INTERMODEL EU

Simulation using Building Information Modelling Methodology of Multimodal, Multipurpose and Multiproduct Freight Railway Terminal Infrastructures

Grant agreement: 690658

D1.4 – Internal Progress report prepared and ready for revision in the Intermodel General Assembly meeting 2

Period covered by the report: from 01/09/2016 to 28/02/2018

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This document contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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1. Introduction

The third internal progress report contains the state of development of the INTERMODEL EU project, the respect of the work plan and how far project's objectives and milestones have been achieved.

The period covered by the third internal technical progress report is from September 1st, 2016 to February 28th, 2018 (18 months).

2. Work carried out and overview of the progress

During the first year and a half (18 months) of the INTERMODEL EU project the Consortium has followed the plan included in the Annex I of the Grant Agreement, and also recommendations received from the European Commission.

The tasks already initiated according to the Gantt chart of the Action during the covered period are listed below:

- Task 1.1 General consortium management *(work in progress)*
- Task 1.2 Project meetings *(work in progress)*
- Task 1.3 Project reporting *(work in progress)*
- Task 1.4 Coordination of the project with the EC *(work in progress)*
- Task 2.1 Information and requirements for terminal use cases *(completed)*
- Task 2.2 Integrated planning environment architecture and interface specifications *(work in progress)*
- Task 2.3 Implementation of integrating ICT environment *(work in progress)*
- Task 2.4 Model coordination *(work in progress)*
- Task 2.5 Decision support in integrated planning environment *(work in progress)*
- Task 3.1 Definition of KPI and KRI *(completed)*
- Task 3.2 Setting of pilot cases *(completed)*
- Task 4.1 7thD BIM execution plan *(completed)*
- Task 4.2 Build BIM models of real locations *(completed)*
- Task 4.3 Build BIM models of virtual locations *(completed)*
- Task 5.1 Data collection *(completed)*
- Task 5.2 Ontology and conceptual modelling *(completed)*
- Task 5.3 Development of the simulation component library *(completed)*
- Task 5.4 Coupling of simulation model components with overarching architecture *(completed)*

- Task 5.5 Calibration and validation *(completed)*
- Task 5.6 Experimentation with real cases *(completed)*
- Task 6.1 Simulation model setting *(completed)*
- Task 6.2 Calibration and validation *(work in progress)*
- Task 7.1 Building an operational simulation model of 2 pilot terminals *(work in progress)*
- Task 7.2 Calibration and validation *(work in progress)*
- Task 8.1 Definition and description of functional, economic and environmental analysis *(work in progress)*
- Task 8.2: Assessment of current transportation and logistics studies and statistical data *(work in progress)*
- Task 9.1 IPR protection *(work in progress)*
- Task 9.2 Exploitation *(work in progress)*
- Task 9.3 Dissemination *(work in progress)*
- Task 9.4 Communication *(work in progress)*
- WP10 Ethics requirements *(completed)*

The two tables below shows a summary of the deliverables and milestones already submitted/achieved during the covered period:

Deliverable	**Month**
D1.1 Website and Intranet	M3
D3.1 Study of the state of the art and description KPI and KRI	M3
D1.2 Internal progress report	M6
D1.9 Risk and contingency plan M6	M6
D1.14 Data management plan	M6
D3.2 Pilot innovations and improvements	M6
D5.1 Data model	M6
D9.1 Communication plan 1	M6
D10.1 H Requirements No.1	M6
D10.2 POPD Requirement No.2	M6
D4.1 BIM Execution Plan Guideline	M7
D2.1 Requirements for terminal projects	M9
D5.2 Ontology and conceptual modelling	M9
D9.7 Electronic project brochure	M10
D1.3 First year full technical and financial report	M12

Deliverable	Month
D1.10 Risk and contingency plan M12	M12
D2.2 Integrated planning environment architecture	M12
D3.3 Input data analysis and test scenarios	M12
D9.2 Communication plan 2	M12
D9.13 Conference paper 1 (Integrated planning environment in terminal projects)	M12
D1.4 Internal progress report	M18
D1.11 Risk and contingency plan	M18
D1.15 Data management plan 2	M18
D2.3 Interoperability and data exchange specification	M18 (3 weeks extension)
D4.2 BIM model demonstration of both real locations	M18
D4.3 7thD BIM model of the virtual pilot cases	M18
D5.3 Operational simulation model of the first real-life case	M18
D5.4 Operational simulation model of the second real-life case	M18
D6.1 External mobility simulation model	M18
D9.3 Communication plan 3	M18
D9.8 Exploitation agreement initial version 1	M18

Milestone	Month
MS4 Definition of KPI and KRI	M3
MS5 Characterization of pilot cases	M12
MS1 Check and get the achievement of 1st reporting period objectives (financial and technical)	M18
MS6 Data collection of real terminals	M18
MS7 Approval of the 7th D design of the virtual terminals by WP2 leader	M18 (meeting in Barcelona)
MS9 First demonstration of the library of simulation components	M18

Milestone	Month
MS10 Second demonstration of the library of simulation components	M18
MS11 Results first case	M17
MS12 Results second case (month 24)	M18
MS13 Parameters of BIM virtual design of terminal checked against real terminal operational and maintenance performance	M18

3. Project progress

3.1 Project objectives for the period

From a project viewpoint and according to the project plan, the main objectives of this period are the ones stated in:

- WP1. Management:
  - Manage efficiently the project and the consortium
  - Review and assess the work being carried out
  - Ensure that all aspects of the EC requirements for communication and reporting are met
  - Creating an appropriate management framework linking together all the project components

- WP2. Integrated planning environment and decision support (research activity):
  - Analyze upcoming information requirements for terminal use cases
  - Describe architecture and specify interfaces for integrated planning environament
  - Implementation of integrated planning environament prototype with new functionalities

- WP3. Data & Indicators definitions (research activity):
  - Defining common and specific KPIs
  - Detecting common and specific PIs
  - Setting improvements and innovations to be tested in pilot cases
  - Define test scenarios for the virtual pilot cases

- WP4. BIM Intermodal Terminal (research and innovation activity):
  - Define a BIM Execution Plan that will be included into WP2 Planning Environment
  - Design BIM Railway Terminal Models based on the real locations to test the developed ICT functionalities

  - Design BIM Railway Terminal Models of virtual pilot cases using a holístic multidimensional approach

- WP5. Terminal Operational Simulation:
  - Develop a data model describing all relevant data used in the simulation component library
  - Develop a simulation component library for the operational simulation of all sorts of freight terminals
  - Link the developed simulation experiments by using the simulation component library as part of two case studies
  - Perform operational simulation experiments by using the simulation component library as part of two case studies.

- WP6. External mobility effects:
  - Develop a data model for all sort of intermodal freight terminals
  - Set the simulation model approach and link it to the BIM model and the operation simulation

- WP7. Interconnection simulations:
  - Implement the interconnection simulation to the actual state of the La Spezia-Melzo corridor to calibrate and validate the model

- WP8. Functional, economic and environmental analysis:
  - Definition and description of functional, economic and environmental analysis

- WP9. Exploitation, dissemination and communication:
  - Protect the intellectual property generated during the project
  - Promote and exploit the results of the project
  - Disseminate activities beyond the consortium to a wider audience
  - Promote the action and visibility of EU funding

- WP10. Ethics requirements:
  - Ensure compliance with the ‘ethics requirements’ that the project must comply with

3.2 Work progress and achievements during the period

Work package 1: Management					
WP#	**1**	**Start date:**	**M1**	**End date:**	**M36**

Objectives for the period M1-M18

The aim of this WP is:

- Manage efficiently the project and the consortium.
- Review and assess the work being carried out.
- Ensure that all aspects of the EC requirements for communication and reporting are met.
- Creating an appropriate management framework linking together all the project components.

Description of work carried out and achievements

Task 1.1 General consortium management (M1-M36)

This task includes the following specific tasks:

- Communication with the European Commission
- Finalizing the consortium agreement
- Organization of internal and external meetings
- Reporting
- Encouraging collaboration between partners to achieve the defined deliverables and milestones
- Management related to data used, re-used and compiled during the project
- Writing and distributing the minutes
- Organizing and submitting the project deliverables
- Organizing and submitting cost statements
- Resolving administrative, contractual and consortium coordination issues

At the beginning of the project, several templates were shared among all partners for progress reporting. All of them were explained in an online meeting, and they were presented for the second time in the first global meeting held in Kiruna.

During the first project eighteen-month period, some particular issues were solved among partners, and communicated to the European Commission.

Risk activation plan

One of the project partners, DHL, reported at the beginning of November 2016 the possible activation of Risk 6 'Under resourced Partner/task/WP'.

During the last six months, risks 4 'Coordination, coherence and synchronization of progress on work packages', 6 'Under resourced Partner/task/WP', 11 'Failures in the software interoperability text' and 17 'Data collection difficulties' have been activated.

Several online follow-up meeting have been held in order to review the work done and on-going activities and agenda.

Several online meetings were initially held to discuss about exploitation and dissemination activities, and about possible conference papers that could be written throughout the project. During the first general meeting held in Kiruna, an Exploitation Workshop was carried out to know partners' expectations, while in the second general meeting held in Espoo, a workplan was presented to develop the Exploitation Agreement meeting deadlines of the 4th versions of the document.

Task 1.2 Project meetings (M1-M36)
The objective of this task is to ensure good collaboration and exchange of ideas and results in the project. For that purpose, the first meeting, the kick-off, was held in Barcelona at the beginning of the project.

General Assembly meetings held during the first eighteen-month period are:

- First GA meeting in Kiruna, from 4th to 6th April 2017, after the first 6-month period;
- Second GA meeting in Espoo, from 20th to 22th September 2017, after the first 12-month period.

Main objectives of these meetings are:

- Review partners' effort, appropriate development of tasks and possibility of risks activation;
- Review deliverables submitted;
- Review the work done and explain next steps and what is expected from each partner in each WP;
- Check if financial and technical targets are being met, and undertake remedial actions, if required.
- Discussion about project dissemination (scientific and research publications, proposals, etc.)
- Workshops in order to discuss technical issues.

The third General Assembly will be held in Barcelona (Spain). A preliminary program has already been proposed by co-organizors FGC-CENIT-IDP, including project meetings to discuss the status and work packages situation, group discussions on relevant and urgent issues, and upcoming work.

Task 1.3 Project reporting (M1-M36)
The present document is the integrated report done every six months to keep the EC and partners informed about the project progress.

