used operational rules but not the train-by-train priorities that might arise day to day.

Degraded operation in the marshalling yard has been simulated as well, and a concisely reported here although not necessary for validation purposes. For the proposed simulation scenarios, no real data were available. Therefore, it is hard to make any comparison with real degraded operation. As a part of work package 4, at least a comparison of executed simulation scenarios has been prepared, see following tables:

Comparison – departure delays of outbound trains (all other trains are running on time):

Day	Outbound train	Scenario 1 -Default Configuration	Scenario 2 - With Delays	Scenario 1 – Broken loco ZC1	Scenario 4 - Additional Trains
10.4. (Tuesday)	62015	0:07:18	0:07:18	0:07:18	0:07:18
11.4. (Wednesday)	60204	0:00:24	0:00:24	0:00:24	0:00:24
12.4. (Thursday)	62101	0:03:51	No delay	0:01:48	No delay
	62015	0:18:49	0:25:37	0:18:49	0:34:33
	62200	No delay	0:05:08	No delay	0:04:50

13.4. (Friday)	44727	0:09:01	0:19:04	0:09:00	0:14:22
	62013	0:09:57	No delay	0:09:56	0:20:14
	45711	No delay	No delay	No delay	0:00:37
	62200	0:02:41	0:02:41	0:02:41	0:17:33

Comparison of wagon count in outbound trains (without transit trains; differences are marked):

Day	Outbound train	Scenario 1 -Default Configuration	Scenario 2 - With Delays	Scenario 1 – Broken loco ZC1	Scenario 4 - Additional Trains
10.4. (Tuesday)	62017	3	3	3	3
	62015	9	9	9	9
	62200	4	4	4	4
	62222	3	3	3	3
	45310	34	34	34	34
	62224	5	5	5	5
11.4. (Wednesday)	45713	6	6	6	6
	44725	8	8	8	8
	60204	12	12	12	12
	62011	18	18	18	18
	45027	10	10	10	10
	62132	30	30	30	30
	83111	3	3	3	3
	62101	31	31	31	31
	45711	21	21	21	21
	44727	2	2	2	2
	60104	19	19	19	19
	62220	8	8	8	8
	62013	30	30	30	30
	62017	23	23	23	23
	62015	20	20	20	20
	62200	13	13	13	13
62222	11	11	11	11	
45310	27	27	27	27	
12.4. (Thursday)	44725	17	17	17	17
	60204	8	8	8	8
	45713	24	24	24	24
	83121	16	16	16	16
	62011	14	14	14	14
	59737	16	16	16	16
	45027	16	16	16	16
	62132	35	37	35	36
	44251	10	10	Not in operation	12
	62101	38	26	38	37
	44727	9	9	9	2
	62013	37	37	37	36
	62220	Not in operation			1
	45711	22	22	22	32
62017	16	28	16	21	

	62015	22	22	22	26
	62200	24	24	24	25
	47336	30	31	30	30
	45310	35	35	35	35
	62222	7	7	7	8
13.4. (Friday)	44725	15	15	15	22
	60204	21	22	21	25
	62134				43
	83037	8	8	8	8
	45713	34	34	34	34
	62011	33	33	33	33
	45027	1	1	1	1
	62132	36	35	37	24
	44251	22	22	27	22
	62101	24	24	24	24
	44727	14	14	14	14
	62013	37	37	37	43
	45711	29	29	29	29
	62017	14	14	14	14
	62015	11	11	11	11
	62200	19	19	19	25
	45310	27	27	27	27
62222	19	19	19	19	
14.4. (Saturday)	60204	26	26	26	26
	45713	31	31	31	31

3. Validation of yard model: Trieste

3.1. Field data: description and processing

A similar approach as in the first case study was used also for the Trieste yard, i.e. data were collected for each subsystem of the simulation model (resource, customer and control subsystem).

The first resource subsystem represents the railway infrastructure. The CAD data (DWG file format) with precise position of each trackage element (tracks, switches, signals, limits, building contours), was delivered by Adriafer. The geometry infrastructure model exactly represents the reality. Additional data like overhead catenary, overlaps behind main signals and speed limits were subsequently added.

The infrastructure model used for simulation includes the slope profile on the modelled part of the main line infrastructure. In the areas of Campo Marzio and in the port, there is no slope profile, because these parts are almost flat.

Regarding wagons, no data about real train compositions were available. This is not a critical lack since no sorting is performed and trains are only split in half. Therefore, three common wagon types were used in the simulation model, namely Sggmrss 80, Sggmrss 90, Sggmrss Twin, to create typical train compositions at arrival. Based on the number of wagons for each train, a model composition was created. For the cases in which the train length exceeded the track limits (useful track length) in Campo Marzio or in the port, the wagon type was replaced by a shorter one or the number of wagons was reduced to meet the track limits (see Annex B).

Similarly to the case study Česká Třebová, vehicle movement (train and shunting unit) was modelled utilizing continuous simulation employing differential equations. The computation takes into account engine power characteristics as well as parameters of the infrastructure the vehicle is moving on.

3.2. Simulation scenarios and outputs

In the early stages of the project, only data for a theoretical week of operation were available. The following data were included for each train:

- Arrival time
- Departure time
- Supposed time period for shunting into the port
- Supposed time period for shunting from the port
- Temporary parking (time period and place)

Unfortunately, the precision of time data is limited to 1 hour. Besides standard operation, some simulation scenarios with degraded operation were prepared. The following simulation scenarios were prepared within work package 4 as part of non-optimized simulation:

- **Scenario 0 – (basis reference scenario) – theoretical week operation**
This theoretical week of operations includes train arrival and departure, shunting operations between Campo Marzio and the port, transloading time in terminal, parking and train handling on Campo Marzio tracks.
- **Scenario 1a – Basis scenario with broken down shunting locomotive**

Comparing to basis scenario in this case one shunting locomotive was set out of order from Monday 23:00 till 11:00.

- **Scenario 1b – Basis scenario with broken down shunting locomotive**

This scenario is similar to previous one (scenario 1a). The solution of the problem with unavailable shunting locomotive is slightly different.

- **Scenario 2a – Basis scenario with additional trains**

In this case, 2 additional trains were added to the basis scenario.

- **Scenario 2b – Basis scenario with additional trains**

This scenario is similar to the previous one (scenario 2a). The solution of the problem with unavailable shunting locomotive is slightly different.

- **Scenario 3a – Basis scenario with broken down transloading track in terminal**

This degraded operation mode contains a broken-down transloading track in the terminal. The transloading track is out of order from Tuesday 00:00 till Friday 23:59:59.

- **Scenario 3b – Basis scenario with broken down transloading track in terminal**

This scenario is similar to the previous one (scenario 3a). The solution of the problem with unavailable transloading track is slightly different.

In February 2019, data from real operation were delivered. In order to be able to make a comparison of the simulation model with real operations, a new scenario was created (based on this data):

- **Scenario 4 – Real week operation**

This scenario is modelling the real operation from 4.2.2019 till 10.2.2019 (Monday – Sunday). For the warm-up phase, the starting situation of the model was prepared based on the real data from 2.3.2019 and 3.3.2019.

There was no time to develop further scenarios modelling degraded situations based on the data from real operation. As mentioned before, all these scenarios were based on theoretical week operation. This is not a large drawback however, since the theoretical week represents a possible realistic scenario. For validation purposes this issue was irrelevant since it is impossible to validate on the degraded scenarios anyway, due to unavailability of data in such relatively rare situations.

As a model simplification no shunting with damaged wagons or re-composition of trains is modelled.

For the model validation and comparison with real operations, the following evaluations were used:

- During simulation run
 - Observing process animation (position of train, current speed)
 - Current occupation of resources (tracks, shunting locomotives)
 - Processing of handling technologies (train service)
 - Log file with conflicts, train delays
- Post-simulation evaluations
 - Occupation and utilization of resources (tracks, shunting locomotives)
 - Waiting time for resources
 - Dwell time in the model
 - Movement dynamics

3.3. Comparison of simulation results with field data

The comparison of simulation results with field data was done only for the scenario modelling real operations in the week from 4.2.2019 till 10.2.2019. It was focused on train arrival, shunting movements to/from port and train departure from the modelled yard. It reflects the availability of the following data from real operation:

- Train arrival time
- Start of shunting to port
- End of shunting to port
- Start of shunting from port
- End of shunting from port
- Start of shunting to/from parking track
- End of shunting to/from parking track
- Train departure time

The detailed comparison data can be found in Annex B of this document.

3.4. Conclusions for the Trieste case

During modelling of railway operations in Campo Marzio and the adjacent port area, the main focus was given on handling the trains and their preparation for departure on time (modelling the real week operation). This goal was achieved by all trains – there is no delay on departure compared with the data from real week operation, and all the wagons entering were handled. This means the timings of the single operations taken from the site visits and real operation data were implemented correctly and provide a realistic picture of reality.

The model itself in fact respects the availability of a train for shunting to the port after train handling (service in Campo Marzio such as uncoupling the train locomotive, coupling the shunting locomotive, simple brake test before shunting etc.). In many cases, the shunting to the port is postponed due to the current situation in the respective terminal (e.g. occupation of transloading tracks). Integrating this time restriction (real start of shunting to port) made model creation and validation easier – real data predefined the time windows in the port for each train. This is valid also in the opposite direction (real start of shunting from port).

The strategy for temporary parking of train composition was taken over exactly as-is from real operation. When the parking tracks were not considered, in fact, the model would reveal capacity problems on different parts of the modelled railway infrastructure. This is another proof of simulation model validity.

The main difference between model and real operation is in the absence of shunting movements with small wagon groups due to damages, shortage/extension of train composition or transfer to another terminal. These movements are marginal with respect to the total, however not considering them the utilization of shunting locomotives could be smaller than in reality; there are no data for comparison to confirm this.

4. Compatibility with RailTopoModel

The evaluation of infrastructure model compatibility between Villon and RailTopoModel has not been executed within the frame of the project. The reason for this is that at the present time, no data representing railway infrastructure on the micro-level (2nd predefined aggregation level) for modelled or similar yards are accessible or even existent (to our knowledge).

Regarding the possibility of imports of railway infrastructure models defined using railML schemes (topology core of railML's scheme version 3 will be defined on the basis of RailTopoModel) into Villon's own data structures, we can state that this should not pose any technical problem in the future. Both models utilize similar infrastructure elements so presumably, the conversion should be possible.

5. Overall conclusions and recommendations

In order to determine the “correctness” of a model, the validation of the model is a crucial part of the development of yard simulations. There are no specific tests for validity that can easily be applied for modelling of marshalling yards. Every simulation project represents a unique challenge to model the current or future state of the simulated railway system.

The modelling of railway operation in case study Trieste is a little bit easier comparing to marshalling yard Česká Třebová. The trains in Trieste are handled as block trains, i.e. usually the train composition at arrival is the same as it is at the time of the departure. The main restriction for shunting trains into port are short tracks for transloading in two terminals. The decomposition of trains to two units and later coupling the units back together (to form a single train again) is a time-consuming process. Another complication in smooth port operation is the influence of railway operation on the network across Europe. Not all train compositions are returning back immediately after transloading in the port (caused by limited network capacity, operation time of destination container terminals, lack of goods for higher utilization rate of outbound train, delays in maritime transport etc.). Due to these facts, the temporary parking of train compositions in the port is required, which on the other hand is reducing trackage capacity and unnecessarily increasing the utilization of shunting locomotives.

In case of marshalling yard Česká Třebová, only a marginal number of trains are running as block trains. The wagons from inbound trains are mostly shunted over the hump to sorting tracks and later coupled into outbound trains (according to common direction/relation). The wagon counts in outbound trains vary from day to day. The yard dispatcher has to properly handle cases of exceeded or not-reached capacity of the available outbound trains scheduled in the timetable. For example, if the capacity of a group train is exceeded and the limits of train length/weight cannot be violated, then a prioritization of groups is required, otherwise it is not possible to create an acceptable group train.

The handling of block trains vs. handling of each single wagon is the main difference between both case study yards.

The validation of the non-optimized 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 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 described in this report.

6. References

- [1] Licciardello R. et al. "OptiYard Deliverable D3.1 - Definition of suitable simulation environment for real-time yard and network management in OptiYard", 31/01/2018.
- [2] Liu R. et al., "OptiYard Deliverable D3.2 Functional and Technical Specification for the OptiYard Simulation Environment", 26/06/2018.
- [3] Licciardello R. et al., "OptiYard Deliverable D4.1 Yard and network simulation model ", 26/06/2018.
- [4] Kavička, A., Klima, V., Adamko, N., 2007: Simulations of Transportation Logistic Systems utilizing Agent- Based Architecture. International Journal of Simulation Modelling 6 (1): 13-24
- [5] Simcon. 2018. Villon simulation tool. Simcon. Accessible on internet: < <http://www.simcon.sk/en/tools/villon>>

Annex A Comparison Simulation vs. Real data for marshalling yard Česká Třebová

The comparison in the following tables is split into three parts – “Train Arrival”, “Train sorting” and “Train departure”. A short explanation of the evaluations in each table follows.

Table - Train arrival

The model uses the same train numbers as in reality. Train arrival in the model happens a few minutes sooner, because the arrival time in the model represents the entry time (placing a train on a mainline track before the station – about 3 km before home signal). The difference between real arrival time and arrival time in the model is equal to the duration of train movement from mainline track to the reception yard or other track group of the MY. It depends on direction, from which the train has arrived (6 to 12 minutes). Number of wagons in trains in the model is identical to the number of wagons in trains from real operation data.

The left column of the table includes also detailed data about wagons in real inbound trains (handling restriction). The restriction to sort wagons over the hump (no humping) was not considered in the simulation model. All wagons were sorted over hump into the sorting yard.

Table - Train sorting

The second table compares the sorting of trains over the hump. Start time of sorting in reality and in the model is compared. The reason for time difference is unknown. It is assumed that some priority wagons were sorted first. Other reason could be that in the real operation, the process of sorting is starting not immediately after train preparation for sorting finishes (because of human factor). In the simulation model, processes are executed immediately when specified conditions are fulfilled (e.g. preceding activities are finished).

Further, the number of sorted wagons was compared. There is no difference between real operation and modelled operation – all incoming wagons in the model were sorted, even wagons with sorting restriction over the hump. In real operation, such wagons are separately shunted from inbound trains to outbound trains. In simulation model, there is no need to utilize shunting locomotive for transfer of wagons between two track groups in marshalling yard – all incoming wagons run directly over the hump to sorting tracks.

Column “Remark” indicates when the order of train sorting in simulation model was the same comparing to real operation and when it was different.