Task 1.4 Coordination of the project with the EC (M1-M36)

IDP as INTERMODEL EU coordinator, has coordinated and followed-up with respect to all measures taken for the purpose that all the commitments agreed upon with the Commission are met, ensuring also the good progress, financial and technical, of all the tasks and requirements of the Commission.

Under this task, deliberables D1.2 'Progress report M6', D1.3 'Progress report M12', D1.9 'Risk and contingency plan M6', D1.10 'Risk and contingency plan M12', D1.11 'Risk and contingency plan M18', D1.14 'Data Management Plan 1', D1.15 'Data Management Plan 2' and the present report have been submitted according to the project schedule.

Deviation from work plan & remedial action

At the moment no deviations from the work plan are foreseen. However, according to the progress of work done, partners are suggesting that time extension in some of the work packages would be positive for the whole project (better synchronization between WPs). This would allow a better development of the tasks included in the project without affecting total budget and working on Solutions to face interoperability barriers found.

In addition, some risks have been activated along this first 18 months. Up to now, when a problem has been found, partners have tried to solve it in a proper manner so that the scope of the project is not affected.

Work package 2: Integrated planning environment and decision support

WP#	2	Start date:	M1	End date:	M32

Objectives for the period M1-M18

The aim of work package is to develop a holistic integrated planning environment that enables technical management of modelled terminal projects and supports making decisions on assets throughout the life cycle. The environment will extend utilization of various building and infrastructure models (BIM and infraBIM) from planning, design and construction towards the operational economic and environmental performance analyses in freight terminals. The outcome aims at increased interaction between participants and enhanced processes for making decisions. Work is necessary for the whole project, and is closely connected with indicators to be developed (WP3), pilot modelling (WP4) and operational simulation (WP5).

The objectives of this WP during the reporting period have been:

- Task 2.1: Analyze upcoming information and requirements for terminal use cases

- Task 2.2: Describe architecture and specify interfaces for integrated planning environament
- Task 2.3: Implementation of integrating ICT environament
- Task 2.4: Model coordination
- Task 2.5: Decision suport in integrated planning environment

Description of work carried out and achievements

The work during this period has first aimed at considering information requirements for the integration ICT environment. Based on the requirements, three use cases have been described leading to ICT architecture with interfaces. Based on these descriptions and specifications the implementation work for ICT environment has started. At the same time, the work package has supported generation of pilot terminal models in WP4. Results from work have been written into a conference paper. We have also been developing a specification for data exchange enhancing interoperability for the platform.

Collaboration during the period has included consortium meetings, work meetings, pilot terminal visits, and regular on-line meetings. Need for regular online meetings has been high due to technologies and interfaces used for integrating models, simulation and indicator data.

T2.1 Information and requirements for terminal use cases (M1-M9)

Overview of the activities within Task 2.1

- Terminals have been analyzed, based on their functional areas. Target is to have a general breakdown structure for terminals, applicable for model-based planning.
- Starting point for work has been key performance indicators developed in WP3 (D3.1). Their importance and characteristics have been considered through on-line meetings. We have also identified how indicators can be visualized in model based planning, through e.g. highlighting objects or areas from terminal visualization.
- Terminal operational simulation has been considered regarding information needs, and considered in relation to planning in kick-off meeting in Barcelona Spain (September 2016), pilot terminal visits to Melzo intermodal inland terminal and the port of La Spezia in Italy (March 2017), partner meeting in Kiruna Sweden (April 2017) and many WP2 on-line meetings held in between.
- D2.1 'Information requirements for terminal use cases' final deliverable published (Deadline M9). The deliverable explains terminal functional areas, assesses terminal performance with indicators, and introduces three use cases to be implemented in INTERMODEL EU project. These three use cases are introduced for implementation: 1) strategic indicators, 2) planning

coordination, and 3) integrated simulation. The information needs for terminals and their derived requirements are formulated to model-based approach prepared together with operative simulation to enhance performance, economy and reduce risk over life cycle.

T2.2 Integrated planning environment architecture and interface specifications (M4-M18)

Overview of the activities within Task 2.2

- We have considered software architecture that allows models form different planning software to be utilised, and visualised into same integrative planning environment. The planning architecture has several data interfaces to bring together various technologies. Utilising open standards in platform interfaces, to improve interoperability in terminal projects across countries.
- Regular online meetings between in WP2 to technologies and interfaces relevant to platform to integrate BIM based design to operative simulations and indicator data. Participation to seminar with focus on open data exchange formats in infrastructures and buildings to get recent R&D overview (infraBIM open, Tampere 6-7.2.2018). Software vendors (e.g. Autodesk, Bentley, are recognising open formats and efforts are coordinated also at European level (e.g. EUBIM).
- The planning architecture has several data interfaces to bring together various technologies. Utilising open standards in platform interfaces, to improve interoperability in terminal projects across countries. Several data exchange formats have been identified, such as geographic elements (LandInfraGML, CityGML), buildings (IFC), and infrastructure data (LandXML, RailML).
- D2.2 “Integrated planning environment architecture” final deliverable published (Deadline M12). The deliverable gives an outlook to the trends and challenges in multimodal terminals and explains model based work practices in terminal development. Then, the software architectures for decision support platform is explained at high level and illustrations for key components presented. Finally, the utilisation of use cases is proposed and the architecture discussed.
- Results from work have been published to a conference paper on Integrated Planning Environment, and it has been accepted to TRA 2018 (16-19 April). Work was published in WP9: Exploitation, dissemination and communication (D9.13).
- D2.3 “Interoperability and data exchange specification” is under development. Several data Exchange formats have been identified, such as geographic elements (LandInfraGML, CityGML), buildings (IFC), and infrastructure data (LandXML, RailML). The use of these format in multimodal context is considered within the deliverable. Primary open formats used are IFC and LandXML. Deadline for deliverable is M18, and we propose a short extension period of 3 weeks to complete the work. The work in interfaces in BIM, InfraBIM, GIS, operative simulations and indicators have taken more attention than expected

at the beginning. More time is needed especially for agreeing interface between simulation, terminal models and indicators, based on a generic format to be developed later in the project as part of the platform implementation. The consideration of interfaces at early phase of platform implementation has also complicated working. The deliverable will be published well in advance to a mid-term review event in April.

T2.3 Implementation of integrating ICT environment (M12-M30)

Overview of the activities within Task 2.3

- The task has started. When the development goes further, the platform will be tested together with simulation information (WP5) with freight terminal models (WP4) from the pilots.

T2.4 Model coordination (M12-M24)

Overview of the activities within Task 2.4

- The task is ongoing, with main focus on supporting the generation of individual terminal BIM models in multimodal pilots.

T2.5 Decision suport in integrated planning environament (M16-M32)

Overview of the activities within Task 2.5

- The task is ongoing, primarily concentrating to discuss how platform is able to support decision making. At this point the indicators are seen as an added value for decision makers – they provide tangible information how various functional part at the terminal, and terminal as a whole, are performing.

Deviation from work plan & remedial action

Inconsistencies found in the DoA regarding this WP and approved by consortium are as follows:

- D2.1 Requirements for terminal projects: due date M9 instead of M6
- D2.6: Gaming technology in interactive operational visualization: due date M32 instead of M30
- Task 2.1 duration from M1 to M9 (instead from M0 to M9)
- Task 2.2 duration from M4 to M19 (instead from M4 to M12)

As abovementioned, there is need to extend deadline for D2.3 by 3 weeks as interaction between WP2 (general architecture) and WP4 – WP5 has taken longer than expected.

The delay in submission of D2.3 does not entail any impact on the other activities included in this work package, and has no impact in the proper development of the whole project.

Work package 3: Data and Indicators definitions

WP#	3	Start date:	M1	End date:	M12

Objectives for the work package (completed in the first mid-term)

WP3 is completed.

The aim of this WP is:

- To establish a set of Key Performance Indicators (KPIs) for the assessment of intermodal freight terminals through an ICT environment. Therefore, to define the relevant outputs of the different modulus of the decision support platform in terms of KPI and PI;
- To define the improvements and innovations that will be tested in pilot cases that will be studied using the provided assessment tool;
- To define test scenarios for pilot cases.

Description of work carried out and achievements

Task 3.1 Definition of KPI and KRI

Within T3.1 and deliverable D3.1, the following work has been done:

The work carried out in order to develop the deliverable D3.1 provides a complete set of KPI and PI. These KPI and PI have been selected after a wide revision of the state of the art and a discussion among partners in a workshop held in Melzo and La Spezia.

On the one hand, a state of the art review was carried out, and a large list of KPIs was developed according to the information gathered. On the other hand, all partners involved in this task, made a list of the most important performance indicators in compliance with their interests and objectives in their daily activities (operators, public bodies, haulers, etc.). Thus creating a new list of KPIs to be discussed during the workshop held in Melzo and La Spezia, together with the list obtained from the state of the art review.

In addition, after some discussions among FGC, CENIT and IDP, a methodology for choosing KPIs was defined. In such context, taking inputs from previous approaches, the method of KPI and PI selection proposed for the INTERMODEL EU project is introduced as follows:

- Identification of the strategy and mission of the organization;
- Identification of stakeholders involved;
- Identification of the different perspectives that should be considered in the performance system;
- Identification of particular strategic goals;
- Selection of effectiveness criteria and feasible KPIs and PIs set.

The working meeting was held at Contship Italia and Autorità Portuale della Spezia during the 20th and 21st of October 2016, had the following objectives:

- Obtain information of the intermodal terminals and its daily operations. Contship Italia and La Spezia added their feedback according to the specific features of their inland and seaport terminals;
- Explain the proposed methodology for KPI definition and review about the state of the art of KPI;
- Show a list of indicators used by other research projects and scientific community.
- Start the discussion about appropriate KPI that should be used for the assessment of the terminals and that should be obtained from the models developed.

The meetings held throughout this task are:

- 18/10/2016 → Internal meeting FGC + CENIT + IDP (FGC headquearters), to share findings from the three partners and define the methodology to select the most appropriate performance indicators.
- 25/10/2016 → Internal meeting CENIT + IDP (CENIT headquarters), to discuss about main conclusions from the working meeting in Italy, and create the matrix to be distributed among partners and get an approval in order to set the KPI list for the deliverable D3.1.

The list of KPI is useful to:

- Analyze the state of the art in application of KPI and KRI in intermodal freight terminals
- Split the terminal operation into different processes and transport modes
- Choose an adequate aggregation level of the relevant variables for each dimension (productivity, service quality, financial costs, sustainability, etc.)

Others:

Additional review of the set of KPIs included in D3.1 has been carried out once the deliverable was submitted, in alignment with the Task 2.1 objectives.
The meetings held in order to discuss if the project should keep all the list as presented in the D3.1 or if a short list of strategic KPIs should be added into the information requirements deliverable D2.1 are described below:

- 02/02/2017 → On-line meeting between VTT (WP2 leader) and CENIT+IDP (involved in Task 3.1, WP3), to discuss about the need of including/not including the long list of KPIs.
- 07/02/2017 → Internal meeting FGC + CENIT + IDP (FGC headquarters) to justify the need of maintaining the long list as included in the deliverable D3.1 and also confirm if they can be obtained from terminal simulations, traffic simulation models and BIM models.

Task 3.2 Setting of pilot cases
Subtask 3.2.1 Pilot innovations and improvements

Within T3.2 and deliverable D3.2, the following work has been done:

The work carried out in order to develop the deliverable D3.2 is focused on firstly, analyzing the tendencies in logistics, and secondly, on selecting a number of technological and operative innovations to be implemented into the four pilot terminals (La Spezia container seaport terminal; Milan-Melzo container dry port; Virtual bulk-container seaport terminal; and Virtual bulk-container inland terminal).

After analyzing main tendencies, FGC and IDP created a questionnaire that was distributed among Consortium partners and stakeholders (operators, constructors, operators, etc.) in order to know innovations foreseen in the design and management of intermodal terminals. The answers and information received have been gathered and analyzed, coming up with the main improvements to be considered within the project.

Most relevant innovative solutions that should be taken into consideration when modeling the terminal cases are the following:

- Internet of things
- Intelligent traffic guidance systems and Intelligent freight cars which will constrain the layout design
- Alternative container design
- Liquefied Natural Gas (LNG)

In addition, improvements developed within OPTIRAIL (its use was analysed by VIAS taking into account the available data provided) and WiderMOS projects will be considered when modelling the real terminals, and also projects that both Contship Italia and Autorità Portuaria della Spezia are going to implement in the short/mid-term.

La Spezia Port Authority provided information about the improvements planned for the port terminal. They will be taken into consideration when modelling and simulating the real seaport terminals throughout the project.
The two main improvements and innovations related to the future development of the project are:

- New railway terminal design, together with a shunting software tool that will support the shunting operation within the port;
- Extension and improvement of the Corridor Management Platform, in relation with the tool developed within the WiderMoS project.

Contship Italia provided some information about the projects they are about to implement in order to enhance the overall terminal performance:

- Conversion of F3 warehouse into temperature controlled warehouse;
- Implementation of a third gantry crane;
- Four new shunting rail trucks.

All this information will be used as input data together with the test scenarios defined in the following subtask. This will allow to correctly defining the four pilot cases using the BIM methodology.

The meetings held throughout this task were:

- 16/12/2016 → Internal meeting FGC + IDP (FGC headquearters), to start working on this task and defining the questionnaire.
- 20/12/2016 → Meeting with a partner involved in the WiderMOS project who explained main project findings to FGC and IDP (FGC headquarters).
- 03/02/2017 → Internal meeting FGC + IDP (FGC headquarters) to analyze the information gathered from the questionnaires received from partners and stakeholders, and deciding what to include in the definition of the models.

Subtask 3.2.2 Test scenarios

Within T3.2 and deliverable D3.3, the following work has been done:

On the one hand, and before setting the test scenarios, CSI and APSP have analysed the historical demand of their own terminals and according to local and national market trends, have done a forecast of the future demand.

On the other hand, a benchmark on capacity of European terminals has been carried out to be able to determine a representative capacity, which is one of the basic design parameters for the virtual terminals.

Partners involved have proposed different scenarios according to different elements that can have an impact in multimodal terminals such as global economy and logistics trends and according to several attributes that must be determined previously to the design of the terminal (such as climate conditions, which play an important role when determining more appropriate construction materials, costs to calculate initial investment and operational expenditure, process times that might be affected by equipment, congestion, etc.). Also, track and interoperability parameters for railtrack model design were analysed by VIAS.

The meetings held throughout this task were:

- 04/05/2017 → Internal meeting FGC + IDP (FGC headquearters), to discuss how to proceed on the definition of the test scenarios and start gathering the information from CSI and APSP.
- 30/05/2017 → Skype Meeting between CSI and IDP to discuss about data needed to develop the test scenarios.
- 16/06/2017 → Internal meeting FGC + CENIT (FGC headquarters) to analyze the information gathered from CSI and APSP and discuss how to organize the definition of the test scenarios of the virtual terminals.

- 07/07/2017 → Call via Bluejeans among all partners involved in the task. Discussion on what scenarios should be considered taking into consideration how the terminal and traffic simulations work, information provided by Macomi and Cenit respectively.
- 26/07/2017 → Call via Bluejeans among all partners involved in the task. Discussion on the information provided by Macomi and Cenit about the simulations and definition of the test scenarios.
- 28/08/2017 → Internal meeting FGC + IDP (FGC headquearters), to discuss about elements identified having an impact in the future multimodal terminals and finish the deliverable.

Once this task is completed, the four pilot cases have been defined and also different scenarios to be tested when using the BIM methodology.

The three deliverables proposed under this work package have been already submitted according to the DoA.

Deviation from work plan & remedial action

From a technical point of view, there has not been any deviation from work plan.

Inconsistencies found in the DoA regarding this WP and approved by consortium are as follows:

- FGC should appear as WP3 leader instead of VIAS
- The acronym KRI is defined as Key Risk Indicator, and should be Key Result Indicator
- D3.2 Pilot innovations and improvements is a report and not a demonstrator activity

Work package 4: BIM Intermodal Terminal

WP#	4	Start date:	M4	End date:	M19

Objectives for the period M4-M18

The objective of this Work Package during the reporting period is to develop the terminal models which will be the keystones that will allow proofing the validity of the proposed ICT Planning Environment as well as virtually testing in the model the potential improvements of the proposed innovations by their implementations in upcoming months. To reach the objectives, main activities carried out during the reporting period are:

- Defining a BIM Execution Plan (BEP) that must be included into WP2 Planning Environament

- Designing BIM railway terminal models based on the real locations to test the developed ICT functionalities
- Designing BIM railway terminal models of virtual pilot cases using a holistic multidimensional approach to optimize desired criteria set in WP2
- Implementing inside the virtual terminals models the proposed innovations listed in WP3 to assess their impact on the indicators.

Work developed here is closely related with planning environment (WP2), operational simulation (WP5) and traffic simulation (WP6).

Description of work carried out and achievements

Task 4.1 7thD BIM Execution Plan (BEP) (M4-M7)

Task 4.1 was done in months M4-M7. This task was focused on developing the BIM Execution Plan, which will serve to define the scope of BIM implementaion, describing team characteristics needed to achieve the modelling, the process impacts of using BIM, contract recommendations for BIM implementation, and the appropriate level of modelling of the different elements and categories of the terminals to better optmize the dedicated resources.

The BIM Execution Plan was developed:

- Elaborating a checklist with main sections that must be covered by the BIM Execution Plan and initial contents;
- BEP document structure was presented to the involved partners according to initial checklist and was used for content development.
- BEP checklist recorded BIM and Data requirements identified by each partner.
- Previous list with data requirements in order to develop the BIM models of the real and virtual terminals. This list was organized according to the following information typology: design parameters (layout, differentiating among seaport terminal/inland terminal/railway connection/road connection), equipment, operational parameters, boundary conditions, operations classification (per areas, per activities, etc.), and measures with regard to production/productivity/utilization/service/performance.
- Online discussions on how project KPI's and simulation requirements affect BEP.
- Meeting in Barcelona in March 23rd – 24th, 2017 (VIAN, IDP and BASF) for a 2-day workshop in order to finalize the BEP.
- Last review during the visits of Melzo and La Spezia terminals in March 30th – 31st, 2017.

The scope of the BIM Execution Plan will be limited only to develop procedure to meet the needs of planning the implementation of BIM throughout the project lifecycle, being tested afterwards through its use of the proposed pilot case evaluation along the subsequent tasks included in the Work Package.

The BIM Exection Plan is described in Deliverable 4.1 that was submitted in M7 (March 2017).

Task 4.2 Build BIM models of real locations (M8-M18)
Task 4.1 was done in months M8-M18. The two models for the real locations have been developed according to schedule.

Work developed under this task can be divided into two phases as follows:

Phase I, focused on data collection.

- Information was collected from CSI and APSP in order to know better the existing infrastructure and identifying basic information required for the construction of the digital model. Main data and information have been provided in CAD and Excel files.
- Data collection during visits of the Melzo and La Spezia terminals in March 2017.

Phase II, focused on construction and parametrization of the information gathered with BIM technology.

- A data base has been created following the elements categorization proposed by the BIM Execution Plan for both inland/seaport intermodal terminals:
    - Waterside area
    - Quayside transport (equipment)
    - Stacking areas
    - Loading/unloading areas
    - Internal transport areas (road and rail)
    - Gates and connections
    - Auxiliary buildings (warehouses and offices)
    - Utilities.

  The information included is related to: physical, operational and simulations attributes, and costs regarding main infrastructure and equipment present in the intermodal terminals.

This information has been utilized for developing the components in each category defined, and has enabled to develop the models for the real locations in LOD150 (Level Of Detail) and LOI300 (Level Of Information).

Different sets of libraries containing families created have been defined for modeling according to the needs of intermodal terminals. Some of thse families have been created using Application Programming Interface (API) and some have been created by IDP.

In addition, a data base regarding the 4D, 5D, 6D and 7D of the BIM models have been thought and created to be utilized in the BIM models of the virtual locations developed

in the subsequent task. BIM models have been linked to different data base using C Sharp programming language.

Each library contains:

- 3D – Physical and geometrical data
- 4D – Scheduling (planning based on individual items construction time and knowhow of the Consortium)
- 5D – Estimating (data base with costs provided by partners' knowhow, IDP, BASF, BED, VIAS)
- 6D – Sustainability (CO_2 emissions reduction and material savings according to the maintenance plans proposed for pavements and/or buildings)
- 7D – Facility Management Applications (based on LCC it will be possible to choose the best practice from a point of view of building maintenance, which will allow to get information regarding CAPEX, OPEX, life cycle cost savings and material savings)

Concurrently, continuous work was done together with MAC for the coupling between BIM model and simulation. As explained in WP5, firstly, a data structure was established with the necessary components needed for the simulation model layout. However, as the interoperability between softwares used was more complicated than expected, real terminals layouts with the simulation attributes were also developed with QGIS in order to provide .sqlite files to MAC, who was working at the same time with the simulation and its performance through experiments using the simulation component library as part of the two case studies. In addition, layouts for the external mobility simulation have been also developed in QGIS in order to provide .shp files to CENIT, who is working on the external mobility simulation, after establishing the data structure according to required components to take into account.