The train numbers “OR000x” are names for internal shunting units coupled in sorting track or other part of marshalling yard (maintenance depot, buffered empty wagons) and sorted over the hump. These internal shunting units are not included in simulation model (no data were available).

Table - Train departure

The last table compares the outbound trains in the simulation model with real trains. The meaning of departure time in the simulation model refers to the time of the train disappearing on the mainline track (model exit time). The departure time in real operation represents the start of movement from the marshalling yard towards the mainline. The time difference between these two times represents

the duration of train movement from the yard to the mainline exit track (different for each direction). In the simulation model, the trains start to move from the yard (departure sidings) based on the real data – departure time, but only the time of disappearing from model is saved into the simulation protocol for later evaluation (thus, the place of time measurement is different).

The evaluation of wagon count per outgoing train in the simulation model and its comparison with reality reveals the consequences of different sorting orders in the model. Logically, in the model, some outbound trains are leaving the marshalling yard with more and some trains with less wagons compared with real operations. To reach a 100% match, it would be necessary to have exactly same sorting order in the model.

The remarks in last column identify the train type. Only outbound trains are relevant for the comparison. The container trains appear in the part of infrastructure model which is not modelled in detail. The transit trains are stopping in the marshalling yard (depending on the capacity of the railway network), to uncouple/couple wagon groups or to change the train locomotive driver.

Train arrival

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon Difference	
Handling with wagons	Wagon count			Model		
10.04.18 12:27:00	19	10/04/2018 12:19	19	19	0	
058308	19	00:08		19		
Shunting without restriction	19					
10.04.18 12:29:00	19	10.04.2018 12:17:00	19	0	19	
044449	19	00:12		19		
No passing over hump	19					
10.04.18 12:32:00	25	10.04.2018 12:25:30	25	25	0	
060106	25	00:06		25		
Shunting without restriction	25					
10.04.18 12:46:00	19				Train was shunted to departure yard	
058308	19					
Shunting without restriction	19					
10.04.18 13:00:00	30	10.04.2018 12:53:00	30	30	0	
062012	30	00:07		30		
Shunting without restriction	30					
10.04.18 13:36:00	32	10.04.2018 13:29:00	32	26	6	
047334	32	00:07		32		
No passing over hump	6					
Shunting without restriction	10					
Shunting with hand brakes	16					
10.04.18 13:56:00	32	10/04/2018 13:44	32	32	0	
066011	32	00:12		32		
Shunting without restriction	32					
10.04.18 14:10:00	28	10.04.2018 13:58:00	28	28	0	
058941	28	00:12		28		
Shunting without restriction	28					
10.04.18 14:17:00	40	10.04.2018 14:10:30	40	0	40	
043207	40	00:06		40		
No fly shunting, no humping	40					
10.04.18 14:22:00	37	10.04.2018 14:10:00	37	37		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
060205	37	00:12		37	0	
Shunting without restriction	37					
10.04.18 14:30:00	49	10.04.2018 14:18:00	25	0	25	
040737	25	00:12		25		
No fly shunting, no humping	25					
058876	24	10.04.2018 14:23:30	24	24	0	
Shunting without restriction	24	00:06		24		
10.04.18 14:33:00	9	10.04.2018 14:16:30	9	8	1	
083125	9	00:16		9		
No fly shunting, no humping	1					
Shunting without restriction	8					
10.04.18 15:34:00	40	10.04.2018 15:27:30	40	0	40	
059037	40	00:06		40		
No fly shunting, no humping	40					
10.04.18 16:44:00	23	10.04.2018 16:32:00	23	0	23	
061023	23	00:12		23		
No fly shunting, no humping	23					
10.04.18 16:48:00	24	10.04.2018 16:41:00	24	0	24	
061032	24	00:07		24		
No fly shunting, no humping	24					
10.04.18 16:52:00	15	10.04.2018 16:44:00	15	15	0	
062014	15	00:08		15		
Shunting without restriction	15					
10.04.18 17:27:00	19	10.04.2018 17:15:00	19	19	0	
058995	19	00:12		19		
Shunting without restriction	19					
10.04.18 18:47:00	24	10.04.2018 18:40:30	24	14	0	Originally train with 24 wagons; 10 wagons were uncoupled
062130	24	00:06		14		
No fly shunting, no humping	6					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting without restriction	18					in reception yard
10.04.18 18:57:00	26	10.04.2018 18:45:00	26	21		
045313	26	00:12		26	5	
No fly shunting, no humping	5					
Shunting without restriction	11					
Shunting with hand brakes	10					
10.04.18 19:22:00	20	10.04.2018 19:15:30	20	20		
060802	20	00:06		20	0	
Shunting without restriction	20					
10.04.18 19:29:00	23	10.04.2018 19:22:30	23	23		
058960	23	00:06		23	0	
Shunting without restriction	23					
10.04.18 19:42:00	10	10.04.2018 18:40:30	10			This is a wagon group of 10 wagons, uncoupled from inbound train with 24 wagons
062130	10					
No fly shunting, no humping	1					
Shunting without restriction	9					
10.04.18 20:13:00	28	10.04.2018 20:06:30	28	28		
058976	28	00:06		28	0	
Shunting without restriction	28					
10.04.18 20:42:00	20	10.04.2018 20:30:00	20	20		
054631	20	00:12		20	0	
Shunting without restriction	20					
10.04.18 21:56:00	17	10.04.2018 21:44:00	17	16		
049415	17	00:12		17	1	
No fly shunting, no humping	1					
Shunting without restriction	14					
Shunting with hand brakes	2					
10.04.18 22:10:00	21	10.04.2018 21:58:00	21	21		
060401	21	00:12		21	0	

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting without restriction	21					
10.04.18 22:26:00	24	10.04.2018 22:19:30	24	10	14	
045732	24	00:06		24		
No fly shunting, no humping	9					
No passing over hump	5					
Shunting without restriction	7					
Shunting with hand brakes	2					
Shunting with hand brakes	1					
10.04.18 22:27:00	6	10.04.2018 22:20:30	6	1	5	
060050	6	00:06		6		
No passing over hump	5					
Shunting without restriction	1					
10.04.18 22:28:00	24	10.04.2018 22:16:00	24	24	0	
064701	24	00:12		24		
Shunting without restriction	24					
10.04.18 22:38:00	32	10.04.2018 22:31:00	32	30	2	
062131	32	00:07		32		
No fly shunting, no humping	2					
Shunting without restriction	24					
Shunting with hand brakes	2					
Shunting with hand brakes	4					
10.04.18 22:46:00	25	10.04.2018 22:34:00	25	0	25	
041753	25	00:12		25		
No fly shunting, no humping	25					
10.04.18 23:13:00	5	10.04.2018 23:01:00	5	0	5	
060051	5	00:12		5		
No passing over hump	5					
10.04.18 23:19:00	4	10.04.2018 23:12:30	4	0	4	
060052	4	00:06		4		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
No passing over hump	4					
10.04.18 23:34:00	7	10.04.2018 23:26:00	7	7		
041328	7	00:08		7	0	
Shunting without restriction	7					
10.04.18 23:40:00	12	10.04.2018 23:33:30	12	0		
056504	12	00:06		12	12	
No fly shunting, no humping	12					
10.04.18 23:56:00	20	10.04.2018 23:48:00	20	20		
048304	20	00:08		20	0	
Shunting without restriction	19					
Shunting with hand brakes	1					
11.04.18 00:01:00	21	10.04.2018 23:54:30	21	17		
060206	21	00:06		21	4	
No fly shunting, no humping	4					
Shunting without restriction	16					
Shunting with hand brakes	1					
11.04.18 00:09:00	18	11.04.2018 00:01:00	18	0		
041364	18	00:08		18	18	
No fly shunting, no humping	18					
11.04.18 00:11:00	24	10.04.2018 23:59:00	24	23		
058613	24	00:12		24	1	
No passing over hump	1					
Shunting without restriction	23					
11.04.18 00:27:00	25					Contrainner train
061030	25					
No fly shunting, no humping	25					
11.04.18 00:33:00	2	11.04.2018 00:25:00	2	2		
062016	2	00:08		2	0	
Shunting without restriction	2					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
11.04.18 00:45:00	7	11.04.2018 00:38:30	7	7		
060202	7	00:06		7	0	
Shunting without restriction	7					
11.04.18 00:57:00	40	11.04.2018 00:50:30	40	0		
059448	40	00:06		40	40	
No fly shunting, no humping	40					
11.04.18 01:07:00	15	11.04.2018 01:00:30	15	10		
060100	15	00:06		15	5	
No fly shunting, no humping	5					
Shunting without restriction	7					
Shunting with hand brakes	1					
Shunting with hand brakes	2					
11.04.18 01:10:00	12	11.04.2018 01:03:30	12	0		
060054	12	00:06		12	12	
No fly shunting, no humping	5					
No passing over hump	7					
11.04.18 01:58:00	24	11.04.2018 01:51:30	24	0		
061010	24	00:06		24	24	
No fly shunting, no humping	23					
No passing over hump	1					
11.04.18 02:08:00	10	11.04.2018 01:56:00	10	9		
060203	10	00:12		10	1	
No fly shunting, no humping	1					
Shunting without restriction	9					
11.04.18 02:30:00	19	11.04.2018 02:23:30	19	1		
060102	19	00:06		19	18	
No fly shunting, no humping	17					
No passing over hump	1					
Shunting without restriction	1					
11.04.18 02:50:00	22	11.04.2018 02:43:30	22	22		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
059414	22	00:06		22	0	
Shunting without restriction	22					
11.04.18 03:19:00	13	11.04.2018 03:12:00	13	10	3	
062010	13	00:07		13		
No passing over hump	3					
Shunting without restriction	9					
Shunting with hand brakes	1					
11.04.18 03:30:00	20	11.04.2018 03:18:00	20	20	0	
062201	20	00:12		20		
Shunting without restriction	19					
Shunting with hand brakes	1					
11.04.18 03:36:00	17	11.04.2018 03:29:30	17	14	3	
060400	17	00:06		17		
No fly shunting, no humping	3					
Shunting without restriction	14					
11.04.18 03:56:00	17	11.04.2018 03:44:00	17	17	0	
049416	17	00:12		17		
Shunting without restriction	17					
11.04.18 04:02:00	26	11.04.2018 03:50:00	26	2	24	
061021	26	00:12		26		
No fly shunting, no humping	24					
Shunting without restriction	2					
11.04.18 04:34:00	23	11.04.2018 04:22:00	23	23	0	
045315	23	00:12		23		
Shunting without restriction	23					
11.04.18 04:58:00	27	11.04.2018 04:46:00	27	27	0	
062227	27	00:12		27		
Shunting without restriction	26					
Shunting with hand brakes	1					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
11.04.18 06:13:00	18	11.04.2018 06:06:30	18	18		
059424	18	00:06		18	0	
Shunting with hand brakes	18					
11.04.18 06:17:00	30	11.04.2018 06:05:00	30	27		3
062133	30	00:12		30		
No fly shunting, no humping	1					
No passing over hump	2					
Shunting without restriction	26					
Shunting with hand brakes	1					
11.04.18 06:47:00	30	11.04.2018 06:38:30	30	30		0
062102	30	00:08		30		
Shunting without restriction	25					
Shunting with hand brakes	2					
Shunting with hand brakes	3					
11.04.18 06:54:00	24	11.04.2018 06:46:00	24	0		24
043700	24	00:08		24		
No fly shunting, no humping	24					
11.04.18 09:15:00	21	11.04.2018 09:08:30	21	0		21
059532	21	00:06		21		
No fly shunting, no humping	21					
11.04.18 09:29:00	21					Shunted to departure yard
059532	21					
No fly shunting, no humping	21					
11.04.18 09:41:00	20	11.04.2018 09:29:00	20	20		0
048305	20	00:12		20		
Shunting without restriction	20					
11.04.18 10:59:00	15	11/04/2018 10:52	15	4		11
060106	15	00:06		15		
No fly shunting, no humping	11					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting without restriction	4					
11.04.18 11:05:00	24	11.04.2018 10:56:30	24	23		
062100	24	00:08		24	1	
No fly shunting, no humping	1					
Shunting without restriction	23					
11.04.18 11:07:00	15	11.04.2018 10:59:30	15	4		
060106	15	00:07		15	11	
No fly shunting, no humping	11					
Shunting without restriction	4					
11.04.18 11:30:00	22	11.04.2018 11:18:00	22	22		
059421	22	00:12		22	0	
Shunting with hand brakes	22					
11.04.18 12:13:00	13	11.04.2018 12:06:00	13	0		
064000	13	00:07		13	13	
No fly shunting, no humping	13					
11.04.18 12:29:00	17	11.04.2018 12:17:00	17	17		
059640	17	00:12		17	0	
Shunting without restriction	17					
11.04.18 12:46:00	28	11.04.2018 12:39:30	28	28		
066010	28	00:06		28	0	
Shunting without restriction	28					
11.04.18 13:15:00	20	11.04.2018 13:08:30	20	0		
048358	20	00:06		20	20	
No fly shunting, no humping	20					
11.04.18 13:36:00	20					Shunted to departure yard
048358	20					
No fly shunting, no humping	20					
11.04.18 13:48:00	40	11.04.2018 13:36:00	40	0		
043204	40	00:12		40	40	