BIM models of both real locations are described and shown in deliverable D4.2, submitted in M18 (Februray 2018).

Task 4.3 Build BIM models of virtual locations (M8-M18)
This task focused on the development of the virtual location models takes into account outcomes from other work packages (especially WP2, WP3 and WP5).

For the tool being created, partners involved have considered the possibility of defining three different stages depending on the degree of advancement of the project, already established in the BIM Execution Plan. The three stages defined in the BEP corresponding to the different BIM goals throughout the project lifecycle are:

- Feasibility study and planning: Interactive and visual terminal planning (new tool being developed with libraries for Revit)
- Basic design: Design analysis, quality
- Construction project: constructability analysis and efficient construction and maintenance

In order to draft the new terminals from a multidisciplinary and a holistic point of view, using the same categories defined in the BEP and also applied in the BIM models for the real locations, and through an interactive way, dialog boxes have been created to be able to model alternatives reducing time required, and getting information and indicators rapidly, facilitating the decision making.

With the aim of creating terminals in an automatic way improving quickness and the quality of the decision-making, the following steps have been taken:

1. Identification of elements that can be modelled
2. Programming for the creation of the geometric elements and definition of libraries
3. Programming for the assignment of necessary attributes in order to obtain the KPIs selected in WP3 in subsequent tasks

All programming work has been done with C Sharp language.

Once the tool for building terminals automatically was created, two BIM models of virtual locations have been built as follows:

1. Initial required data: area and shape; location and annual volume throughput;
2. MAC with a tool obtains a first sketch layout design and minimum requirements for the appropriate operation of the terminal;
3. IDP develops the models with the tool created, considering also equipment requirements together with MAC, obtaining the indicators selected in WP3. In this process, the 'virtual customer' gives his opinion and supervises and controls the evolving design.

After this steps, a simulation should be run to get the operation indicators, and then, an iterative procedure starts in order to improve the design and get better results (better indicators compared with the previous). In this task, no innovations are used.

The two virtual terminals have been built based on the properties already defined in WP3. However, there have been some internal discussions on the inclusion of bulk in multipurpose terminals as explained in deliverable D4.3

BIM models of both virtual locations are described and shown in deliverable D4.3, submitted in M18 (Februray 2018).

Task 4.4 Optimization of first 7D static KPIs (M14-M19)

Work under this task has already started and it has been focused on the calculation of KPIs established in WP3 with the aim of comparing the virtual terminals built in Task 4.3 and the virtual terminals improved with the innovations projects determined in WP3. Calculations to obtain the indicators are done in an excel file (exporting data from the BIM model and importing results to the dashboard which is being defined in WP2).

The implementation of innovations in both virtual terminals should lead to an improvement of the terminal indicators, that will be analysed by the team. Based on

the category which the innovation belongs to (Superstructure; Handling; Auxiliary Systems; Railway tracks and internal roads; Rolling stock), the corresponding leader together with CSI and APSP are developing detailed briefing so that the BIM model can be modified accordingly. After this, the team will make decisions on which the best way to implement the innovation is based on the assessment of the 7th Dimensions.

Innovations to be implemented were previously defined in WP3:

- La Spezia real model is modified with the new railway terminal design and the inclusion of the CMP. The improved maintenance scheduling for the railway interconnection will not be developed as the planning for WP7 is not overlapped with the present task.
- Melzo real model is modified with the third gantry crane, four new shunting rail tracks, second gate in/out, conversion of F3 warehouse into temperature controlled warehouse. The improved maintenance scheduling for the railway interconnection will not be developed as the planning for WP7 is not overlapped with the present task.
- Virtual pilot case 1 is modified with alternative container design for bulk cargo/reefer container and LCA new materials.
- Virtual pilot case 2 is modified with automated and robotized equipment and LCA new materials.

Pilot cases alternatives including innovations and improvements and optimization of the KPIs will be reported in the Deliverable D4.4. IDP suggests to extend the duration of Task 4.4 so that it can be developed in parallel with simulations carried out by MAC under WP5, and try to optimize indicators through iterations.
In addition, as Optirail and maintenance plans can not be included as expected, VIAS is proposing an alternative track maintenance methodology to be developed within WP7, that could be implemented as well in the terminal models.

Deviation from work plan & remedial action

According to the original project planning WP4 started in M4 and ended in M19. However, IDP suggests to extend the duration of the work Package after month 19. Instead of completing the works in M19 (March 2018), it is proposed to work on the optimization of first 7D static KPIs, and this work should be done together with MAC to be able to get indicators coming from both the BIM model and the simulation.

Also, as it is mandatory using compatible formats, effort is being made by IDP and MAC to automatize the export of the layout (geometry and attributes) from BIM to the simulation without drafting layouts with QGIS.

Main reasons for this extension are:

- Including case studies and analysis of resulting KPIs from both BIM model and simulation, enabling the team to assess results from both points of view. In addition, although library components have already been thought to be aplicable in general terminals, more time would allow to improve the applicability of the decision support environment.

- Interaction between WP2 (general architecture) and WP4 is taking longer and more effort than expected.
- Further development of the interface between BIM and simulation component library is needed. Since simulation softwares (for both terminal and external mobility simulations) do not read BIM formats, IDP is encouraged to work on the export of SQLite and SHP files from BIM models to simulation. If this is achieved, it will not be necessary to go through an additional software (QGIS or ARCGis) to create manually the layouts with associated data.
- In addition, during this period, some tests could be carried out for basic and construction design projects (second and third phase defined as abovementioned). This would allow to improve the overall tool being developed and the methodology to follow during the decision-making.

IDP suggests continuing with WP4 after month 19:

- Original period: M4–M19
- Proposed period: M4-M28 (extension for tasks 4.3 and 4.4, to further study on models for virtual locations and optimize KPIs; and improvement of the interface between BIM and simulation)

If this extension is accepted, deliverable D4.4 should be submitted in M28 and results coming from both model and simulation will be used to show the optimizacion of KPIs.

This fact will not have any impact in the proper development of the whole project.

Work package 5: Terminals operational simulations

WP#	5	Start date:	M1	End date:	M17

Objectives for the work package (completed in the first mid-term)

The objective of this work package is to build a decision support environment that supports in optimizing the design and the operational performance of intermodal freight terminals. To reach this objective we will:

- Develop a data model that describes all relevant data used in the simulation component library.
- Develop a simulation component library (the decision support environment) for the operational simulation of all sorts of freight terminals.
- Link the developed simulation component library to external systems, such as integrated planning environment.
- Perform operational simulation experiments by using the simulation component library as part of two case studies.

Description of work carried out and achievements

Task 5.1 Data collection

Task 5.1 was executed in months M1-6. The goal of this task was two-fold. First, to develop a data model that describes what data is used in the operational simulation component library. Second, to collect data from the real cases.

The data model was developed based on:

- Earlier simulation studies that have been conducted by Macomi in 2015-2016. These include intermodal terminals and rail simulation studies in Europe, USA and Asia.
- Kick-off meeting Intermodel project (September 2016 in Barcelona).
- Internal meetings within Macomi (September 2016 – March 2017).
- External meeting of the Macomi team with terminal operators (RSC Rotterdam, APM Terminals Rotterdam) and consultants on intermodal ports (DHV Rotterdam).
- Several internal (online) project meetings between Macomi, VTT, VIASYS and IDP.
- Visit of the Melzo and La Spezia terminals in March 2017.

Once the data model was developed. The actual data was collected for the real cases, Melzo terminal and La Spezia terminal. The following steps were taken:

- Data collection by Contship Italia (Melzo / La Spezia).
- Data collection by IDP on the layout of the terminals.
- Data collection during the Macomi visit of the Melzo and La Spezia terminals in March 2017.
- Preparation of the data to enable to import the collection data into the simulation component library. This involved data cleansing, data aggregation and interpreting the collected data.
- Several internal (online) project meetings between Macomi, VTT, VIAS, CENIT and IDP.

The results of Tasks 5.1 are described in Deliverable 5.1. Deliverable consists of two parts:

- Data model.
- Data requirements document.

The data model is (together with the conceptual modelling) the basis of the library of simulation components. Deliverable 5.1 (part 1 and part 2) is finished and has been submitted to the project coordinator according to the project schedule. Deliverable 5.1 was submitted in M6.

Task 5.2 Ontology and conceptual modelling

The ontology and conceptual modelling was carried out in the period of M3-M9, and was delivered according to schedule.

The following inputs were used to develop the ontology and conceptual modelling:

- Earlier simulation studies that have been conducted by Macomi in 2015-2016

- Scientific literature of the state of the art
- A study on the Industry widespread terminology
- Several internal (online) project meetings between Macomi, VTT, VIAS, CENIT and IDP.
- General Assembly meeting of the Intermodel project (in Barcelona M1, Kiruna M6 and Espoo M12).

The ontology consists of taxonomy of terms used in the problem area, complemented with the description of interrelationships among them. With this specification, it is exactly known which concepts are described by which phrases, improving the communication for the project. Validation of the ontology and conceptual model has been carried out with terminal experts (see task 5.1) as well as during the visit to La Spezia and Melzo in March 2017.

Conceptual models are abstract formulations of the ideas, concepts and relationships to be expressed in the simulation. Using the ontology they describe how real-life processes and rules are represented with strict formalisms like UML or BPMN.
The conceptual modelling contains:

- UML class diagrams
- Process flow diagrams
- Cargo flows diagrams

The ontology and conceptual models are described in Deliverable 5.2 that was reviewed by the project team and submitted in M9.

Both ontology and conceptual models were used as the basis for the development of the simulation component library (task 5.3) and the two simulation models.

Task 5.3 Development of the simulation component library
A simulation component library has been developed according to schedule. Several internal and external meetings have been held to study:

- Which existing simulation components to reuse from the Macomi Prescriptive Simulation Platform (PSP platform, see www.macomi.nl).
- Which existing simulation components can be modified from the Macomi Prescriptive Simulation Platform, adapting to the requirements of the project and cases to investigate,
- What components to develop from scratch.