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
No fly shunting, no humping	40					
11.04.18 14:19:00	31	11.04.2018 14:10:00	31	31		
060205	31	00:09		31	0	
Shunting without restriction	31					
11.04.18 14:26:00	20	11.04.2018 14:14:00	20	20		
044449	20	00:12		20	0	
Shunting without restriction	20					
11.04.18 14:31:00	30	11.04.2018 14:24:00	30	28		
047334	30	00:07		30	2	
No passing over hump	2					
Shunting without restriction	16					
Shunting with hand brakes	12					
11.04.18 15:40:00	34	11.04.2018 15:33:00	34	24		
062012	34	00:07		34	10	
No fly shunting, no humping	2					
No passing over hump	8					
Shunting without restriction	24					
11.04.18 17:22:00	14	11.04.2018 17:10:00	14	14		
059944	14	00:12		14	0	
Shunting without restriction	14					
11.04.18 17:43:00	14	11.04.2018 17:36:00	14	14		
062014	14	00:07		14	0	
Shunting without restriction	13					
Shunting with hand brakes	1					
11.04.18 19:07:00	38	11.04.2018 18:58:30	38	4		
062130	38	00:08		4	0	
No fly shunting, no humping	5					
Shunting without restriction	33					38 wagons arrive; only 4 wagon are humped
11.04.18 19:23:00	26	11.04.2018 19:11:00	26	21		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
062131	26	00:12		26	5	
No fly shunting, no humping	5					
Shunting without restriction	21					
11.04.18 19:34:00	12	11.04.2018 19:27:00	12	11	1	
083200	12	00:07		12		
No fly shunting, no humping	1					
Shunting without restriction	11					
11.04.18 19:43:00	34					Rest of the wagons as tranzit
062130	34					
No fly shunting, no humping	1					
Shunting without restriction	33					38 wagons arrive; only 4 wagon are humped
11.04.18 19:54:00	25	11.04.2018 19:46:00	25	0	25	
041340	25	00:08		25		
No fly shunting, no humping	25					
11.04.18 20:22:00	5	11.04.2018 20:15:00	5	0	5	
044250	5	00:07		5		
No fly shunting, no humping	5					
11.04.18 21:44:00	34	11/04/2018 21:32	34	33	1	
054631	34	00:12		34		
No fly shunting, no humping	1					
Shunting without restriction	33					
11.04.18 22:12:00	38	11.04.2018 22:00:00	38	38	0	
059193	38	00:12		38		
Shunting without restriction	38					
11.04.18 22:23:00	6	11.04.2018 22:16:30	6	0	6	
060050	6	00:06		6		
No fly shunting, no humping	1					
No passing over hump	5					
11.04.18 22:26:00	18	11.04.2018 22:14:00	18	18		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
049415	18	00:12		18	0	
Shunting without restriction	16					
Shunting with hand brakes	2					
11.04.18 23:08:00	20	11.04.2018 23:00:00	20	20	0	
048304	20	00:08		20		
Shunting without restriction	20					
11.04.18 23:17:00	4	11.04.2018 23:10:30	4	0		
060052	4	00:06		4	4	
No passing over hump	4					
11.04.18 23:20:00	5	11.04.2018 23:08:00	5	0		
060051	5	00:12		5	5	
No passing over hump	5					
11.04.18 23:24:00	25	11.04.2018 23:17:30	25	0		
061030	25	00:06		25	25	
No fly shunting, no humping	25					
11.04.18 23:27:00	35	11.04.2018 23:18:30	25	25		
059718	25	00:08		25	0	
Shunting without restriction	25					
064001	10	11.04.2018 23:15:00	10	0		
No fly shunting, no humping	10	00:12		10	10	
11.04.18 23:54:00	8	11.04.2018 23:46:00	8	8		
041328	8	00:08		8	0	
Shunting without restriction	8					
12.04.18 00:16:00	35	12.04.2018 00:08:00	35	34		
060206	35	00:08		35	1	
No fly shunting, no humping	1					
Shunting without restriction	34					
12.04.18 00:34:00	2	12.04.2018 00:27:00	2	2		
062016	2	00:07		2	0	

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting without restriction	2					
12.04.18 00:36:00	14	12.04.2018 00:29:30	14	11	3	
060100	14	00:06		14		
No fly shunting, no humping	1					
No passing over hump	2					
Shunting without restriction	10					
Shunting with hand brakes	1					
12.04.18 00:45:00	17	12.04.2018 00:37:00	17	0	17	
041364	17	00:08		17		
No fly shunting, no humping	17					
12.04.18 01:06:00	13	12.04.2018 00:59:30	13	9	4	
060054	13	00:06		13		
No passing over hump	4					
Shunting without restriction	9					
12.04.18 01:23:00	25	12.04.2018 01:16:30	25	5	20	
061010	25	00:06		25		
No fly shunting, no humping	20					
Shunting without restriction	5					
12.04.18 01:28:00	32	12.04.2018 01:21:30	32	32	0	
066010	32	00:06		32		
Shunting without restriction	32					
12.04.18 01:58:00	25	12/04/2018 01:51	25	23	2	
045732	25	00:06		25		
No fly shunting, no humping	2					
Shunting without restriction	20					
Shunting with hand brakes	1					
Shunting with hand brakes	2					
12.04.18 02:00:00	14	12.04.2018 01:53:30	14	8	6	
060202	14	00:06		14		
No fly shunting, no humping	5					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
No passing over hump	1					
Shunting without restriction	8					
12.04.18 02:08:00	8	12.04.2018 01:56:00	8	6		
060203	8	00:12		8	2	
No fly shunting, no humping	1					
No passing over hump	1					
Shunting without restriction	6					
12.04.18 02:12:00	20	12.04.2018 02:00:00	20	20		
068207	20	00:12		20	0	
Shunting without restriction	20					
12.04.18 02:36:00	29	12.04.2018 02:24:00	29	12		
059754	29	00:12		29	17	
No fly shunting, no humping	1					
No passing over hump	16					
Shunting without restriction	12					
12.04.18 02:42:00	14	12.04.2018 02:30:00	14	14		
049416	14	00:12		14	0	
Shunting without restriction	14					
12.04.18 02:44:00	20	12.04.2018 02:37:30	20	20		
052026	20	00:06		20	0	
Shunting without restriction	20					
12.04.18 02:54:00	20					Shunted to departure yard
052026	20					
Shunting without restriction	20					
12.04.18 03:08:00	22	12.04.2018 03:01:30	22	19		
060102	22	00:06		22	3	
No fly shunting, no humping	1					
No passing over hump	2					
Shunting without restriction	19					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
12.04.18 03:09:00	38	12.04.2018 02:57:00	38	38		
062201	38	00:12		38	0	
Shunting without restriction	37					
Shunting with hand brakes	1					
12.04.18 03:13:00	32	12.04.2018 03:06:00	32	31		
062010	32	00:07		32	1	
No fly shunting, no humping	1					
Shunting without restriction	31					
12.04.18 03:21:00	21	12.04.2018 03:09:00	21	0		
055925	21	00:12		21	21	
No fly shunting, no humping	21					
12.04.18 03:32:00	19	12.04.2018 03:25:30	19	0		
044448	19	00:06		19	19	
No passing over hump	19					
12.04.18 03:40:00	19					Shunted to departure yard
044448	19					
No passing over hump	19					
12.04.18 03:57:00	26	12.04.2018 03:45:00	26	0		
061021	26	00:12		26	26	
No fly shunting, no humping	26					
12.04.18 04:01:00	30	12.04.2018 03:49:00	30	30		
062133	30	00:12		30	0	
Shunting without restriction	29					
Shunting with hand brakes	1					
12.04.18 04:15:00	40	12.04.2018 04:03:00	40	0		
043206	40	00:12		40	40	
No fly shunting, no humping	40					
12.04.18 04:28:00	19	12.04.2018 04:16:00	19	19		
062227	19	00:12		19	0	

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting without restriction	19					
12.04.18 04:50:00	22	12.04.2018 04:43:30	22	21		
060400	22	00:06		22	1	
No fly shunting, no humping	1					
Shunting without restriction	21					
12.04.18 05:23:00	8	12.04.2018 05:11:00	8	8		
041327	8	00:12		8	0	
Shunting without restriction	8					
12.04.18 06:14:00	24	12.04.2018 06:07:00	24	24		
064700	24	00:07		24	0	
Shunting without restriction	24					
12.04.18 06:28:00	24					Shunted to departure yard
064700	24					
Shunting without restriction	24					
12.04.18 08:01:00	25	12.04.2018 07:53:00	25	0		
043700	25	00:08		25	25	
No fly shunting, no humping	25					
12.04.18 08:27:00	20	12.04.2018 08:15:00	20	20		
059760	20	00:12		20	0	
Shunting without restriction	20					
12.04.18 09:07:00	55	12.04.2018 08:59:00	25	0		
040736	25	00:08		25	25	
No fly shunting, no humping	2					
No passing over hump	23					
048739	30	12.04.2018 08:55:00	30	30		
Shunting without restriction	30	00:12		30	0	
12.04.18 09:14:00	15	12.04.2018 09:07:00	15	0		
064000	15	00:07		15	15	
No fly shunting, no humping	15					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
12.04.18 09:16:00	25	12.04.2018 08:59:00	25	0		
040736	25	00:17		25	25	
No fly shunting, no humping	2					
No passing over hump	23					
12.04.18 09:33:00	15					Shunted to departure yard
064000	15					
No fly shunting, no humping	15					
12.04.18 10:28:00	26	12.04.2018 10:19:30	26	18		
062102	26	00:08		26	8	
No fly shunting, no humping	8					
Shunting without restriction	15					
Shunting with hand brakes	3					
12.04.18 11:56:00	20	12.04.2018 11:47:30	20	20		
062100	20	00:08		20	0	
Shunting without restriction	20					
12.04.18 12:47:00	23	12.04.2018 12:40:00	23	17		
062012	23	00:07		23	6	
No fly shunting, no humping	6					
Shunting without restriction	16					
Shunting with hand brakes	1					
12.04.18 13:00:00	18	12.04.2018 12:53:30	18	14		
060106	18	00:06		18	4	
No fly shunting, no humping	4					
Shunting without restriction	13					
Shunting with hand brakes	1					
12.04.18 14:03:00	33	12.04.2018 13:51:00	33	33		
060205	33	00:12		33	0	
Shunting without restriction	32					
Shunting with hand brakes	1					
12.04.18 14:26:00	25	12.04.2018 14:14:00	25	0		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
041751	25	00:12		25	25	
No fly shunting, no humping	25					
12.04.18 14:36:00	10	12.04.2018 14:27:30	10	6	4	
083125	10	00:08		10		
No fly shunting, no humping	4					
Shunting without restriction	6					
12.04.18 14:42:00	19	12.04.2018 14:30:00	19	0	19	
052265	19	00:12		19		
No passing over hump	19					
12.04.18 16:24:00	17	12.04.2018 16:12:00	17	17	0	
052527	17	00:12		17		
Shunting without restriction	17					
12.04.18 16:30:00	41	12.04.2018 16:18:00	41	0	41	
043204	41	00:12		41		
No fly shunting, no humping	41					
12.04.18 16:34:00	9	12.04.2018 16:27:00	9	5	4	
062014	9	00:07		9		
No fly shunting, no humping	3					
No passing over hump	1					
Shunting without restriction	4					
Shunting with hand brakes	1					
12.04.18 17:05:00	25	12.04.2018 16:58:30	25	25	0	
052282	25	00:06		25		
Shunting without restriction	25					
12.04.18 17:27:00	34	12.04.2018 17:15:00	34	24	10	
062221	34	00:12		34		
No fly shunting, no humping	10					
Shunting without restriction	24					
12.04.18 17:32:00	23	12.04.2018 17:25:30	23	0		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
052446	23	00:06		23	23	
No fly shunting, no humping	22					
No passing over hump	1					
12.04.18 17:59:00	37	12.04.2018 17:50:30	37	37		37 arrive and 32 wagons are humped
062130	37			32	5	
Shunting without restriction	37					
12.04.18 18:12:00	23	12.04.2018 18:05:30	23	0		
052446	23	00:06		23	23	
No fly shunting, no humping	22					
No passing over hump	1					
12.04.18 18:19:00	20	12.04.2018 18:07:00	20	18		
062131	20	00:12		20	2	
No fly shunting, no humping	2					
Shunting without restriction	18					
12.04.18 18:20:00	5					5 wagons as transit
062130	5					
Shunting without restriction	5					
12.04.18 19:01:00	18	12.04.2018 18:49:00	18	0		
041365	18	00:12		18	18	
No fly shunting, no humping	18					
12.04.18 19:09:00	22					
052161	22					
Shunting with hand brakes	22					This train is not modelled, because it was parked. And no further data are available about the processing.
12.04.18 20:36:00	30	12.04.2018 20:24:00	30	30		
045313	30	00:12		30	0	
Shunting without restriction	22					
Shunting with hand brakes	2					
Shunting with hand brakes	6					
12.04.18 20:40:00	8	12.04.2018 20:28:00	8	8		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
054631	8	00:12		8	0	
Shunting without restriction	8					
12.04.18 20:52:00	19	12.04.2018 20:44:00	19	0	19	
059744	19	00:08		19		
No passing over hump	19					
12.04.18 21:00:00	19					Transit
059744	19					
No passing over hump	19					
12.04.18 22:05:00	18	12.04.2018 21:53:00	18	18	0	
049415	18	00:12		18		
Shunting without restriction	18					
12.04.18 22:13:00	20	12.04.2018 22:05:00	20	20	0	
048304	20	00:08		20		
Shunting without restriction	19					
Shunting with hand brakes	1					
12.04.18 22:46:00	5	12.04.2018 22:39:30	5	0	5	
060050	5	00:06		5		
No passing over hump	5					
12.04.18 23:12:00	5	12.04.2018 23:00:00	5	0	5	
060051	5	00:12		5		
No passing over hump	5					
12.04.18 23:27:00	26	12.04.2018 23:20:30	26	0	26	
061030	26	00:06		26		
No fly shunting, no humping	26					
12.04.18 23:28:00	10	12.04.2018 23:20:00	10	10	0	
041328	10	00:08		10		
Shunting without restriction	10					
12.04.18 23:34:00	4	12.04.2018 23:27:30	4	0	4	
060052	4	00:06		4		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
No passing over hump	4					
12.04.18 23:42:00	18	12.04.2018 23:34:00	18	0		
041364	18	00:08		18	18	
No fly shunting, no humping	18					
13.04.18 00:09:00	26	13.04.2018 00:01:00	26	20		
060206	26	00:08		26	6	
No fly shunting, no humping	6					
Shunting without restriction	17					
Shunting with hand brakes	3					
13.04.18 00:15:00	19	13.04.2018 00:09:30	19	0		
044448	19	00:05		19	19	
No passing over hump	19					
13.04.18 00:18:00	22	13.04.2018 00:09:30	22	22		
065520	22	00:08		22	0	
Shunting with hand brakes	22					
13.04.18 00:25:00	25	13.04.2018 00:18:30	25	21		
060100	25	00:06		25	4	
No fly shunting, no humping	4					
Shunting without restriction	8					
Shunting with hand brakes	13					
13.04.18 00:34:00	9					Transit
060206	9					
Shunting without restriction	6					
Shunting with hand brakes	3					
13.04.18 00:37:00	4	13.04.2018 00:25:00	4	2		
060053	4	00:12		4	2	
No passing over hump	2					
Shunting without restriction	2					
13.04.18 00:55:00	5	13.04.2018 00:46:30	5	5		