Some external parties were involved in the meetings:

- A Terminal Operating System supplier (TOS) – December 2016.
- Port of Rotterdam – December 2016.
- Several terminals – December 2016 – January 2017.
- Delft University of Technology, Erasmus University Rotterdam – September 2016 - January 2018.

Simulation components were developed to suit the needs for both cases of Melzo and La Spezia, as well as other similar intermodal terminals, including all the required infrastructure and equipment. The developed components can be divided into several categories:

- Containers with sizes, types and limitations
- Stacking infrastructure: Stack blocks, ground spots, crane rails and transfer lanes
- Terminal infrastructure: gates, yards
- Networks: road and rail with traffic rules
- External vehicles: trains, vessels and trucks
- Equipment: terminal tractors, reach stackers
- Cranes differentiating types into: STS, RTG, RMG
- Control logic for a terminal operating software (TOS)
- User interface
- KPI's as per D3.1 and additional KPIs

Developed components within the simulation were demonstrated to the project partners:

- Several internal (online) project meetings between Macomi, VTT, VIAS, CENIT and IDP.
- The Melzo case study was demonstrated at the General Assembly meeting in Espoo M12 (see Deliverable 5.3 and Milestone 9). The results have been reported in deliverable D5.3 reaching milestone MS11.
- More workshops and further demonstrations are planned for the General Assembly meeting in Barcelona M19 (see Deliverable 5.4 and Milestone 10). The results have been reported in deliverable D5.4, thus reaching MS12.

Task 5.4 Coupling of simulation model with overarching architecture

Simulation has been coupled to the layout coming from the BIM model, so that the same infrastructure information can be used both in WP4 and WP5.

Firstly, a data structure was established, comprising necessary components for the simulation model layout, their properties and their way of representation in the drawing. Layout was organised into several layers to seamlessly import varying components, assigning them as correct objects (e.g. road link or rail track).

Exported files in a database using .sqlite format can be imported into the Macomi's map editor, inspected as well as altered if necessary. Then the layout can be directly used in the simulation experiments.

Validation for the import functionality has been carried out in several stages, also taking into account the differences between requirements for Melzo and La Spezia terminals. Verification and validation efforts firstly included importing test to Macomi's map editor and visual inspections at the terminals. Then semi-automated test per logical groups of components, e.g. railway and road networks and stack blocks to see

whether these are defined correctly and can be used in the simulation model and displayed in the simulation animation.

An export possibility from the map editor in the simulation component library to the BIM model is currently being developed as a complementary feature allowing to gather all layout information from various sources in one place easily, especially added logistics featured for the simulation. This will allow to combine expert knowledge from different sources in one. Functionality to export simulation output data (animation and KPI's) is being developed.

Foundations for the simulation coupling to traffic microsimulation were established. The demarcation has been fixed at the truck gate, so that all activities to happen on a terminal are part of the terminal simulation model and the truck transit beyond (as well as from on departure) is managed by the traffic microsimulation. Format and parameters exchanged were agreed upon and the connection was created.

Task 5.5 Calibration and validation

The calibration and validation of the simulation library was executed in a number of steps:

- Compare the results of the simulation component library to earlier simulation studies that have been conducted by Macomi in 2015-2016. These include intermodal terminals and rail simulation studies in Europe, USA and Asia.
- Expert validation. The simulation component library was demonstrated to several expert from the field of designing intermodal terminals and operational experts working at intermodal terminals. Validation efforts included validation workshop with experts involving model walkthrough, and statistical analysis of the outputs, comparing them with historical data.
- Validation of the results of the simulation component library to the results for the first real case (Melzo terminal).
- Validation of the results of the simulation component library to the results for the second real case (La Spezia terminal).

The parties to assist with the validation efforts:

- Intermodal terminal operator (APM Terminals Rotterdam, RSC Rotterdam, Contship Italia, etc.).
- Port authorities of Rotterdam.
- Universities with research on intermodal terminals (Delft University of Technology, Erasmus University Rotterdam and University of Groningen).

Simulation models for both cases were confronted with the operational performance data from the terminals in order to identify any discrepancies and counteract them. Calibration mostly relates to setting the correct values for abstract variables for vehicle arrivals, cargo split or equipment productivity, so that the correct delays and waiting times are represented. This is a data intensive process, which improves with the amount and quality of the data from the terminals. This activity mostly included comparison of KPI output data with historical performance.

Model validation was performed with the problem owners, as well as other partners including container terminals to make sure the simulation library components closely represent reality.

The results of the validation and calibration are described in deliverables D5.3 and D5.4, accomplishing MS13.

Task 5.6 Experimentation with real cases
Simulation models were developed and configured for the cases of Melzo and La Spezia, using most recent available terminal data from 2016. Business processes were established based on terminal visits, workshops and conference calls with the terminal experts.

The following steps were taken:

1) Layout import for Melzo and La Spezia separately, including drawing checks and adjustments, configuration for simulation and coupling with resources
2) Modify simulation components to suit specific requirements of the cases so that the correct representation can be met
3) Configure simulation components with their correct numbers and parameter values
4) Validation against historical data together with expert walkthrough
5) Experimenting – configuring scenarios to investigate, which differ in terms of input parameters and arrivals, and then executing the simulation run for all, collecting animation and KPI data separately for each.

First of all, the simulation components were combined with layouts and overarching control structure of the simulated TOS. For each case, equipment numbers and volume split inside the terminal was established. Then, basing on the available historical data arrival files for vehicles (external truck, trains and for La Spezia also vessels) were determined for a reasonable duration of a week. Both cases were then run and extensively investigated in terms of animation as well as KPI values.

Task 5.6 is concluded with two reports, one per each terminal to support the demonstrators from the deliverables D5.3 and D5.4, as well as a testimony for the milestones MS10 to MS13.

Deviation from work plan & remedial action

According to the original project planning WP5 started in M1 and ended in M17.
Macomi, however, suggests continuing with WP5 after month 17.

- Original period: M1-M17
- New period: M1-28

The reasons for this:

- To include more case studies (some of the 'Virtual Cases' mentioned in WP3). This is a valuable addition to further test the application of the simulation component library in more cases. Currently, the simulation component library was tested on the real cases of La Spezia and Melzo. To apply the library to more cases will test and improve the general applicability of the decision support environment.
- The interaction between WP2 (general architecture) and WP5 took longer and more effort than expected (see task 5.4).
- To further improve the interface between the BIM and simulation component library. An improved interface between to get the layout and properties export from the BIM model to the simulation component library in a more efficient way.
- From map editor to BIM (see Task 5.4), currently IDP is working on automation of exporting of the layout to the simulation from BIM, instead QGIS. Once that is established an import functionality to BIM (export from the simulation model) will be defined and implemented in a corresponding manner. So far this feature was not possible due to COTS software limitations, hence the change in approach.

This extension will not have any impact in the proper development of the whole project.

Work package 6: External mobility effects

WP#	6	Start date:	M6	End date:	M30

Objectives for the period

The main purpose of WP6 is to simulate the impact of the intermodal terminal operation on the surrounding mobility. The steps to take are according to the DoA:

- Analyze the impact of generated traffic (trucks) due to the terminal activity on the surrounding network (focusing on the interaction with private vehicles).
- The impact on the surrounding network will be assessed in economic and environmental terms.

WP6 consist of three main tasks. Work during months 1 to 18 mainly resides in T6.1 (Definition of the simulation model and data setting) which concludes in month 18. Technically, and as described during the Kick of meeting held in Barcelona (Spain) in September 2016, the main steps in the work to be done concerning task 6.1 are:

- 6.1.1. Benchmark traffic simulation software and define framework (M6)
- 6.1.2. Define an input data model for the EMS module in order to be adapted for any kind of terminal (M7-12)
- 6.1.3. Define the interfaces between TOS and BIM models (input/output data) (M13-14)

- 6.1.4. Set up the methodology to estimate the number of trucks entering/leaving the terminal as a function of the freight terminal demand (M15-16)
- 6.1.5. Define how KPI will be integrated in the model and introduce them (M17-18)

Having finished the subtask 6.1.1 and 6.1.2 in the previous periods, the main objective during this period was to conclude T6.1 and produce the first deliverable of WP6.1: D6.1 External mobility simulation model.

Besides that, some focus was planned towards the advancement of Task 6.2, to start constructing the simulation models for the 2 terminals in collaboration with partners (CONTSHIP and AP La Spezia).

Below the subtasks considered in activity 6.2 are given.

- 6.2.1. Collect data from the Melzo dry port and La Spezia container terminals (M18-19)
- 6.2.2. Develop both external mobility simulation models (EMS) (M19-22)
- 6.2.3. Validate and calibrate the simulation models in collaboration with partners (CONTSHIP and AP La Spezia) (M22-24)
- 6.2.4. Presentation of the simulation models (M24, in fact it is D6.2)

Description of work carried out and achievements

T6.1 Definition of the simulation model and data setting

On the activities carried out within Task 6.1, all of them have been finished. That is: the input data model needed for importing data from any kind of terminal (T6.1.2); the interfaces between TOS and BIM models (T6.1.3); the methodology to estime arrivals of trucks into the simulation and how it should be paired with the terminal simulation developed in WP5 (T6.1.4) which includes specific coding and configuration files definition; and discussion on how the KPIs are to be calculated and integrated in the decision system model (T6.1.5). However, the final definition of such indicators will not be fully explored until subsequent tasks, mainly within task 6.3 (anyway, all necessary (and not aggregated) data to calculate defined KPI of the external mobility impact are one of the current outputs of the simulation model. No major further actions should be required during the next months related to this set of outputs)

Respect to T6.1.4, it will be fully tested during calibration/validation (T6.2).

T6.2 Simulation of study cases (validation and calibration)

Concerning Task 6.2, work started towards the definition of the road network system surrounding the two real cases being assessed in Melzo and la Spezia as a first step towards calibration for the real case (it is important to remark that developments related to T6.1 have been mostly tested using Melzo or La Spezia networks). Additionally, the data needed for calibration has been identified and asked to the partners providing it (CONTSHIP and AP La Spezia). Work for the next period of time (M19 to M24) will be centred in this specific task, and finished within month 24.

Task T6.3 is to be developed during the last year of the project.

Deviation from work plan & remedial action

The delay commented during the last reporting period has been addressed. Work in T6.1 is finished with no delays in the schedule whereas work in T6.2 has already started just a little bit ahead of schedule.

Work Package 7: Interconnection Simulations

WP#	7	Start date:	M6	End date:	M32

Objectives for the period M6-M18

The objective of this work package during the first mid-term is to create an assessment tool for railway interconnections among intermodal terminals and apply it to a case of Melzo – La Spezia. Main goals:

- Provide a network-wide assessment tool considering terminal railway connections
- Assess and align different design of rail terminals and rail infrastructure to provide optimal solutions
- Decrease the overall logistic cost of rail links between intermodal terminals and to promote modal shift to rail freight
- Assess the performance of the Melzo – La Spezia case in terms of rail interconnection resilience

Description of work carried out and achievements

Task 7.1: Building an operational simulation model of two pilot terminals

For deliverable 7.1 – Rail interconnection simulator
As no two railway terminals exist in seclusion, the tool is being developed to account for not only a single connection between them but all rail shipment destinations for several terminals, including interference from other trains (not stopping at either case terminal) using network or terminal capacity. In order to evaluate the capacity and resilience of the network the created data-intensive tool first establishes a timetable for trains, and then tries to optimise it against tardiness (cargo lateness at the destination).

Given a certain railway network with track capacities and travel times, connected terminal properties, a certain pool of trains with capacities and a set of container volumes over time with their destinations and due dates the tool is to create a feasible timetable to plan the transportation of goods. This timetable consists of container bundling optimisation to put the best possible number of container on the trains, path

optimisation, to travel the best available route, and timing to plan activities over time. Subsequently, a genetic algorithm optimisation module is to re-plan the initial solution and improve it in terms of container tardiness. The planning can be constrained by resource of infrastructure unavailability due to working hours, other trains in the network or maintenance.

Subtask 7.1.1 Input data model
Outline of the input data model has been developed, and can be divided into 5 categories:

- Terminal characteristics
- Network characteristics
- Volumes to transport
- Available trains
- Special constructs (border handovers, impact from other traffic)

The model can take into account maintenance activities by temporarily taking infrastructure offline or reducing its capacity (e.g. extending travel time).
The data structure will be finalised based on the results of the data collection activities performed by VIAS, provided this can be obtained with sufficient lead time to conclude the D7.1 on time.

Subtask 7.1.2 Simulation model setting
The model uses the main characteristics from WP4 and WP5, together with additional publicly available data to model and optimise the rail interconnection problem. Should data of higher quality become available (e.g. infrastructure by VIAS, volume and logistics by CSI), it will be incorporated to the highest extent possible. We use heuristics for initial solution and genetic algorithms to optimise the performance for cargo tardiness.

As the deliverable D7.1 is due in month 24, the activities leading to obtaining it from task 7.1 will continue beyond month 18.

Tasks 7.2 and 7.3: Calibration and validation; Assessment of interconnection pilot cases

Although the execution of tasks 7.2 and 7.3 has not yet started, preparations and planning for them, as well as for concluding the task 7.1, were made.

According to several internal discussions among partners involved in this WP, and as described in the draft document for Activation of risk 17 ‘Data collection difficulties’ and also according to Internal Meeting 16 February 2018 minutes (both draft documents sent to the PO at the same time than submission of present document), the planning for M18-24 is to study the La Spezia / Melzo corridor:

- VIAS will deliver the layout and information of the rail network between Melzo and La Spezia and will propose a maintenance methodology
- IDP will create and deliver the rail network layout from the BIM
- CONTSHIP will provide information on the volumes and train services

MACOMI will finalise the network simulation model.

Deviation from work plan & remedial action

No deviation is foreseen.

Inconsistencies found in the DoA:
According to schedule, Task 7.1 and Task 7.2 should be extended to M24 to be aligned with the submission of deliverable D7.1 'Rail interconnection simulator'.

This extension to M24 would allow us to carry out the solution proposed by VIAS in order to get more information and collect accurate and reliable data on the rail network.

This fact will not have any impact in the proper development of the whole project.

In addition, MAC is taking the lead in tasks 7.2 and 7.3 (instead of CSI who appears as lead for both). Consequently, D7.2 and D7.3 will be lead by MAC as well.

Work Package 8: Functional, economic and environmental analysis

WP#	8	Start date:	M4	End date:	M36

Objectives for the period M4-M12

The main objective of this WP is:

- Assessment of the functional, economic and environmental effects and the underlying driver models of inter- and multimodal terminals.

In addition, the WP tasks and activities will be focused on answering the following items:

- Which drivers (measured through standard macro and micro economic and logistics specific Key Performance Indicators) determine the overall impact?
- How can these aspects be integrated in decision processes and anticipated in planning, building and operating inter and multimodal terminals?
- Integration of WP 3-6 results and assessment of their influence on functional, economic and environmental impacts of intermodal terminals.

WP8 consist of four main tasks, being the first one (T8.1 Definition and description of functional, economic and environmental analysis) the only one initially scheduled

during the period comprised between months 1 to 18. Despite that, work in task 8.2 has already started as well.

The main steps in the work to be done concerning tasks 8.1 and 8.2, as included in the DoA are:

- 8.1.1. Functional analysis (M4-18)
- 8.1.2. Economic analysis (M4-18)
- 8.1.3. Environmental analysis (M4-18)
- 8.2.1. Current logistics studies (M19-27)
- 8.2.2. Statistical data and forecasts (M19-27)

After the transfer of leadership in the task from DHL to CENIT (now CENIT-CIMNE), the objectives for this period were set mainly on task 8.1 but to start working on T8.2. Hereunder is given the figure presented during the Project Meeting held in Espoo (Finland) on September 2017. As it can be seen in the figure, work on T8.2 was set to start earlier to ease the publication of any findings in research journals.

Figure 1. Chronogram for the months 13 to 18 of the project (new schedule presented in Espoo, Finalnd in September 2017

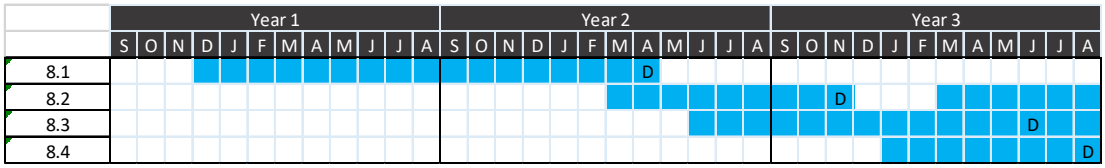

Figure 2. Original Chronogram

Additionally, the milestones set in Espoo for this 6 months period were:

- M14: First framework on existing analytics to be used in functional, social and environmental assessments
- M18: Compendium of existing analytics and expert assessment on their fitness (first paper draft)
- M18: First draft on logistic trends at international and European level

Description of work carried out and achievements

CENIT-CIMNE and DHL held several internal meetings to discuss the approach to be taken in the task and breakdown the work to be done, aiming to speed up WP8 as much as possible to ease the dissemination of its results through Scientific publications.

Task 8.1: Definition and description of functional, economic and environmental analysis

Overview of the activities carried out within Task 8.1

- The structure of deliverable D8.1 has been made and work on its contents has already started (expected to be completed within month 20)
- The framework to be used for the assessment of the functional, economic and environmental (FEE) aspects has been constructed.
- After some discussion, it has been decided to complete the work with a matrix linking the relationship of the FEE aspects with design elements considered when constructing a terminal. A first draft of the matrix has been constructed and is to be discussed with logistics experts in March and in a workshop on the topic envisaged for the next Project Meeting to be held in Barcelona, in March as well.

CENIT-CIMNE and DHL suggest submitting deliverable D8.1 'Definition and description of functional, economic and environmental analysis' in M28 being consistent with the end of Task 8.1. In addition, more results will be able to be assessed according to further developments in WP4 and WP5.

Task 8.2: Assessment of current transportation and logistics studies and statistical data

Overview of the activities carried out withn Task 8.2:

- Work identifying current logistic trends, technology advancements and market evolution has been conducted and almost completed (T8.2.1). It is expected to distribute the first draft on the documentation from T8.2.1 right after the next project meeting in Barcelona (12-14 March 2018).

Deviation from work plan & remedial action

There is a still some delay on the completion of WP8.1 due to the transfer of effort from DHL to CENIT-CIMNE and the merger situation of CENIT and CIMNE.

However, and to be consistent with the duration of Task 8.1, from M4 to M28, it is proposed to submit deliverable D8.1 in M28 instead of M20. Further results coming from WP4 and WP5 will be available considering the extension requested in these work packages.

At the same time, the work in WP8.2 has been moved ahead of its scheduled time and currently is midway up to its final completion.

Work package 9: Exploitation, dissemination and communication

WP#	9	Start date:	M1	End date:	M36

Objectives for the period M1-M18

The objectives of this WP is to develop a comprehensive and extensive strategy for exploitation and dissemination of the results and communication of the project. This set of activities will:

- Protect the intellectual property generated during the project;
- Promote and exploit the results of the project:
- Disseminate activities beyond the consortium to a wider audience;
- Promote the action and visibility of EU funding.

Description of work carried out and achievements

Task 9.1: IPR protection & Task 9.2: Exploitation

These two tasks are focused on the protection of the knowledge resulting from the project and the preparation of the ground for further exploitation results.

As all partners are involved in these tasks, a session about this topic was included in the agenda of the first general meeting held in Kiruna (April 2017) in order to:

- Set the basis of the Exploitation Agreement (EA);
- Discuss on the protection of IPR and the use of patenting.

Afterwards, a questionnaire about exploitation was distributed among the partners to get their opinions and to work on the draft of the EA that was written during September 2017. A draft was distributed among partners before the second general meeting held in Espoo (September 2017). This document, besides results obtained from the questionnaire, also includes the exploitation plan phases to allow the Consortium developing the Exploitaiton Agreement by the end of the project.

The team is preparing a workshop for the third general meeting held in Barcelona in March 2018 in order to characterize the Key Exploitable Results identified, as well as risks that could be encountered and exploitations forms.

First version of the Exploitation Agreement corresponds to Deliverable D9.8 submitted in M18 (February 2018).