Real arrival time	Wagon count	Model entry time	Wagons in	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference	model	Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
059684	5	00:08		5	0	
Shunting without restriction	5					
13.04.18 00:58:00	5	13.04.2018 00:46:00	5	3	2	
060203	5	00:12		5		
No fly shunting, no humping	2					
Shunting without restriction	3					
13.04.18 01:05:00	5					Shunted to departure yard
059684	5					
Shunting without restriction	5					
13.04.18 01:08:00	30	13.04.2018 00:56:00	30	30	0	
066011	30	00:12		30		
Shunting without restriction	30					
13.04.18 01:09:00	35	13.04.2018 01:02:30	35	35	0	
052104	35	00:06		35		
Shunting without restriction	35					
13.04.18 01:14:00	7	13.04.2018 01:07:30	7	5	2	
060202	7	00:06		7		
No fly shunting, no humping	2					
Shunting without restriction	5					
13.04.18 01:21:00	14	13.04.2018 01:14:30	14	0	14	
041700	14	00:06		14		
No fly shunting, no humping	14					
13.04.18 01:25:00	9	13.04.2018 01:18:00	9	9	0	
062016	9	00:07		9		
Shunting without restriction	9					
13.04.18 01:44:00	12	13.04.2018 01:37:30	12	0	12	
060102	12	00:06		12		
No fly shunting, no humping	12					
13.04.18 02:05:00	18	13.04.2018 01:58:30	18	18		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
052768	18	00:06		18	0	
Shunting without restriction	18					
13.04.18 02:31:00	8	13.04.2018 02:19:00	8	1	7	
060105	8	00:12		8		
No fly shunting, no humping	7					
Shunting without restriction	1					
13.04.18 03:25:00	25	13.04.2018 03:19:00	25	1	24	
061021	25	00:06		25		
No fly shunting, no humping	24					
Shunting without restriction	1					
13.04.18 03:40:00	18	13.04.2018 03:33:30	18	15	3	
060400	18	00:06		18		
No fly shunting, no humping	3					
Shunting without restriction	15					
13.04.18 03:47:00	18					Shunted to departure yard
060400	18					
No fly shunting, no humping	3					
Shunting without restriction	15					
13.04.18 03:50:00	16	13.04.2018 03:38:00	16	11	5	
060055	16	00:12		16		
No fly shunting, no humping	1					
No passing over hump	4					
Shunting without restriction	11					
13.04.18 03:51:00	24	13.04.2018 03:39:00	24	24	0	
062201	24	00:12		24		
Shunting without restriction	23					
Shunting with hand brakes	1					
13.04.18 04:34:00	31	13.04.2018 04:22:00	31	31	0	
062133	31	00:12		31		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting without restriction	31					
13.04.18 04:37:00	12	13.04.2018 04:30:00	12	4	8	
062010	12	00:07		12		
No fly shunting, no humping	7					
No passing over hump	1					
Shunting without restriction	4					
13.04.18 04:44:00	18	13.04.2018 04:32:00	18	18	0	
052907	18	00:12		18		
Shunting without restriction	18					
13.04.18 05:05:00	19	13.04.2018 04:53:00	19	19	0	
062227	19	00:12		19		
Shunting without restriction	18					
Shunting with hand brakes	1					
13.04.18 05:41:00	28	13/04/2018 05:34	28	28	0	
066010	28	00:06		28		
Shunting without restriction	28					
13.04.18 05:49:00	28	presun do OS				
066010	28					
Shunting without restriction	28					
13.04.18 07:07:00	10	13.04.2018 06:55:00	10	10	0	
041327	10	00:12		10		
Shunting without restriction	10					
13.04.18 08:31:00	24	13.04.2018 08:23:00	24	0	24	
043700	24	00:08		24		
No fly shunting, no humping	24					
13.04.18 08:44:00	31	13.04.2018 08:35:30	31	30	1	
062102	31	00:08		31		
No fly shunting, no humping	1					
Shunting without restriction	29					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting with hand brakes	1					
13.04.18 09:26:00	36	13/04/2018 09:14	36	36		
045315	36	00:12		36	0	
Shunting without restriction	23					
Shunting with hand brakes	13					
13.04.18 09:33:00	16	13.04.2018 09:21:00	16	16		
048739	16	00:12		16	0	
Shunting without restriction	16					
13.04.18 09:49:00	14	13.04.2018 09:42:00	14	3		
064000	14	00:07		14	11	
No fly shunting, no humping	11					
Shunting without restriction	3					
13.04.18 11:59:00	27	13.04.2018 11:50:30	27	19		
062100	27	00:08		27	8	
No fly shunting, no humping	7					
No passing over hump	1					
Shunting without restriction	19					
13.04.18 12:37:00	30	13.04.2018 12:30:00	30	19		
062012	30	00:07		30	11	
No fly shunting, no humping	11					
Shunting without restriction	3					
Shunting with hand brakes	16					
13.04.18 12:59:00	23	13.04.2018 12:52:30	23	18		
060106	23	00:06		23	5	
No fly shunting, no humping	5					
Shunting without restriction	15					
Shunting with hand brakes	3					
13.04.18 13:39:00	26	13.04.2018 13:32:00	26	26		
047334	26	00:07		26	0	
Shunting without restriction	17					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting with hand brakes	9					
13.04.18 14:27:00	28	13.04.2018 14:15:00	28	26		
060205	28	00:12		28	2	
No passing over hump	2					
Shunting without restriction	26					
13.04.18 14:37:00	21	13.04.2018 14:30:30	21	18		
045732	21	00:06		21	3	
No fly shunting, no humping	3					
Shunting without restriction	17					
Shunting with hand brakes	1					
13.04.18 14:48:00	26	13.04.2018 14:41:30	26	17		
045730	26	00:06		26	9	
No fly shunting, no humping	1					
No passing over hump	8					
Shunting without restriction	14					
Shunting with hand brakes	3					
13.04.18 15:08:00	26	13.04.2018 15:01:30	26	26		
047330	26	00:06		26	0	
Shunting without restriction	26					
13.04.18 15:09:00	41	13.04.2018 14:57:00	41	0		
043204	41	00:12		41	41	
No fly shunting, no humping	41					
13.04.18 15:15:00	26					Shunted to departure yard
047330	26					
Shunting without restriction	26					
13.04.18 15:31:00	20	13.04.2018 15:24:30	20	20		
053130	20	00:06		20	0	
Shunting without restriction	20					
13.04.18 15:35:00	17	13.04.2018 15:28:30	17	17		

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
053010	17	00:06		17	0	
Shunting without restriction	17					
13.04.18 16:37:00	17	13.04.2018 16:30:30	17	14	3	
060402	17	00:06		17		
No fly shunting, no humping	3					
Shunting without restriction	14					
13.04.18 16:38:00	17	13.04.2018 16:26:00	17	15	2	
062131	17	00:12		17		
No fly shunting, no humping	1					
No passing over hump	1					
Shunting without restriction	9					
Shunting with hand brakes	6					
13.04.18 16:40:00	5	13.04.2018 16:33:00	5	4	1	
062014	5	00:07		5		
No fly shunting, no humping	1					
Shunting without restriction	4					
13.04.18 16:42:00	18	13.04.2018 16:30:00	18	1	17	
041365	18	00:12		18		
No fly shunting, no humping	17					
Shunting without restriction	1					
13.04.18 16:44:00	25	13.04.2018 16:32:00	25	0	25	
041807	25	00:12		25		
No fly shunting, no humping	25					
13.04.18 17:12:00	8	13.04.2018 17:00:00	8	8	0	
044250	8	00:12		8		
Shunting without restriction	8					
13.04.18 18:35:00	16	13.04.2018 18:27:00	16	16	0	
052538	16	00:08		16		
Shunting without restriction	16					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
13.04.18 18:42:00	19	13.04.2018 18:34:00	19	19		
052988	19	00:08		19	0	
Shunting without restriction	19					
13.04.18 18:46:00	1	13.04.2018 18:34:00	1	1		
054631	1	00:12		1	0	
Shunting without restriction	1					
13.04.18 18:50:00	19					Shunted to departure yard
052988	19					
Shunting without restriction	19					
13.04.18 19:03:00	29	13.04.2018 18:54:30	29	17		29 wagons arrive;
062130	29			20	3	20 wagons are uncoupled and humped
No fly shunting, no humping	3					
Shunting without restriction	23					
Shunting with hand brakes	3					
13.04.18 19:54:00	10	13.04.2018 19:47:00	10	9		
083200	10	00:07		10	1	3 waggons were added (shutend) to this group and 13 waggons were humped
No fly shunting, no humping	1					
Shunting without restriction	9					
13.04.18 20:39:00	9					Transit
062130	9					29 wagons arrive;
Shunting without restriction	6					20 wagons are uncoupled and humped
Shunting with hand brakes	3					
13.04.18 21:01:00	25	13.04.2018 20:53:00	25	0		
041752	25	00:08		25	25	
No fly shunting, no humping	25					
13.04.18 22:15:00	18	13.04.2018 22:03:00	18	17		
049415	18	00:12		18	1	
No fly shunting, no humping	1					
Shunting without restriction	16					

Real arrival time	Wagon count	Model entry time	Wagons in model	Sorted wagons	Real vs. Model	Remark
Train number	Wagon count	Difference		Real	Wagon	
Handling with wagons	Wagon count			Model	Difference	
Shunting with hand brakes	1					
13.04.18 22:38:00	6	13.04.2018 22:31:30	6	1	5	
060050	6	00:06		6		
No passing over hump	5					
Shunting without restriction	1					
13.04.18 22:55:00	24	13.04.2018 22:43:00	24	24	0	
064701	24	00:12		24		
Shunting without restriction	24					
13.04.18 22:56:00	8	13.04.2018 22:48:00	8	4	4	
041328	8	00:08		8		
No fly shunting, no humping	4					
Shunting without restriction	4					
13.04.18 23:02:00	20	13.04.2018 22:54:00	20	20	0	
048304	20	00:08		20		
Shunting without restriction	20					
13.04.18 23:12:00	7	13.04.2018 23:00:00	4	0	4	
060051	4	00:12		4		
No passing over hump	4					
060052	3	13.04.2018 23:05:30	3	0		
No passing over hump	3	00:06		3	3	
13.04.18 23:31:00	27	13.04.2018 23:24:30	27	0	27	
061030	27	00:06		27		
No fly shunting, no humping	26					
No passing over hump	1					

Train sorting

Real sorting start Train number	Wagon count Wagon count	Simulation sorting start Time difference	Sorted wagons		Earlier/ later in model	Remark
			Real Model	Sorted Wagons Difference		
10/4/18 13:33	30	10. 4. 2018 14:39:59	30	30		
062012	30	1:06	30	0	Earlier	
10/4/18 15:06	32	10.4.2018 15:51:13	32	32		
047334	32	0:45	32	0	Later	
10/4/18 15:36	37	10. 4. 2018 17:33:27	37	37		
060205	37	1:57	37	0	Later	
10/4/18 16:06	4					
OR0002	4					Internal train
10/4/18 19:05	15	10.4.2018 18:25:43	15	15		
062014	15	0:39	15	0	Earlier	
10/4/18 19:21	12					
OR0003	12					
10/4/18 19:36	14	10. 4. 2018 21:02:25	14	14		
062130	14	1:26	14	0	Later	
10/4/18 21:39	9	10.4.2018 18:12:31	9	9		
083125	9	3:26	9	0	Earlier	
10/4/18 21:50	26	10. 4. 2018 20:48:14	26	26		
045313	26	1:01	26	0	Earlier	
10/4/18 21:51	20	10.4.2018 21:51:59	20	20		From here same order (incl. 54631)
054631	20	0:00	20	0		
11/4/18 0:15	24	10.4.2018 23:55:32	24	24		
045732	24	0:19	24	0	Earlier	
11/4/18 0:22	6					
OR0004	6					Internal train
11/4/18 0:59	32	11.4.2018 1:03:19	32	32		
062131	32	0:04	32	0	Later	
11/4/18 1:24	21	11. 4. 2018 1:50:05	21	21		
060206	21	0:26	21	0	Later	

Real sorting start Train number	Wagon count Wagon count	Simulation sorting start Time difference	Sorted wagons		Earlier/ later in model	Remark
			Real Model	Sorted Wagons Difference		
11/4/18 1:26	2	11. 4. 2018 2:00:14	2	2		
062016	2	0:34	2	0	Later	
11/4/18 4:13	13	11.4.2018 4:16:47	13	13		
062010	13	0:03	13	0	Later	
11/4/18 4:44	20	11.4.2018 5:03:40	20	20		
062201	20	0:19	20	0	Later	End of same order (incl. this row)
11/4/18 7:21	27	11.4.2018 7:56:17	27	27		
062227	27	0:35	27	0	Later	
11/4/18 7:32	17	11.4.2018 5:36:34	17	17		
049416	17	1:55	17	0	Earlier	
11/4/18 7:51	23	11.4.2018 6:22:09	23	23		
045315	23	1:28	23	0	Earlier	
11/4/18 8:14	30	11.4.2018 8:23:23	30	30		
062133	30	0:09	30	0	Later	From here same order (incl. 62133)
11/4/18 8:42	30	11. 4. 2018 10:03:56	30	30		
062102	30	1:21	30	0	Later	
11/4/18 12:57	1					
OR0001	1					Internal train
11/4/18 13:16	24	11. 4. 2018 12:32:19	24	24		
062100	24	0:43	24	0	Earlier	
11/4/18 13:32	17	11.4.2018 13:34:35	17	17		
059640	17	0:02	17	0	Later	
11/4/18 15:57	1					
OR0002	1					Internal train
11/4/18 16:16	31	11.4.2018 15:58:58	31	31		
060205	31	0:17	31	0	Earlier	
11/4/18 16:35	30	11.4.2018 16:53:53	30	30		
047334	30	0:18	30	0	Later	
11/4/18 19:02	34	11. 4. 2018 18:19:08	34	34		

Real sorting start Train number	Wagon count Wagon count	Simulation sorting start Time difference	Sorted wagons		Earlier/ later in model	Remark
			Real Model	Sorted Wagons Difference		
062012	34	0:42	34	0	Earlier	End of same order (incl. this row)
11/4/18 19:17	14	11. 4. 2018 19:04:56	14			
062014	14	0:12	14	0	Earlier	
11/4/18 21:38	5	11. 4. 2018 21:41:28	5			
044250	5	0:03	5	0	Later	
11/4/18 21:53	26	11.4.2018 21:11:33	26			
062131	26	0:41	26	0	Earlier	
11/4/18 22:13	4	11.4.2018 20:08:20	4			
062130	4	2:04	4	0	Earlier	
11/4/18 22:20	12					
OR0004	12					Internal train
11/4/18 22:35	11	11.4.2018 21:23:52	11			Wagon Uy - no hump
083200	11	1:11	12	1	Earlier	Train with 12 wagons
11/4/18 22:47	1					
OR0003	1					Internal train
11/4/18 23:20	34	11.4.2018 23:34:31	34			
054631	34	0:14	34	0	Later	
11/4/18 23:34	14	11. 4. 2018 18:37:50	14			
059944	14	4:56	14	0	Earlier	
11/4/18 23:58	3					
1R0001	3					Internal train
12/4/18 1:22	2	12. 4. 2018 2:28:58	2			
062016	2	1:06	2	0	Later	
12/4/18 1:44	35	12.4.2018 2:18:39	35			
060206	35	0:34	35	0	Later	
12/4/18 4:17	29	12. 4. 2018 4:25:26	29			
059754	29	0:08	29	0	Later	
12/4/18 4:30	38	12. 4. 2018 6:50:55	38			
062201	38	2:20	38	0	Later	