Task 9.3: Dissemination

- Design, creation and management of the INTERMODEL website:
    - Projects domain is: http://www.intermodeleu.eu/
    - Designing, creating and placing the INTERMODEL site on the server/project webside structure, public area, private area
    - Create accounts on Twitter https://twitter.com/IntermodelP ,Linkedin https://www.linkedin.com/in/intermodel-project-335722133, You Tube https://www.youtube.com/channel/UCZjDMG4L58ELZ9KB7JQ8u3Q
    - Update the webside
    - Website and intranet administration

- First newsletter

- INTERMODEL EU promotional video:

  Published 7.11.2016
  This video introduces InterModel EU project, developing intermodal terminals 1.9.2016-31.8.2019.
  More information: http://www.intermodel-project.eu
  Coordinator: IDP, Ingenieria Y Arquitectura Iberia Sl, Spain
  Video: Janne Porkka, VTT, Technical Research Centre of Finland
  Terminals: La Spezia Port Authority & Melzo Milan, Italy
  Virtual models: Viasys VDC, Finland
  Music: Open Hands "Blue Chicken" (CC BY)

  https://www.youtube.com/watch?v=-w8Rsmg4KGc

- Project presentations and participation in conferences and fairs:

  Project partner: ZNIK
  Energy Cleantech Cluster Milano, Italy, in Brussels, November 30th, 2016
  Agro Transilvania Cluster Romania, in Brussels, November 30th, 2016
  Gdansk Port Authorities, in Gdansk, Poland, December 21st, 2016
  Intralomag, Lodz, Poland, November 29 th -30 th , 2017
  National Smart Specializations, Warsaw, Poland, December 5th, 2017

  Project partner: IDP
  GeoBIM Building and Infrastructure in Amsterdam, Holand, November November 24th and 25th, 2016

  Succesful R&I in Europe. 8th European Networking Event in Düsseldorf, Germany, March 2nd and 3rd, 2017

  Connecting Europe Conference, Tallinn, Estonia, 21st – 22nd September 2017

  Project partner: FGC
  Open Day Projects organized by the RailGrup Cluster in Barcelona, Spain, May May 18th, 2017

  Project partner: MAC
  RailTech Europe, Utrecht, Holand, March 2017
  TOC Europe, in Amsterdam, June 2017

  Project partner: CENIT
  ICPLT – Interdisciplinary Conference on Production, Logistics and Traffic, Darmstadt, Germany, September 25 th -26 th 2017

  Project partner: VTT

Open infraBIM Tampere, Tampere, Finland, February 6 th – 7 th 2018

- List of proposed conference papers discussed during several online meetings:

Deliv.	Main Author	CO-Author	TOPIC	Deadline for submission
3.1	CENIT		Indicators in intermodal terminals (comprehensive state of the art)	31/03/2017
5.2	MACOMI		Ontology for simulation at intermodal terminals	28/04/2017
8.3	CENIT	DHL	Development on the results from the terminals and recomendations for new and	15/02/2019
8.1-2	CENIT	DHL	Review on current studies and data forecast and implications on intermodal terminals	30/11/2018
2.4	VTT		Conference paper: Decision support for owners of terminal projects	30/08/2018

First conference paper related to work done in WP3 submitted for the Call for papers 3rd ICPLT, held in September 2017 in Darmstadt, Germany, was accepted. The paper has been submitted in July.
Title: *Assessment of intermodal freight terminals with Key Performance Indicators integrated in the BIM process.*

Two different abstracts were submitted for the Call for abstracts TRA Vienna 2018, held in April 2018, and both have been accepted:
Title 1st paper: *Integrated model-based terminal planning – current use, challenges and further research needs*
Title 2nd paper: *Terminal Planning: The Selection of Relevant KPIs to Evaluate Operations*
The team submitted the full conference paper 'Terminal planning: the selection of relevant KPIs to evaluate operations', which has been accepted to TRA Vienna 2018 (16-19 April). This conference paper is the result of the D9.13.

Task 9.4: Communication

Overview of the activities within Task 9.4:

- Development of the Communication Plan 1
- Development of the Communication Plan 2 (Update of the plan presented after the first 6-month period)
- Development of the Communication Plan 3 (Update of the plan presented after the first 18 months)
- Select trade shows and conferences in order to present the INTERMODEL EU project:
  - Successful R&I in Europe. 8th European Networking Event Düsseldof, Germany (2nd – 3rd March, 2017)
  - Transport Week Sopot Poland (7th – 9th March, 2017)
  - CEF Conference, Brussels, Belgium (21st -22nd September 2017)
  - 3rd Interdisciplinary Conference on Production, Logistics and Traffic, Darmstadt, Germany (ICPTL) (25th – 26th September 2017)
  - TRA Conference, Vienna, Austria (16th -19th April 2018)

The communication plan, including the part concerning to scientific communication, was formally presented during first project meeting held in Kiruna.

Deliverables D9.1, D9.2 and D9.3 corresponding to Communication Plans have been submitted accomplishing the schedule.

Deviation from work plan & remedial action

No deviation is foreseen.

Work package 10: Ethics requirements

WP#	10	Start date:	M1	End date:	M36

Objectives for the period M1-M6

The objectives of this WP is to set out the 'ethics requirements' that the project must comply with.

Description of work carried out and achievements

Under this work package there is no task assigned. However, IDP has written the two deliverables with regard to:

- H-Requirement No. 1: concerning humans in research activities as identified and established according to EU and national directives.
- POPD-Requirement No. 2: information on consent procedures that must be implemented before the start of relevant research.

On the one hand, in accordance to the nature of the research carried out under the INTERMODEL EU project, human participants are not required.

On the other hand, data collected for the project excludes personal sensitive data and is basically related to intermodal terminals.

In the case where the consortium could consider to gather the opinion of human experts, the information will be collected in a completely anonymous way, as established in the Data Management Plan and those experts will be part of the consortium members / stakeholders which already have their own procedures for data protection.

If the opinion of external experts or potential users is needed in the future, the information will be also collected in an anonymous way and the Data Management Plan will be updated with all the necessary to comply with EC directives and national regulations regarding POPD.

Both deliverables have been distributed among all the partners in order to get the approval.

In case of changes throughout the project, both documents will be updated if required.

Deviation from work plan & remedial action
No deviation is foreseen.

3.3 Summary of Deliverables

D#	Name	Delivered	Summary and Comments
D1.1	Website and intranet	100%	The INTERMODEL website has been designed, developed and launched. The site serves as both dissemination and project management tools and, includes public and private areas. The public area promotes the project and allows for dissemination of public results and permits the public to contact the consortium via contact form and visit partners' websites. The private area, accessible via a login, includes confidential and project management documents, helps partners share information and communicate more effectively. The website will include all the relevant public information regarding the project to make it known and will be used as a dissemination tool of the results and developments of the project to industry experts, interested parties and the public. It will include vídeos and reports regarding the simulations of the pilots. The content of the website will be periodically updated as the project advances.
D1.2	Internal Progress report prepared and ready for revision in the INTERMODEL General Assembly 1	100%	Report including a summary of the progress made, critical points, risks and contingency plans.
D1.3	First year full technical and financial report	100%	Report including a summary of the progress made, critical points, risks and contingency plans.
D1.4	Internal progress report prepared and ready for revision in the INTERMODEL General Assembly 2	100%	Report including a summary of the progress made, critical points, risks and contingency plans.
D1.9	Risk and Contingency Plan M6	100%	Report including the monitoring and control activities related to the risks, starting with those described in the initial Risks Plan. This document will be updated every 6 months.
D1.10	Risk and Contingency Plan M12	100%	Report including the monitoring and control activities related to the risks. This document is an update of the risk and contingency plan presented in February 2017 (M6).
D1.11	Risk and Contingency Plan M18	100%	Report including the monitoring and control activities related to the risks. This document is an update of the risk and contingency plan presented in August 2017 (M12).
D1.14	Data Management Plan 1	100%	Outlines how data collected or generated will be handled during and after the INTERMODEL EU action, describes which standards and methodology for data collection and generation will be followed, and whether and how data will be shared.
D1.15	Data Management Plan 2	100%	Outlines how data collected or generated will be handled during and after the INTERMODEL EU action, describes which standards and methodology for data collection and generation will be followed, and whether and how data will be shared. This document is an update of the data management plan submitted in February 2017 (M6).

D2.1	Information and requirements for terminal use cases	100%	Public deliverable to collect existing knowledge, based on key performance and risk indicators (WP3), on freight terminals, model based planning and terminal simulation, and convert results into model-based information requirements. The deliverable introduces three use cases to be implemented in INTERMODEL EU project.
D2.2	Integrated planning environment architecture and interface specifications	100%	Public deliverable combines planning individual segments and discipline models (buildings, logistics etc.) to operational simulation and indicators to evaluate performance. Introduces Decision Support Platform key components and its application in three use cases.
D2.3	Interoperability and data exchange specification	60%	Work ongoing. Deadline M18, we ask for extension period of 3 weeks to complete the work
D2.4	Documentation of implemented integrating ICT environment prototype	8%	Work started and ongoing.
D2.5	Interactive decision making with integrated planning environment [M30]	5%	Work started recently and ongoing.
D3.1	Study of the State of the art and description of KPI and KRI of terminals, hinterland mobility and rail network	100%	This deliverable provides a set of KPIs (high-level indicators) and PIs (secondary level indicators) that will be included in a scoreboard integrated in the BIM decision-making tool. This comparative scoreboard that includes the selected KPIs related to financial, operational, quality service, sustainable and safety issues and from three points of view (investor/management, operator and public body) will help to compare alternatives, assess potential measures and solutions and provide support to decision-makers taking into account both project definition and exploitation phases. *Comments: at first sight and before testing the collection of KPIs from terminal simulation tool/traffic simulation model/BIM, it seems feasible to obtain all the KPIs included in the deliverable. However, further tests within the project could show difficulties and/or the impossibility of gathering all the information required to calculate them. In that case, a revision of the KPI list will be carried out, and if necessary, it will be modified and updated.*
D3.2	Pilot innovations and improvements	100%	Selection of the technological and operative innovations to be implemented in the four pilot terminals and the rail interconnection between them.
D3.3	Input data analysis and scenarios	100%	The input data has been set so that the pilot cases can be correctly defined to design them using the BIM methodology and incorporate all the relevant BIM dimensions.
D4.1	BIM Execution Plan Guideline	100%	The BIM Execution Plan was developed. It defines the scope of BIM implementation, describes the team characteristics needed to achieve the modeling, the process impacts of using BIM, contract recommendation for BIM implementation, and the appropriate level of modeling of the different elements and categories of the terminals to better optimize the dedicated resources.
D4.2	BIM model demonstration of both real locations	100%	As a testimonial for the deliverable a report is written describing how models have been built, used inputs and obtained results.
D4.3	7th BIM model of the virtual pilot cases	100%	As a testimonial for the deliverable a report is written describing how models have been built, used inputs and obtained results.
D4.4	Pilot cases alternatives including Pilot Innovations and Improvements	50%	Due date month 19. However, extension has been requested as explained in WP4 section ‘deviation from work plan and remedial actions’.

D5.1	Data model	100%	The deliverable consists of 2 parts: • Data model in the format of a ERD and report. The data model defines the scope of what is being simulated within the project. Furthermore, it states how the simulation models will work internally. • Data requirements document. This document can be send to terminal that will be simulated in the project. The terminal can fill in the data that is required for building simulation models.
D5.2	Ontology and conceptual modelling	100%	The deliverable consists of 2 parts: • The ontology in a report format comprising taxonomy, structure and interrelations within the project domain • The conceptual models in UML formalism, supported by process diagrams in BPMN and cargo flow diagrams
D5.3	Operational simulation model of the first real-life case	100%	As a testimonial for the deliverable a report is written describing the simulation model, used inputs and obtained results.
D5.4	Operational simulation model of the second real-life case	100%	As a testimonial for the deliverable a report is written describing the simulation model, used inputs and obtained results.
D6.1	External mobility simulation model	100%	• Benchmark traffic simulation software and define framework • Periodic meetings on data compatibility and model integration with IDP, MAC, VIAN and VTT • Production of list of data requirements for the simulation produced and sent to pilot cases terminal partners • Work on the input model data for the EMS
D6.2	External mobility actual performance in the La Spezia and Melzo terminals	0%	Due date month 24.
D6.3	Assessment of external mobility impacts of La Spezia and Melzo pilot cases	0%	Due date month 30.
D7.1	Rail Interconnection Simulator	50%	Small demonstrations of the progress have been made to the consortium members Due date month 24.
D7.2	Assessment of the rail interconnection pilot cases (CSI)	0%	Due date month 30.
D7.3	Assessment of rail interconnection resilience (CSI)	0%	Due date month 32.
D8.1	Definition and description of functional, economic and environmental analysis	40%	• Internal meeting with DHL • Desk research as regards to the impact of intermodal facilities • Work on first draft of D8.1 The deadline for D8.1 is not under risk and will be delivered on time.

			Due date month 20. CENIT-CIMNE and DHL suggest to deliver a first draft in M20 and final version in M28 in accordance with WP4 and WP5 further developments.
D8.2	Assessment of current transportation and logistics studies and trade statistics	0%	Due date month 34.
D8.3	Set of KPI for assessing and operating intermodal terminals	0%	Due date month 34.
D8.4	Assessment and validation workshops onsite at selected terminals	0%	Due date month 36.
D9.1	Communication Plan 1	100%	The Communication Plan 1 has been implemented during February 2017. A comprehensive Intermodel EU Communication Plan prepared at the beginning of the project, on the basis of the draft contained in the application. The Communication Plan describes the various actions that fit the objectives and tools, It is the basis for internal and external communication, defines the communication strategy of the project, including objectives, target groups, information systems and internal and external communications. The plan sets out what the details of the dissemination of project results.
D9.2	Communication Plan 2	100%	The Communication Plan 2 is an update of the first communication plan submitted in February 2017.
D9.7	Electronic project brochure completed and available for distribution	100%	The first brochure was designed in June 2017. It provides a brief explanation to understand the project goals and information about consortium.
D9.13	Conference paper 1: Integrated planning environment in terminal projects	100%	Conference paper published in WP9: Exploitation, dissemination and communication, explaining indicator based approach from project to be implemented into integrated planning environment. The work has been done in collaboration with WP3 participants. For the final version of conference paper, few minor improvements were performed to version presented in deliverable. Paper was approved for the TRA Vienna 2018.

3.4 Milestones table

MS#	Name	Related Deliverables	Achieved	Summary and Comments
MS1	Check and get the achievement of 1st reporting period objectives (financial and technical)	D1.4	100%	The present document corresponds to the technical progress done during the 1st reporting period (18 months), and financial statements have been requested to the whole consortium to monitorize effort and costs, so that the technical and financial periodic report will be submitted to the EC within 60 days following the end of the first reporting period.

MS4	Definition of KPI and KRI	D3.1	100%	List of KPIs that will be used to compare alternatives, assess potential measures and solutions and provide support to decision-makers taking into account both project definition and exploitation phases through a scoreboard integrated in the BIM decision-making tool.
MS5	Characterization of pilot cases	D3.2 D3.3	100%	Pilot cases have been defined considering two different aspects: 1. Definition of innovations and imprevements that will be implemented into the four pilot terminals (D3.2); 2. Different scenarios representative enough and input data needed (D3.3).
MS6	Data collection of real terminals	D4.2	100%	Data collection from CSI and APSP has been done during the first 18 months. It has been difficult to collect certain data, and in that cases partners' know-how and other sources of information have been used.
MS7	Approval of the 7th D design of the virtual terminals by WP2 leader	D4.3	100%	Report ready for review and to be submitted.
MS9	First demonstration of the library of simulation components	D5.3	100%	First demonstration during the General Meeting in Espoo (M13).
MS10	Second demonstration of the library of simulation components	D5.4	100%	Second demonstration ready for being shown to all partners during the General Meeting in Barcelona (March 2018).
MS11	Results first case	D5.3	100%	Report ready for review and to be submitted.
MS12	Results second case	D5.4	100%	Report ready for review and to be submitted.
MS13	Parameters of virtual design of terminal checked against real terminal operational and maintenance performance	D5.3 D5.4	100%	Report ready for review and to be submitted.
MS14	Launch of the external mobility simulation model	D5.3, D5.4, D6.1, D6.2	60%	Due date month 24.
MS15	Presentation of the external mobility assessment of the pilot cases in La Spezia and Melzo terminal	D6.2, D6.3, D3.1, D8.3	0%	Due date month 30.
MS16	Launch of the interconnection simulation model (calibrated and verified)	D7.1	40%	Deadline month 26.
MS17	Presentation of the conclusions derived from the assessment of rail interconnection pilot cases	D7.2	0%	Deadline month 32.
MS18	Presentation of the conclusions derived from the assessment of the rail network resilience test	D7.3	0%	Deadline month 34.
MS19	Validation of DSS in	D7.1, D7.2,	0%	Deadline month 32.

	real location (pilot)	D7.3		
MS20	Reduction on forecast of expenditures on maintenance and operational	WP2 TO 7	0%	Deadline month 36.
MS21	Reduction on environmental impact forecast evaluation reaching set target metrics	WP2 TO 7	0%	Deadline month 36.

Annex I

This appendix includes:

- Updated Gantt chart.

WP		Title	Start	End	Leader	YEAR 1												YEAR 2												YEAR 3											
						M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36
WP1		**Management**	**1**	**36**	**IDP**																																		
	Task 1.1	General consortium management	1	36	IDP																																		
	Task 1.2	Project meetings	1	e/6M	IDP																																		
	Task 1.3	Project reporting	1	e/6M	IDP																																		
	Task 1.4	Coordination of the project with the EC	1	e/12M	IDP																																		
WP2		**Integrated planning environment and decision support (researct act.)**	**1**	**32**	**VTT**																																		
	Task 2.1	Information and requirements for terminal use cases	1	9	VTT																																		
	Task 2.2	Integrated planning environment architecture and interface specifications	4	19	VTT																																		
	Task 2.3	Implementation of integrating ICT environment	12	30	VTT																																		
	Task 2.4	Model coordination	12	24	VTT																																		
	Task 2.5	Decision support in integrated planning environment	16	32	VTT																																		
WP3		**Data & Indicators definitions (research act.)**	**1**	**12**	**FGC**																																		
	Task 3.1	Definition of KPI and KRI	1	3	FGC																																		
	Task 3.2	Setting of pilot cases	1	12	FGC																																		
WP4		**BIM Intermodal Terminal (research & innovation act.)**	**4**	**19**	**IDP**																																		
	Task 4.1	7th D BIM execution plan	4	7	VIAN																																		
	Task 4.2	Build BIM models of real locations	8	18	IDP																																		
	Task 4.3	Build BIM models of virtual locations	8	28	IDP																																		
	Task 4.4	Optimisation of first 7D static KPIs & KRIs	14	28	IDP																																		
WP5		**Terminals Operational Simulations**	**1**	**17**	**MAC**																																		
	Task 5.1	Data collection	1	6	MAC																																		
	Task 5.2	Ontology and conceptual modelling	3	9	MAC																																		
	Task 5.3	Development of the simulation component library	7	17	MAC																																		
	Task 5.4	Coupling of simulation model components with overarching architecture	7	28	MAC																																		
	Task 5.5	Calibration and validation	10	14	MAC																																		
	Task 5.6	Experimentation with real cases	10	28	MAC																																		
WP6		**External mobility effects (research act.)**	**6**	**30**	**CENIT**																																		
	Task 6.1	Simulation model setting	6	18	MAC																																		
	Task 6.2	Calibration and validation	18	24	CENIT																																		
	Task 6.3	Assessment of external mobility affectations	24	30	CENIT																																		
WP7		**Interconnection simulations (research act.)**	**6**	**32**	**MAC**																																		
	Task 7.1	Building an operational simulation model of 2 pilot terminals	6	24	MAC																																		
	Task 7.2	Calibration and validation	18	24	CSI																																		
	Task 7.3	Assessment of interconnection pilot cases	22	32	CSI																																		
	Task 7.4	Interconnection resilience testing	28	32	MAC																																		
WP8		**Functional, economic and environmental analysis**	**4**	**36**	**DHL**																																		
	Task 8.1	Definition and description of functional, economic and environmental analysis	4	28	DHL																																		
	Task 8.2	Assessment of current transportation and logistics studies and statistical data	16	27	DHL																																		
	Task 8.3	Validation and reconciliation of results at selected terminals	25	34	DHL																																		
	Task 8.4	Integration of the key results	29	36	DHL																																		
WP9		**Exploitation, dissemination and communication**	**1**	**36**	**IDP**																																		
	Task 9.1	IPR protection	1	36	IDP																																		
	Task 9.2	Exploitation	18	36	IDP																																		
	Task 9.3	Dissemination	1	36	ZNIK																																		
	Task 9.4	Communication	1	36	ZNIK																																		
WP10		**Ethics requirements**	**1**	**36**	**IDP**																																		
	D10.1	H Requirement No.1		6	IDP																																		
	D10.2	PODP - Requirement No. 2		6	IDP																																		