Real sorting start Train number	Wagon count Wagon count	Simulation sorting start Time difference	Sorted wagons	Sorted Wagons Difference	Earlier/ later in model	Remark
			Real Model			
12/4/18 4:52	25	12. 4. 2018 3:44:08	25			
045732	25	1:07	25	0	Earlier	
12/4/18 6:54	19	12. 4. 2018 9:03:36	19			
062227	19	2:09	19	0	Later	
12/4/18 7:22	30	12. 4. 2018 8:13:50	30			
062133	30	0:51	30	0	Later	
12/4/18 7:48	32	12. 4. 2018 7:36:14	32			
062010	32	0:11	32	0	Earlier	
12/4/18 7:51	14	12.4.2018 5:06:29	14			
049416	14	2:44	14	0	Earlier	
12/4/18 12:28	26	12. 4. 2018 11:57:37	26			
062102	26	0:30	26	0	Earlier	From here same order (incl. 62102)
12/4/18 12:47	20	12.4.2018 13:15:23	20			
062100	20	0:28	20	0	Later	
12/4/18 13:43	23	12. 4. 2018 14:23:49	23			
062012	23	0:40	23	0	Later	
12/4/18 14:39	33	12. 4. 2018 16:00:54	33			
060205	33	1:21	33	0	Later	End of same order (incl. this row)
12/4/18 15:48	2					
OR0001	2					Internal train
12/4/18 19:06	20	12. 4. 2018 21:02:27	20			
062131	20	1:56	20	0	Later	
12/4/18 19:18	10	12. 4. 2018 16:13:27	10			
083125	10	3:04	10	0	Earlier	
12/4/18 19:30	32	12. 4. 2018 20:18:11	32			
062130	32	0:48	32	0	Later	
12/4/18 19:34	8					
OR0002	8					Internal train
12/4/18 19:58	34	12.4.2018 19:15:22	34			

Real sorting start Train number	Wagon count Wagon count	Simulation sorting start Time difference	Sorted wagons		Earlier/ later in model	Remark
			Real Model	Sorted Wagons Difference		
062221	34	0:42	34	0	Earlier	
12/4/18 20:16	9	12. 4. 2018 17:24:19	9			
062014	9	2:51	9	0	Earlier	
12/4/18 22:07	3					
OR0003	3					Internal train
12/4/18 22:44	30	12. 4. 2018 22:26:39	30			
045313	30	0:17	30	0	Earlier	From here same order (incl. 45313)
12/4/18 23:00	8	12. 4. 2018 23:01:49	8			
054631	8	0:01	8	0	Later	
13/4/18 1:44	17	13. 4. 2018 1:39:11	17			
060206	17	0:04	17	0	Earlier	
13/4/18 2:08	9	13. 4. 2018 2:18:06	9			
062016	9	0:10	9	0	Later	
13/4/18 4:35	24	13. 4. 2018 5:33:14	24			
062201	24	0:58	24	0	Later	
13/4/18 7:49	31	13. 4. 2018 6:32:13	31			
062133	31	1:16	31	0	Earlier	End of same order (incl. this row)
13/4/18 8:11	19	13.4.2018 7:22:41	19			
062227	19	0:48	19	0	Earlier	
13/4/18 8:29	12	13. 4. 2018 6:45:07	12			
062010	12	1:43	12	0	Earlier	
13/4/18 11:02	31	13. 4. 2018 10:32:34	31			
062102	31	0:29	31	0	Earlier	From here same order (incl. 62102)
13/4/18 11:34	36	13.4.2018 11:38:24	36			
045315	36	0:04	36	0	Later	
13/4/18 13:19	27	13. 4. 2018 13:53:26	27			
062100	27	0:34	27	0	Later	
13/4/18 14:24	30	13. 4. 2018 14:37:43	30			
062012	30	0:13	30	0	Later	End of same order (incl. this row)

Real sorting start Train number	Wagon count Wagon count	Simulation sorting start Time difference	Sorted wagons		Earlier/ later in model	Remark
			Real Model	Sorted Wagons Difference		
13/4/18 14:41	1					
OR0001	1					Internal train
13/4/18 15:48	28	13. 4. 2018 16:21:59	28			
060205	28	0:33	28	0	Later	
13/4/18 16:06	21	13. 4. 2018 17:12:03	21			
045732	21	1:06	21	0	Later	
13/4/18 16:39	26	13.4.2018 18:17:40	26			
045730	26	1:38	26	0	Later	
13/4/18 19:26	5	13. 4. 2018 18:49:49	5			
062014	5	0:36	5	0	Earlier	
13/4/18 19:31	8	13. 4. 2018 19:27:52	8			
044250	8	0:03	8	0	Earlier	
13/4/18 19:45	7					
OR0002	7					Internal train
13/4/18 20:14	26	13.4.2018 15:22:56	26			
047334	26	4:51	26	0	Earlier	
13/4/18 20:17	1	13. 4. 2018 19:37:45	1			
054631	1	0:39	1	0	Earlier	
13/4/18 20:33	17	13. 4. 2018 18:33:50	17			
062131	17	1:59	17	0	Earlier	
13/4/18 20:57	20	13. 4. 2018 20:48:19	20			
062130	20	0:08	20	0	Earlier	
14/4/18 0:20	5					
OR0003	5					Internal train
14/4/18 0:43	13	13. 4. 2018 21:01:19	13			
083200	13	3:41	13	0	Earlier	

Train departure

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
10/4/18 12:34	25	10/4/18 12:47	25			
060106	25	0:13	25		0	Transit train
10/4/18 12:49	9					
044727	9					Outbound train, no wagons for train
10/4/18 13:06	19	10/4/18 13:17	19			
058308	19	0:11	19		0	Transit train
10/4/18 14:15	16					
062220	16					Outbound train, no wagons for train
10/4/18 14:25	32	10/4/18 14:39	32			
066011	32	0:14	32		0	Transit train
10/4/18 14:33	25	10/4/18 14:40	25			
040737	25	0:07	25		0	Transit train
10/4/18 14:38	28	10/4/18 14:51	28			
058941	28	0:13	28		0	Transit train
10/4/18 14:45	59	10/4/18 14:50	40			
043207	40	0:05	40		0	Transit train
044449	19	10/4/18 15:02	19			
		0:17	19		0	Transit train
10/4/18 14:52	24	10/4/18 15:16	24			
058876	24	0:24	24		0	Transit train
10/4/18 15:20	24					Outbound train, no wagons for train
045711	24					
10/4/18 15:35	40	10/4/18 15:49	40			
059037	40	0:14	40		0	Transit train
10/4/18 17:32	25					
061011	25					Container train
10/4/18 18:20	19	10/4/18 18:31	19			
058995	19	0:11	19		0	Transit train
10/4/18 18:53	27	10/4/18 19:21	27			
062015	27	0:28	9		18	Outbound train

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
10/4/18 18:59	15	10/4/18 19:10	15			
062017	15	0:11	3		12	Outbound train
10/4/18 19:25	20	10/4/18 19:37	20			
060802	20	0:12	20		0	Transit train
10/4/18 19:27	10					
062130	10					Shunted from reception to departure yard
10/4/18 19:33	16	10/4/18 19:43	16			
062200	16	0:10	4		12	Outbound train
10/4/18 19:43	23	10/4/18 19:57	23			
058960	23	0:14	23		0	Transit train
10/4/18 20:45	24	10/4/18 20:50	24			
062130	24	0:05	10		14	Transit train with shunting of wagon groups
10/4/18 21:14	25					
043701	25					Container train
10/4/18 21:49	16	10/4/18 21:56	16			
062222	16	0:07	3		13	Outbound train
10/4/18 22:12	21	10/4/18 22:19	21			
060401	21	0:07	21		0	Transit train
10/4/18 22:29	6	10/4/18 22:42	6			
060050	6	0:13	6		0	Transit train
10/4/18 22:46	17	10/4/18 22:54	17			
049415	17	0:08	17		0	Transit train
10/4/18 22:54	24	10/4/18 23:07	24			
064701	24	0:13	24		0	Transit train
10/4/18 22:58	29	10/4/18 23:05	29			
045310	29	0:07	34		5	Outbound train
10/4/18 23:02	25	10/4/18 23:15	25			
041753	25	0:13	25		0	Transit train
10/4/18 23:22	12	10/4/18 23:27	12			
062224	12	0:05	5		7	Outbound train

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
10/4/18 23:29 060052	4	10/4/18 23:34 0:05	4	4	0	Transit train
10/4/18 23:31 060051	5	10/4/18 23:33 0:02	5	5	0	Transit train
10/4/18 23:36 041328	7	10/4/18 23:49 0:13	7	7	0	Transit train
10/4/18 23:42 056504	12	10/4/18 23:55 0:13	12	12	0	Transit train
10/4/18 23:59 048304	20	11/4/18 0:12 0:13	20	20	0	Transit train
11/4/18 0:11 041364	18	11/4/18 0:25 0:14	18	18	0	Transit train
11/4/18 0:16 058976	28	11/4/18 0:22 0:06	28	28	0	Transit train
11/4/18 0:30 045713	13	11/4/18 0:41 0:11	13	6	7	Outbound train
11/4/18 0:47 060202	7	11/4/18 1:00 0:13	7	7	0	Transit train
11/4/18 0:48 044725	52	11/4/18 0:56 0:08	12	8	4	Transit train
059448	40					Shunted from reception to departure yard
11/4/18 1:10 060100	15	11/4/18 1:22 0:12	15	15	0	Transit train
11/4/18 1:16 060054	12	11/4/18 1:28 0:12	12	12	0	Transit train
11/4/18 2:11 060203	10	11/4/18 2:17 0:06	10	10	0	Transit train
11/4/18 2:33 060102	19	11/4/18 2:45 0:12	19	19	0	Transit train
11/4/18 2:42	7					Outbound train

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
083037	7					(in model no wagons for this train)
11/4/18 2:48	17	11/4/18 2:54	17			
060204	17	0:06	12		5	Outbound train
11/4/18 2:52	22	11/4/18 3:10	22			
059414	22	0:18	22		0	Transit train
11/4/18 2:59	40	11/4/18 3:04	40			
059448	40	0:05	40		0	Transit train
11/4/18 3:45	17	11/4/18 3:53	17			
060400	17	0:08	17		0	Transit train
11/4/18 4:21	25	10/4/18 22:52	25			
061031	25	5:28	25		0	Container train
11/4/18 6:25	26	11/4/18 6:37	26			
062011	26	0:12	18		8	Outbound train
11/4/18 6:33	18	11/4/18 6:38	18			
059424	18	0:05	18		0	Transit train
11/4/18 6:58	5	11/4/18 7:06	5			
045027	5	0:08	10		5	Outbound train
11/4/18 8:15	25	11/4/18 8:21	25			
062132	25	0:06	30		5	Outbound train
11/4/18 8:53	24	11/4/18 5:34	24			
061020	24	3:18	26		2	Container train
11/4/18 9:16	21	11/4/18 9:27	21			
059532	21	0:11	21		0	Transit train
11/4/18 9:30	10	11/4/18 9:41	10			
083111	10	0:11	3		7	Outbound train
11/4/18 9:58	6					Outbound train
044251	6					(in model no wagons for this train)
11/4/18 11:00	15					
060106	15					Shunted from reception to departure yard
11/4/18 11:10	15	11/4/18 11:17	15			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
060106	15	0:05	15		0	Transit train
11/4/18 11:32	22	11/4/18 11:40	22			
059421	22	0:08	22		0	Transit train
11/4/18 11:46	20	11/4/18 11:54	20			
048305	20	0:08	20		0	Transit train
11/4/18 12:06	30	11/4/18 12:15	30			
062101	30	0:09	31		1	Outbound train
11/4/18 12:17	24	11/4/18 12:28	24			
045711	24	0:11	21		3	Outbound train
11/4/18 12:22	11	11/4/18 12:30	11			
044727	11	0:08	2		9	Outbound train
11/4/18 12:27	13	11/4/18 12:33	13			
064000	13	0:06	13		0	Transit train
11/4/18 12:32	7	11/4/18 12:39	7			
060104	7	0:07	19		12	Outbound train
11/4/18 12:48	28	11/4/18 13:01	28			
066010	28	0:13	28		0	Transit train
11/4/18 13:26	20					
048358	20					Shunted from reception to departure yard
11/4/18 13:34	17	11/4/18 13:40	17			
062220	17	0:06	8		9	Outbound train
11/4/18 13:44	1	11/4/18 13:57	1			
062013	1	0:13	30		29	Outbound train
11/4/18 13:53	20	11/4/18 13:58	20			
048358	20	0:05	20		0	Transit train
11/4/18 14:26	40	11/4/18 14:38	40			
043204	40	0:12	40		0	Transit train
11/4/18 15:45	20	11/4/18 15:56	20			
044449	20	0:11	20		0	Transit train
11/4/18 16:42	26					

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
061031	26					Container train
11/4/18 17:44	14					
041701	14					Container train
11/4/18 18:45	13	11/4/18 18:56		13		
062017	13	0:11		23	10	Outbound train
11/4/18 19:14	26	11/4/18 19:25		26		
062015	26	0:11		20	6	Outbound train
11/4/18 19:37	34					
062130	34					
11/4/18 19:56	25	11/4/18 20:08		25		
041340	25	0:12		25	0	Transit train
11/4/18 20:53	38	11/4/18 20:59		38		
062130	38	0:06		34	4	Transit train with shunting of wagon groups
11/4/18 21:09	15	11/4/18 21:15		15		
062200	15	0:06		13	2	Outbound train
11/4/18 21:29	24	11/4/18 21:38		24		
043701	24	0:09		24	0	Container train
11/4/18 21:37	20	10/4/18 19:49		20		
061022	20	1:47		23	3	Container train
11/4/18 22:25	6	11/4/18 22:39		6		
060050	6	0:14		6	0	Transit train
11/4/18 22:28	11	11/4/18 22:33		11		
062222	11	0:05		11	0	Outbound train
11/4/18 22:57	24	11/4/18 23:04		24		
045310	24	0:07		27	3	Outbound train
11/4/18 23:04	21					
052052	21					Most probably a container train
11/4/18 23:08	20	11/4/18 23:26		20		
048304	20	0:18		20	0	Transit train
11/4/18 23:24	18	11/4/18 23:32		18		

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
049415	18	0:08	18		0	Transit train
11/4/18 23:34	9	11/4/18 23:40	5			
060051	5	0:06	5		0	Transit train
060052	4	11/4/18 23:39	4			
		0:05	4		0	Transit train
11/4/18 23:42	10	11/4/18 23:52	10			
064001	10	0:10	10		0	Transit train
11/4/18 23:55	8	12/4/18 0:11	8			
041328	8	0:16	8		0	Transit train
11/4/18 23:59	25	12/4/18 0:05	25			
059718	25	0:06	25		0	Transit train
12/4/18 0:18	38	12/4/18 0:25	38			
059193	38	0:07	38		0	Transit train
12/4/18 0:37	14	12/4/18 0:51	14			
060100	14	0:14	14		0	Transit train
12/4/18 0:39	8					there were no wagons in model for this
062224	8					outbound train
12/4/18 0:48	17	12/4/18 1:02	17			
041364	17	0:14	17		0	Transit train
12/4/18 0:55	17	12/4/18 1:04	17			
044725	17	0:09	17		0	Outbound train
12/4/18 1:07	13	12/4/18 1:17	13			
060054	13	0:10	13		0	Transit train
12/4/18 1:30	32	12/4/18 1:43	32			
066010	32	0:13	32		0	Transit train
12/4/18 2:20	8	12/4/18 2:30	8			
060203	8	0:10	8		0	Transit train
12/4/18 2:22	29	12/4/18 2:27	14			
060202	14	0:05	14		0	Transit train
060204	15	12/4/18 2:33	15			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
		0:11	8		7	Outbound train
12/4/18 2:46 052026	20					Shunted from reception to departure yard
12/4/18 2:56 045713	30	12/4/18 3:07 0:11	30		24	6 Outbound train
12/4/18 3:07 052026	20	12/4/18 3:06 0:00	20		20	0 Transit train
12/4/18 3:10 060102	22	12/4/18 3:24 0:14	22		22	0 Transit train
12/4/18 3:33 044448	19					Shunted from reception to departure yard
12/4/18 3:42 068207	20	12/4/18 3:47 0:05	20		20	0 Transit train
12/4/18 4:31 044448	19	12/4/18 4:36 0:05	19		19	0 Transit train
12/4/18 4:49 043206	40	12/4/18 5:01 0:12	40		40	0 Transit train
12/4/18 4:56 060400	22	12/4/18 5:08 0:12	22		22	0 Transit train
12/4/18 5:17 083121	20	12/4/18 5:25 0:08	20		20	4 Outbound train
12/4/18 5:23 055925	21	12/4/18 5:36 0:13	21		21	0 Transit train
12/4/18 5:30 041327	8	12/4/18 5:36 0:06	8		8	0 Transit train
12/4/18 5:40 062011	26	12/4/18 5:51 0:11	26		26	12 Outbound train
12/4/18 6:18 064700	24					Shunted from reception to departure yard
12/4/18 6:53	4	12/4/18 6:59	4			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
059737	4	0:06	16		12	Outbound train
12/4/18 6:59	23	12/4/18 7:08	23			
045027	23	0:09	16		7	Outbound train
12/4/18 8:15	24	12/4/18 8:27	24			
064700	24	0:12	24		0	Transit train
12/4/18 8:48	20	12/4/18 8:59	20			
059760	20	0:11	20		0	Transit train
12/4/18 9:08	25					
040736	25					Shunted from reception to departure yard
12/4/18 9:16	15					
064000	15					Shunted from reception to departure yard
12/4/18 9:20	25	12/4/18 9:26	25			
040736	25	0:06	25		0	Transit train
12/4/18 9:38	15	12/4/18 9:59	15			
064000	15	0:21	15		0	Transit train
12/4/18 9:44	34	12/4/18 9:50	34			
062132	34	0:06	35		1	Outbound train
12/4/18 10:13	19	12/4/18 10:19	19			
044251	19	0:06	10		9	Outbound train
12/4/18 11:30	39	12/4/18 11:42	39			
062101	39	0:12	38		1	Outbound train
12/4/18 11:53	30	12/4/18 12:08	30			
048739	30	0:15	30		0	Transit train
12/4/18 12:36	9	12/4/18 12:44	9			
044727	9	0:08	9		0	Outbound train
12/4/18 13:11	38	12/4/18 13:23	38			
062013	38	0:12	37		1	Outbound train
12/4/18 13:13	18	12/4/18 13:16	18			
060106	18	0:03	18		0	Outbound train
12/4/18 13:27	40	12/4/18 13:37	40			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
059821	40	0:10	21	19		Container train
12/4/18 13:58	14					There were no wagons for this
062220	14					outbound train
12/4/18 14:21	28	12/4/18 14:32	28			
045711	28	0:11		22	6	Outbound train
12/4/18 14:28	25	12/4/18 14:37	25			
041751	25	0:09	25		0	Transit train
12/4/18 15:55	2	12/4/18 16:17	2			
061031	2	0:22	25	23		Container train
12/4/18 16:15	19	12/4/18 16:29	19			
052265	19	0:14	19		0	Transit train
12/4/18 16:58	41	12/4/18 17:10	41			
043204	41	0:12	41		0	Transit train
12/4/18 17:28	25	12/4/18 17:34	25			
052282	25	0:06	25		0	Transit train
12/4/18 18:00	23					
052446	23					Shunted from reception to departure yard
12/4/18 18:13	5					
062130	5					Shunted from reception to departure yard
12/4/18 18:41	15	12/4/18 18:52	15			
062017	15	0:11	16	1		Outbound train
12/4/18 18:42	23	12/4/18 18:53	23			
052446	23	0:11	23	0		Transit train
12/4/18 18:46	23	12/4/18 19:17	23			
062015	23	0:31	22	1		Outbound train
12/4/18 18:56	17	12/4/18 19:03	17			
052527	17	0:07	17	0		Transit train
12/4/18 19:08	18	12/4/18 19:19	18			
041365	18	0:11	18	0		Transit train
12/4/18 19:13	11	12/4/18 19:19	11			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
062200	11	0:06	24	13		Outbound train
12/4/18 20:42	40	12/4/18 20:47	40			
062130	40	0:05	5	35		Transit train with shunting of wagon groups
12/4/18 20:53	19					
059744	19					Shunted from reception to departure yard
12/4/18 21:39	25	12/4/18 21:47	25			
043701	25	0:08	25	0		Container train
12/4/18 22:15	20	12/4/18 22:29	20			
048304	20	0:14	20	0		Transit train
12/4/18 22:28	23	12/4/18 22:37	23			
045310	23	0:09	35	12		Outbound train
12/4/18 22:47	12	12/4/18 22:59	5			
060050	5	0:12	5	0		Transit train
062222	7	12/4/18 22:53	7			
		0:06	7	0		Outbound train
12/4/18 22:58	23	12/4/18 23:08	23			
043040	23	0:10	21	2		Container train
12/4/18 23:21	19	12/4/18 23:32	19			
059744	19	0:11	19	0		Transit train
12/4/18 23:30	10	12/4/18 23:43	10			
041328	10	0:13	10	0		Transit train
12/4/18 23:43	5	12/4/18 23:53	5			
060051	5	0:10	5	0		Transit train
12/4/18 23:45	4	12/4/18 23:50	4			
060052	4	0:05	4	0		Transit train
12/4/18 23:48	18	12/4/18 23:59	18			
041364	18	0:11	18	0		Transit train
13/4/18 0:00	25	13/4/18 0:13	25			
051031	25	0:13	21	4		Container train
13/4/18 0:21	9					

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
060206	9					Shunted from reception to departure yard
13/4/18 0:22	22	13/4/18 0:40	22			
065520	22	0:18	22		0	Transit train
13/4/18 0:27	25	13/4/18 0:48	25			
060100	25	0:21	25		0	Transit train
13/4/18 0:32	19	13/4/18 0:32	19			
044448	19	0:00	19		0	Transit train
13/4/18 0:42	4	13/4/18 0:51	4			
060053	4	0:09	4		0	Transit train
13/4/18 0:56	5					
059684	5					Shunted from reception to departure yard
13/4/18 1:05	15	13/4/18 1:14	15			
044725	15	0:09	15		0	Outbound train
13/4/18 1:20	25	13/4/18 1:25	25			
060206	25	0:05	9		16	Transit train with shunting of wagon groups
13/4/18 1:23	7	13/4/18 1:32	7			
060202	7	0:09	7		0	Transit train
13/4/18 1:30	35	13/4/18 1:40	5			
060203	5	0:10	5		0	Transit train
066011	30	13/4/18 1:55	30			
		0:25	30		0	Transit train
13/4/18 1:42	11	13/4/18 1:49	11			
060204	11	0:07	21		10	Outbound train
13/4/18 1:46	12	13/4/18 2:03	12			
060102	12	0:17	12		0	Transit train
13/4/18 1:51	35	13/4/18 1:56	35			
052104	35	0:05	35		0	Transit train
13/4/18 2:03	5	13/4/18 2:13	5			
059684	5	0:10	5		0	Transit train
13/4/18 2:17	4	13/4/18 2:33	4			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
083037	4	0:16	8	8	4	Outbound train
13/4/18 2:18	18	13/4/18 2:21	18	18		
052768	18	0:03	18	18	0	Transit train
13/4/18 2:30	18	13/4/18 2:34	18	18		
049415	18	0:04	18	18	0	Transit train
13/4/18 2:34	8	13/4/18 2:40	8	8		
060105	8	0:06	8	8	0	Transit train
13/4/18 2:57	32	13/4/18 3:09	32	32		
045713	32	0:12	34	34	2	Outbound train
13/4/18 3:41	18					
060400	18					Shunted from reception to departure yard
13/4/18 3:52	16	13/4/18 4:05	16	16		
060055	16	0:13	16	16	0	Transit train
13/4/18 4:23	18	13/4/18 4:35	18	18		
060400	18	0:12	18	18	0	Transit train
13/4/18 5:42	28					
066010	28					Shunted from reception to departure yard
13/4/18 6:04	28	13/4/18 6:02	28	28		
066010	28	0:01	28	28	0	Transit train
13/4/18 6:07	24	13/4/18 6:19	24	24		
062011	24	0:12	33	33	9	Outbound train
13/4/18 6:21	18	13/4/18 6:29	18	18		
052907	18	0:08	18	18	0	Transit train
13/4/18 6:56	1	13/4/18 7:04	1	1		
045027	1	0:08	1	1	0	Outbound train
13/4/18 7:09	10	13/4/18 7:17	10	10		
041327	10	0:08	10	10	0	Transit train
13/4/18 8:24	5	13/4/18 8:30	5	5		
062132	5	0:06	36	36	31	Outbound train
13/4/18 8:32	3					Outbound train (train is not in model, because

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
052889	3					it is a slow train for Chornice)
13/4/18 9:05	16	13/4/18 5:36	16			
061020	16	3:28	25		9	Container train
13/4/18 10:01	14	13/4/18 10:07	14			
064000	14	0:06	14		0	Transit train
13/4/18 10:30	16	13/4/18 10:42	16			
048739	16	0:12	16		0	Transit train
13/4/18 10:46	15	13/4/18 10:52	15			
044251	15	0:06	22		7	Outbound train
13/4/18 11:44	27	13/4/18 11:53	27			
062101	27	0:09	24		3	Outbound train
13/4/18 13:02	23	13/4/18 13:15	23			
060106	23	0:13	23		0	Transit train
13/4/18 13:07	12	13/4/18 13:24	12			
044727	12	0:17	14		2	Outbound train
13/4/18 13:28	41	13/4/18 13:50	41			
062013	41	0:22	37		4	Outbound train
13/4/18 15:09	26					
047330	26					Shunted from reception to departure yard
13/4/18 15:32	38	13/4/18 15:44	38			
045711	38	0:12	29		9	Outbound train
13/4/18 15:37	25	13/4/18 16:09	25			
061031	25	0:32	25		0	Container train
13/4/18 15:44	41	13/4/18 15:56	41			
043204	41	0:12	41		0	Transit train
13/4/18 15:54	17	13/4/18 16:00	17			
053010	17	0:06	17		0	Transit train
13/4/18 16:08	26	13/4/18 16:14	26			
047330	26	0:06	26		0	Transit train
13/4/18 16:37	17	13/4/18 16:56	17			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
060402	17	0:19	17		0	Transit train
13/4/18 16:45	18	13/4/18 16:55	18			
041365	18	0:10	18		0	Transit train
13/4/18 16:46	20	13/4/18 17:02	20			
053130	20	0:16	20		0	Transit train
13/4/18 17:00	25	13/4/18 17:04	25			
041807	25	0:04	25		0	Transit train
13/4/18 18:43	19					
052988	19					Shunted from reception to departure yard
13/4/18 18:54	15	13/4/18 19:05	15			
062017	15	0:11	14		1	Outbound train
13/4/18 18:56	16	13/4/18 19:02	16			
052538	16	0:06	16		0	Transit train
13/4/18 19:02	34	13/4/18 19:17	34			
062015	34	0:15	11		23	Outbound train
13/4/18 19:24	19	13/4/18 19:34	19			
052988	19	0:10	19		0	Transit train
13/4/18 20:18	31	13/4/18 20:26	31			
062200	31	0:08	19		12	Outbound train
13/4/18 20:39	9					
062130	9					Shunted from reception to departure yard
13/4/18 21:15	29	13/4/18 21:20	29			
062130	29	0:05	9		20	Transit train with shunting of wagon groups
13/4/18 22:04	25	13/4/18 22:10	25			
041752	25	0:06	25		0	Transit train
13/4/18 22:39	6	13/4/18 22:51	6			
060050	6	0:12	6		0	Transit train
13/4/18 22:50	35	13/4/18 22:59	35			
045310	35	0:09	27		8	Outbound train
13/4/18 22:59	8	13/4/18 23:11	8			

Real departure time Train number	Wagon count	Model leaving time Difference	Departed wagons		Difference	Remark
			Real Model			
041328	8	0:12	8	8	0	Transit train
13/4/18 23:05	20	13/4/18 23:18	20	20		
048304	20	0:13	20	20	0	Transit train
13/4/18 23:17	19	13/4/18 23:34	19	19		
062222	19	0:17	19	19	0	Outbound train
13/4/18 23:22	24	13/4/18 23:35	24	24		
064701	24	0:13	24	24	0	Transit train
13/4/18 23:23	3	13/4/18 23:28	3	3		
060052	3	0:05	3	3	0	Transit train
13/4/18 23:28	4	13/4/18 23:46	4	4		
060051	4	0:18	4	4	0	Transit train
14/4/18 0:22	2					Train does not appear in model. Trains are entering into the model until end of 13.4 only.
060100	2					
14/4/18 0:51	11					Train does not appear in model. Trains are entering into the model until end of 13.4 only.
060054	11					
14/4/18 1:14	26	14/4/18 1:31	26	26		
060204	26	0:17	26	26	0	Outbound train
14/4/18 1:21	1					Train does not appear in model. Trains are entering into the model until end of 13.4 only.
060102	1					
14/4/18 1:47	18	14/4/18 1:30	18	18		
049415	18	0:16	18	18	0	Transit train, entered into the model on 13.4.
14/4/18 2:02	40	14/4/18 2:14	40	40		
045713	40	0:12	31	31	9	Outbound train

Annex B Comparison Simulation vs. Real data for yard Trieste Campo Marzio

The following protocol lists all trains from real week operation, which were included in the simulation scenario “Real week operation”. The data in white cells represent the real operation data and the data in green cells represent the operation in the simulation model. Trains which were not considered due to the missing data or some exceptions, are marked in red (these trains were not modelled).

As explained before, three typical wagon types were used to build a composition of inbound trains. The number of wagons in train compositions from real week operation was respected. In case the train length exceeded the track limits (useful track length) in Campo Marzio or in the port, the wagon type was replaced by a shorter one or the number of wagons was reduced to meet the track limits. Reduction of the number of wagons in the train composition is marked in blue.

Additional remarks about train handling (parking, changes, assumed values, etc.) in the simulation model are written in rightmost columns of the table.

Inbound Train				Arrival					Real shunting to port				Sim shunting to port		Life in Port	Real shunting from	
Name in Sim	Intern. name	Wagon count	Load./Emp.	Day	Enter	Arrivale	Plan a.	Track TCM	Day	Start Shunt	End Shunt	Gate	Start Shunt	End Shunt		Day	Start Shunt
0Fr11-T-M89-T-1Thu23	t01	16	Loaded	Fri	12:05	11:50	11:50	20	Fri	12:30	12:50	3	13:20	14:25	T-M89-T	Thu	22:30
0Sun17-T-1Mo04	t17	17	Loaded	Sun	16:55	17:00		24	Sun	18:15	18:35	3	18:00	19:13	T	Mon	01:35
0Sun21-T-1Mo09	t3	18	Loaded	Sun	21:34	21:39		21	Mon	02:00	02:20	3	0:05	1:18	T	Mon	07:00
1Mo05-T-1Mo21	t2	16	Loaded	Mon	5:50	05:55	05:55	24	Mon	07:35	07:50	3	7:20	08:45	T	Mon	19:00
1Mo00-T-1Mo10	t5	17	Loaded	Mon	0:30	00:35	00:35	19	Mon	02:50	03:25	3	2:30	04:49	T	Mon	09:15
0Sa20-T-M4-T-1Mo22	t1	18->17	Loaded	Sat	20:21	20:26		19	Sa	22:10	22:35	3	22:00	23:13	T-M4-T	Mon	09:50
0Sun22-T-1Mo14	t6	18	Loaded	Sun	22:29	22:34	01:30	22	Mon	02:25	02:45	4	2:10	3:12	T	Mon	11:00
0Sun21-T-1Mo12	t13	16	Loaded	Sun	21:25	21:30	21:30	24	Mon	00:30	00:35	3	22:40	23:45	T-M2	Mon	12:00
0Fr17-T-1Mo15	t8	20	Loaded	Fri	17:45	17:50	17:50		Sa	20:10	20:40	4	19:55	20:43	T	Mon	13:25
0Sun17-T-1Mo16	t9	18	Loaded	Sun	17:40	17:45	17:45	21	Sun	20:50	21:20	3	20:35	21:28	T	Mon	15:20
0Sa09-T-1Mo17	t3	17	Loaded	Sat	9:25	09:30		21	Mon	15:10	15:50	4	15:00	15:48	T	Mon	16:20
0Sun09-T-1Mo21	t11	18	Loaded	Sun	1:25	01:30	01:30	14	Sun	18:45	19:30	3	18:30		T	Mon	17:30
0Fr21-T-P23-T-1Mo23	t12	17	Loaded	Fri	21:36	21:41	21:41	24	Sun	?	?	3	22:30	23:43	T-P23-T	Mon	21:15
0Sun10-T-0Sun22	t12	17	Loaded	Sun	10:45	10:50	10:50	24	Sun	11:25	11:55	3	11:10	12:23	T	Sun	22:15
0Sun23-T-1Tue12	t9	19	Loaded	Sun	23:24	23:29		23	Mon	12:50	13:25	4	12:40	13:49	T	Tue	15:50
0Sa23-T-1Tue00	t13	16	Loaded	Sat	22:55	23:00	23:00	24	Sun	01:00	01:00		0:45	1:51	T-M4-T-M4	Tue	00:00
1Mo07-??-1Tue??	t14	9	Loaded	Mon		07:50	07:05	21->14	Mon	11:40	11:55					Tue	13:00
1Mo09-T-1Tue15	t4	15	Loaded	Mon	9:10	09:15	09:15	23	Mon	10:15	10:35	3	10:00	11:59	T	Tue	13:00
1Mo13-P14-T-1Tue18	t7	20->18	Loaded	Mon	13:15	13:20	13:20	23	Mon	15:50	16:15	3	15:35	16:26	P14-T-P14	Tue	17:05
1Mo17-T-1Tue17	t8 or t10	17	Loaded	Mon	17:25	17:30	17:30	22	Mon	18:00	18:30	3	17:45	18:33	T	Tue	14:40
1Mo21-T-1Tue12	t9	19	Loaded	Mon	20:55	21:00	21:00	23	Mon	22:30	23:00	3	22:15	23:11	T	Tue	10:10
0Fr22-T-1Tue09	t3	19->16	Loaded	Fri	22:40	22:45	22:45		Sat	02:00	02:25	3	0:45	1:53	M6-T-M1	Tue	07:10
1Tue01-T-1Tue17	t9	19	Loaded	Tue	1:05	01:10	01:10	21		02:40	03:10	3	2:15		T	Tue	15:50
1Tue01-T-1Tue11	t2	16	Loaded	Tue	1:40	01:45	01:45	21	Tue	02:00	02:30	3	2:30	3:46	T	Tue	09:35
1Tue06-ROLA-1Tue15	t16	10	Loaded	Tue	6:50	06:55	06:55	23	Tue	07:55	08:15	3	7:40	8:36	M1 only (Rola)	Tue	14:10
1Tue07-T-1Tue22	t15 or t3	19->17	Loaded	Tue	7:10	07:15	07:15	22	Tue	10:45	11:25	3	10:30	11:30	T	Tue	19:40
1Tue07-M5-T-M2-1Tue22	t2	16	Loaded	Tue	7:17	07:22	07:22	22	Tue	08:40	09:05	3	08:20	09:28	M5-T-M2	Tue	20:35
1Tue09-T-1Wed20	t03	19	Loaded	Tue	9:10	09:15	09:15	23	Tue			4	10:30	11:57	T	Wed	19:40
1Tue09-M3-T-1Wed18	t12	17	Loaded	Tue	9:20	09:25	09:25	24	Tue	15:25?		3	15:10	16:10	M3-T	Wed	16:05
1Tue17-M1-T-M2-1Wed05	t17	18->17	Loaded	Tue	17:45	17:50	17:50	24	Tue	18:20	18:45	3	18:00	19:21	Mo1-T-Mo2	Wed	02:40
1Tue18-T-1Wed05	t18	20	Loaded	Tue	18:15	18:20	18:20	21	Tue	20:10	20:30	3	19:55	20:56	T	Wed	03:40
1Tue22-T-1Thu05	t13	16->15	Loaded	Tue	21:55	22:00	22:00	24	Wed	08:35	08:55	3	8:10	9:26	M3-T	Wed/Thu	23:40
1Tue22-T-1Wed09	t3	18	Loaded	Tue	22:40	22:45	22:45	20	Wed	02:00	02:25	3	0:45	1:33	T	Wed	08:10
1Wed00-T-1Wed15	t20	16	Loaded	Wed	0:30	00:35	00:35	23	Wed	00:40	01:05	3	1:25	2:15	T	Wed	12:20
1Wed01-T-1Wed19	t9	19	Loaded	Wed	1:25	01:30	01:30	23	Wed	03:00	03:35	3	2:45	3:47	T	Wed	17:20
1Wed05-ROLA-1Wed13	t16	10	Loaded	Wed	5:40	05:45	05:45	23	Wed	06:45	07:05	3	6:30	7:21	M2 only (Rola)	Wed	11:40
1Wed09-T-1Wed22	t03	17	Loaded	Wed	9:10	09:15	09:15	22	Wed	11:00	11:35	3	10:45	11:43	T	Wed	20:25
1Wed09-T-1Wed22	t02	16	Loaded	Wed	9:20	09:25	09:25	24	Wed	09:50	10:10	3	9:45	11:15	T	Wed	19:55
0Fr17-T-M1011-T-M4-1Wed11	t13	16	Loaded	Fri	23:10	23:15	23:15	24	Wed	00:30	00:50	3	0:10	1:16	T-M1011-T-M4	Wed	09:15
1Wed06-T-M4-T-2Tue07	t12	17	Loaded	Wed	6:40	06:45	06:45	20	Wed	16:40	17:20	3	16:15	18:00	T-M4-T		stays in model, departure ne
1Wed19-T-P14-???	t08	20->16	Loaded	Wed	19:25	19:30	19:30	22	Wed	20:25	20:45	3	20:10	21:21	T-P14		probably buffering in TSCM to be
1Wed20-T-1Thu13	t09	18	Loaded	Wed	20:40	20:45	20:45	22	Wed	22:35	23:00	3	22:20	23:35	T	Thu	12:00
1Wed21-T-1Thu07	t23	17	Loaded	Wed	21:09	21:14	21:14	23	Wed	22:10	22:30	3	21:20	22:33	T	Thu	03:00
1Wed21-T-1Thu14	t01	17->16	Loaded	Wed	21:40	21:45	21:45	21	Thu	01:05	01:25	3	0:50	2:14	T	Thu (20wg)	13:00
1Wed23-T-M3-T-1Fr05	t13	16	Loaded	Wed	23:10	23:15	23:15	19	Thu	00:30	00:50	3	0:01	1:47	T-M3-T	Fri	00:05
1Thu00-T-1Thu12	t05	16	Loaded	Thu	0:10	00:15	00:15	23	Thu	01:50	02:15	3	1:15	3:06	T	Thu	11:00
1Thu00-T-1Thu09	t03	20->17	Loaded	Thu	0:40	00:45	00:45	19	Thu	03:25	03:45	3	2:10	3:44	Mo1-T	Thu (17wg)	08:00
1Thu01-T-P14-???	t11	21->16	Loaded	Thu	1:25	01:30	01:30	21	Thu	?	?		7:00	7:45	T-P14		
1Thu07-ROLA-1Thu15	t16	10	Loaded	Thu	7:52	07:57	07:57	20	Thu	09:50	10:10	3	9:35	11:19	M2 only (Rola)	Thu	14:10
1Thu09-T-1Fr06	t11	18	Loaded	Thu	9:21	09:26	09:26	22	Thu	20:35	21:05	4	20:20	21:08	T	Fri (20wg)	02:10
1Thu09-T-1Fr13	t03->t09	19	Loaded	Thu	9:33	09:38	09:38	23	Thu	16:30	17:00	4	16:15	17:06	T		11:10
1Thu10-T-1Fr23	t12	17	Loaded	Thu	10:22	10:27	10:27	24	Thu	12:45	13:05	3	12:30	14:00	T	Thu/Fri	22:20:00 Th
1Thu22-T-1Fr23	t21	17->16	Loaded	Thu/Fri	22:15	22:20	22:20	20	Fri	03:40	04:00	3	3:20	4:56	T	Fri	21:35
1Thu23-T-1Fr09	t03	18	Loaded	Thu/Fri	23:20	23:25	23:25	22	Fri	00:25	00:45	3	0:05	1:41	T	Fri	07:00
1Thu23-T-1Fr19	t20->t18	16	Loaded	Thu/Fri	23:25	23:30	23:30	21	Fri	04:10	04:30	3	3:45	5:00	T	Fri	17:15
1Fr01-T-1Fr17	t09	18	Loaded	Fri	0:55	01:00	01:00	19	Fri	02:45	03:05	3	2:30	3:22	T	Fri	15:30
1Thu23-T-1Fr12	t04	15	Loaded	Thu/Fri	23:50	23:55	23:55	23	Fri	01:45	02:00	3	1:30	2:36	T	Fri	11:55
1Fr05-ROLA-1Fr15	t16	10	Loaded	Fri	5:45	05:50	05:50	21	Fri	08:20	08:40	3	8:00	9:17	M2 only (Rola)	Fri	12:40

In port		Sim shunting from port		Outbound train					Remark	
End Shunt	Gate	Start Shunt	End Shunt	Day	Departure	ORA MAD	Track TCM	Load./Emp.		
22:45	3	22:10	23:05	Thu	23:30	22:45	15	Loaded	From T2 to M89 on 19:10 Fr	From M89 to T2 on 8:40 Thu
01:55	3	01:15	02:25	Mon	04:55	01:55	24	Loaded		
07:30	3	6:15	7:18	Mon	09:03	07:30	16	Loaded		
19:25	3	18:30	19:33	Mon	21:05	19:25	24	Loaded		
09:45	3	8:50	9:46	Mon	10:57	09:45	24	16-L/1-Emp		
10:10	3	10:00	11:06	Mon	22:35	10:15	20	Loaded	No data about departure time - used planned departure time for 45262	From T1 to M4 on 13:00 Sun
11:35	4	10:55	12:07	Mon	14:04	11:35	20	Loaded		From M4 to T1 on 3:30 Mon
12:15	3	11:00	12:55	Mon	12:39	12:15	21	Loaded		
14:20	3	13:10	14:15	Mon	15:04	14:20	15	Loaded	it seems that train was placed on track 11 and later on track 15	
15:45	3	11:40	13:04	Mon	16:40	15:45	15	Loaded		
16:45	3	16:05	16:54	Mon	17:56	16:45	23	Loaded		
17:25	7	17:11		Mon	11:52	17:55	16	?	No info in shunting list	
21:40	3	21:00	22:11	Mon	23:00	21:45	24	Loaded	From T1 to P2-3 on 9:00 Sa - ?? Sa	From P2-3 to T1 on 14:00 Mon - ?? Mon
22:40	3	20:30	21:33	Sun	22:47	22:40	19	Loaded		
16:10	4	15:25	16:29	Tue	17:54	16:10	21	Loaded		
00:25	3	23:30	0:18	Tue	05:30	00:25	19	Loaded	From T2 to M4 on 4:00 Sun - 4:40 Sun	From M4 to T2 on 13:30 Sun - 14:15 Sun
13:30	3			Tue	-	13:30			shunted after arrival from track 21 to track 14 - Meeting in Trieste = train canceled for sim	From T2 to M4 on 2:15 Mon - 4:00 Mon
13:30	3	12:30	13:27	Tue	15:00	13:30	15	Loaded		
17:30	3	16:40	17:26	Tue	18:40	17:30	15	Loaded	From P1-4 to T3 on 20:40 Mon	From T3 to P1-4 on 2:30 Tue
15:05	4	14:15	15:04	Tue	17:07	15:05	16	Loaded		
10:40	4	9:50	10:45	Tue	12:10	10:40	15	Loaded		
07:50	3	7:00	7:48	Tue	09:00	07:50	15	Loaded	From M6 to T1 on 21:30 Mon - ?? Mon	From T1 to M1 on 2:00 Mo - ?? Sa
16:10	4	15:25		Tue	17:54	16:10	21	Loaded		
10:10	4	9:20	10:37	Tue	11:30	10:10	21	Loaded	departure not known - set to 11:30	
14:35	3	13:50	14:37	Tue	15:12	14:35	17	Loaded	ROLA - unloading/loading on track Molo 2	
20:00	3	19:15	20:12	Tue	22:00	21:00	24	Loaded	???	
21:00	3	20:15	21:12	Tue	22:20	21:00	24	Loaded	From M5 to T1 on 11:30 Tue	From T1 to M2 on 17:00 Tue
20:00	4	19:00	19:44	Wed	20:43	20:00	15	Loaded	???	
16:35	3	15:40	16:46	Wed	18:00	16:35	24	Loaded	???	Train 12->Train 21???
03:00	3	2:52	3:37	Wed	05:25	03:00	20	Loaded		
04:10	4	3:20	0:1875	Wed	05:15	04:10	23	Loaded		
00:05	3	23:10	0:15	Wed/Thu	05:30	00:05	24	Loaded	From M3 to T2 on 15:13 Wed	From T2 to M3 on 15:13 Wed
08:45	3	8:00	8:44	Wed	09:09	08:45	15	Loaded		
12:55	4	11:55	12:40	Wed	15:05	12:55	15	15Loaded	diference wagon count in/Out	
17:40	4	17:00	18:03	Wed	19:00	17:40	20	Loaded		
12:10	3	11:30	12:16	Wed	13:35	12:10	16	Loaded		
20:45	4	20:00	20:55	Wed	22:00	20:45	15	19Loaded	diference wagon count in/Out	
20:20	3	19:30	20:33	Wed	22:20	20:20	19	Loaded		
09:45	3	9:00	10:21	Wed	11:00	09:45	19	Loaded	From T1 to M10-11 on 05:00 Sa	From M10-11 to T2 on 18:30 Tue
next week									waiting on track Molo 4 after unloading the rest of the week	From T2 to M4 on 22:00 Tue
loaded in next week (in model on TSCM track 13) - on Thu 17:15										Arrival set to Fr 0 Week - no di
12:40	3	11:45	12:34	Thu	13:20	12:40	19	Loaded	From T3 to P1-4 on 3:00 Thu	
03:20	3	3:03	4:28	Thu	07:15	03:20	20	Loaded		
13:30	3	12:00	13:06	Thu (20wg)	14:10	13:30	24	Loaded		
00:20	3	23:45	0:47	Fri	05:17	00:20	24	Loaded	From T2 to M3 on 8:15 Thu	From M3 to T2 on 16:20 Thu
11:35	3	10:40	11:59	Thu	12:30	11:35	15	15Load/1Emp		
08:30	3	7:45	8:47	Thu (17wg)	09:20	08:30	15	Loaded		
14:35	3	13:55	14:44	Thu	15:12	14:35	17	Loaded	From T3 to P1-4 on 19:00 Thu	train had bad documents - no departure in the modelled week
02:40	3	3:08	4:06	Fri (20wg)	06:26	02:40	15	Loaded	???	ROLA-transloading time 180 min
11:45	4	10:50	11:49	Fri	13:25	11:45	24	Loaded	53032	
22:40:00 Th	3	20:30	21:45	Fri	23:27	22:40 Th	19	Loaded		
21:55	3	21:15	22:52	Fri	23:00	21:55	19	Loaded		
07:35	3	6:40	7:46	Fri	09:19	07:35	15	Loaded		
17:45	4	17:00	17:44	Fri	19:15	17:45	15	Loaded	Train18	
16:00	4	15:15	16:04	Fri	17:50	16:00	23	Loaded		
12:25	3	11:00	12:37	Fri	12:47	12:25	19	Loaded		
13:00	3	13:17	14:03	Fri	15:12	13:00	17	Loaded	???	

Inbound Train				Arrival					Real shunting to port				Sim shunting to port		Life in Port	Real shunting from	
Name in Sim	Intern. name	Wagon count	Load./Emp.	Day	Enter	Arrivale	Plan a.	Track TCM	Day	Start Shunt	End Shunt	Gate	Start Shunt	End Shunt		Day	Start Shunt
1Fr06-T-1Fr22	t02	17	Loaded	Fri	6:08	06:13	06:13	24	Fri	07:40	07:55	3	7:20	9:01	T	Fri	21:00
1Fr06-T-1Fr23	t19	15->16	Loaded	Fri	6:20	06:25	06:25	23	Fri	10:30	11:10	4	10:15	11:02	T	Fri	23:25
1Fr10-T-1Sa13	t22	20->19	Loaded	Fri	10:35	10:40	10:40	23	Fri	14:35	14:55	4	14:20	15:08	T	Sat (20wg)	11:50
1Fr11-T-M89-T-2Tue12	t01	17	Loaded	Fri	11:05	11:50	11:50	20	Fri	12:30	12:50	3	12:20	13:20	T-M89-T	parked on M89	
1Fr13-T-1Sa13	t07	20	Loaded	Fri	13:10	13:15	13:15	19	Fri	18:20	18:30	4			T	Sat	12:40
1Fr17-M2-T-1Sat09	t02	16	Loaded	Fri	17:05	17:10	17:10	24	Fri	20:25	20:40	3	20:05	21:18	M2-T	Sat	07:55
1Fr17-T-1Sat20	t24	17	Loaded	Fri/Sat	17:25	17:30	17:30	22	Sat	01:40	02:10	3	1:40	2:30	T	Sat	19:15
1Fr18-T-1Sat05	t17	18->16	Loaded	Fri	17:55	18:00	18:00	20	Fri	21:45	23:10	3	22:40	23:53	T	Sat	02:40
1Fr19-T-1Sat17	t09	19	Loaded	Fri/Sat	19:40	19:45	19:45	21	Sat	00:40	00:55	3	0:30	1:19	T	Sat	15:45
1Fr20-T-1Sat11	t05	16	Loaded	Fri	20:50	20:55	20:55	23	Fri	23:30	23:50	3	23:10	1:20	T	Sat	09:30
1Fr22-T-M7-T-???	t03	17	Loaded	Fri/Sat	22:40	22:45	22:45	24	Sat	03:05	03:25	3	2:45	6:06	T-M7-T	maybe after sim finish	
1Fr23-M2-T-M13-T-???	t13	18	Loaded	Fri/Sat	23:20	23:25	23:25	20	Sat	13:05	13:20	3			M2-T-M3-T	maybe after sim finish	
1Sa00-T-M1011-T-???	t04	17	Loaded	Sat	0:20	00:25	00:25	23	Sat	10:50	11:10	3	10:30	12:05	T-M10-11	maybe after sim finish - stored on	
1Sa00-T-1Sun12	t09	20	Loaded	Sat	0:45	00:50	00:50	21	Sat	12:45	13:15	3	12:30	14:15	T	Sun	10:40
1Sa06-ROLA-1Sa15	t16	16	Loaded	Sat	5:55	06:00	06:00	22	Sat	07:05	07:20	3	6:50	7:45	M2 only (Rola)	Sat	12:25
1Sa07-T-1Sat22	t2	16	Loaded	Sat	6:55	07:00	07:00	24	Sat	07:25	07:40	3	7:10	10:16	T	Sat	20:30
1Sa07-T-1Sat18	t6	19	Loaded	Sat	7:50	07:55	07:55	22	Sat	08:30	09:10	4	8:15	9:03	T	Sat	17:35
1Sa09-T-1Sat23	t12	17->16	Loaded	Sat	8:55	09:00	09:00	19	Sat	09:30	10:00	3	9:15	12:29	T	Sat	22:40
1Sa10-T-1Sun16	t3	19	Loaded	Sat	10:30	10:35	10:35	22	Sat	18:10	18:40	4	17:50	19:06	T	Sun	15:30
1Sa11-T-2Mon00	t7	20	Loaded	Sat	11:50	11:55	11:55	23	Sat	16:20	16:50	4	16:00	17:05	T	Sun	23:15
1Sa14-T-2Tue05	t19	17	Loaded	Sat	14:05	14:10	14:10	21	Sun	14:40	15:05	3	14:20	15:08	T		
1Sa17-T-1Sun17	t8	19	Loaded	Sat	17:45	17:50	17:50	23	Sat	20:10	20:40	4	20:00	20:50	T	Sun	09:30
1Sa19-T-2Mon00	t09	20	Loaded	Sat	19:15	19:20	19:20	21	Sat	23:30	23:50	3	23:15	00:04	T	Sun	17:00
1Sa20-M3-T-1Sun06	t1	19	Loaded	Sat	19:55	20:00	20:00	20	Sat	21:05	21:35	3			M3-T		
1Sa21-T-1Sun06	t23	16	Loaded	Sat	21:35	21:40	21:40	23	Sat	23:00	23:15	3	22:00	23:03	T	Sun	03:00
1Sa22-M6-T-2Tue06	t5	15	Loaded	Sat	22:25	22:30	22:30	20	Sun	03:35	04:00	3	3:15	4:44	M6-T		
1Sa23-T-M3-T-2Tue12	t13	16	Loaded	Sat	23:10	23:15	23:15	19	Sun	01:20	01:35	3	1:00	2:05	T-M3-T		
1Sa23-T-2Mon20	t9	19	Loaded	Sat	23:40	23:45	23:45	22	Sun	16:25	16:50	4	16:15	17:11	T		
1Sun00-T-2Mon18	t11	10	Loaded	Sun	00:25	00:30	00:30	14	Sun	10:10	10:40	3	9:50	10:46	T	Mon	17:35
1Sun06-T-P23-T-2Mo23	t2	16	Loaded	Sun	6:10	06:15	06:15	19	Sun	06:35	06:55	3	6:30	7:44	T-P23-T		23:10
1Sun07-T-2Mon01	t1	14	Loaded	Sun	7:15	07:20	07:20	24	Sun	11:20	11:40	3	11:00	12:18	T	Mon	00:55
1Sun10-T-2Mon22	t12	17	Loaded	Sun	10:35	10:40	10:40	19	Sun	11:45	12:15	3	11:15	12:41	T		
1Sun21-T-2Mon04	t17	18->16	Loaded	Sun	21:25	21:30	21:30	19	Sun	23:50	00:10	3	0:10		T	Mon	03:45
1Sun21-T-2Mon12	t9	18	Loaded	Sun	21:40	21:45	21:45	24	Mon	01:30	01:45	3	1:15		T	Mon	?
	t4	14	Loaded	Mon		00:40	00:40	22	Mon	01:15	01:25	3			T		

In port		Sim shunting from port		Outbound train					Remark	
End Shunt	Gate	Start Shunt	End Shunt	Day	Departure	ORA MAD	Track TCM	Load./Emp.		
21:30	3	19:30	21:55	Fri	22:20	21:30	24	15Load/1Emp		
23:55	4	22:50	00:32	Fri	23:59	23:55	23	Loaded	???	
12:20	4	11:40	13:24	Sat (20wg)	13:25	12:20	19	Loaded		
23:20	4			Sat	13:33	13:10	15	Loaded	From T2 to M89 on 19:10 Fr not clear data	
00:25	3	7:30	9:02	Sat	09:05	08:25	24	Loaded	From M2 to T1 on 22:20 Fr	
19:45	4	19:00	19:53	Sat	20:15	19:45	15	Loaded		
03:00	3	3:53	4:56	Sat	05:05	03:00	19	Loaded		
16:10	4	15:30	16:14	Sat	17:10	16:15	15	Loaded		
10:00	3	9:10	11:39	Sat	11:22	10:00	24	Loaded		
					maybe after sim finish				From T1 to M7 on 10:00 Sat not clear data	
					maybe after sim finish					
Molo 10-11				maybe after sim finish - stored on Molo 10-11						
11:15	3	10:20	11:13	Sun	12:33	11:15	20	19-load/1-Emp		
12:40	3	12:10	13:46	Sat	15:40	12:40	16	Loaded		
21:00	3	20:10	21:26	Sat	22:02	21:00	24	Loaded		
18:05	4	17:20	18:15	Sat	18:55	18:05	15	Loaded		
22:55	3	21:30	23:38	Sat	23:35	22:44	24	Loaded		
16:20	4	15:15	16:04	Sun	16:00	16:20	22	Loaded	departure time was set to 17:30	
23:45	4	23:00	23:44	Mon	00:10	23:45	23	Loaded		
until end									wagon out-shunted to track 11	
10:05	3	9:10	9:54	Sun	11:20	10:05	15	Empty		
17:25	3	16:40	17:38	Mon	00:57	17:25	20	Loaded		
03:25	3	3:03	4:10	Sun	06:30	03:25	24	Loaded	not clear data	
									parked until next week	
									parked until next week	
until end									From T2 to M3 on 2:20 Sun	
18:00				Mon	?	?	16	7-load/3-Load	Opicina?	
01:10	3	0:35		Mon	01:58	01:10	22	Loaded		
04:00	3			Mon	04:46	04:00	24	Loaded	no data	
?				Mon	?	?			Arrival after simulation finish	