IFC Rail Project

Storyline (SL) Implementation Report (IR)

Acquisition and upgrade of an existing railway line (AC)

Planning Phase (PL)

SLAC-PL

Contents

Room:	Railway Room	**Date:**	2021.10.31
Project/Activity:	IFC Rail Phase 2	**Test Leader:**	Palma Zaira Laterza
Document Title:	WP1: Storyline (SL) Implementation Report	**ID:**	SLAC-PL
Version:	1.0	**Stakeholder:**	RFI

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1 Storyline documentation update

RFI and ITF jointly participated in the storyline with the technical support of Engisis.

The organization adopted allowed the group to achieve the objectives even if it was not possible to organize physical meetings.

In particular, the work was organized by dividing the stakeholder team in specialized subgroups by rail domains (Alignment, Track, Energy, Signalling, Telecom), coordinated by the test leader for the specialistic support. Engisis was chosen as technical support for operational work on datasets and validations.

The Stakeholder Team scheduled internal periodic monthly meetings to update everyone on the progress of the RFI Storyline and also of the other storylines.

The Test Leader organized also periodic meetings with all Software Vendors and the Stakeholder Team technical experts to give instructions on the test execution plan, to share the updates on test progress and validation process and to answer all possible Software Vendors clarifications requests.

The Software Vendors also had the opportunity to ask for dedicated meetings in case of any doubts.

The storyline testing plan was organized in 3 different milestones and each milestone consisted of several steps, where domain models were produced, exchanged and validated.

The exchange of the produced models, for the validation process, was done through the GitHub repository created for the storyline.

1.1 Updated Storyline Synthesis

Room:	**Railway Room**	Author: Domain Expert	**Palma Zaira Laterza**
Project/Activity:	**IFC Rail Phase 2**	Verification: Technical Expert	**Evandro Alfieri**
Document Title:	**Storyline: Acquisition and upgrade of an existing railway line**	Approbation: Test leader	**Palma Zaira Laterza**
Version:	**1.0**	PMO checker:	**Guy Pagnier**
Date:	**2021.10.31**	ID:	**SLAC-PL**
Description (a)	RFI is interested in the acquisition of a portion of a railway line currently managed by another company, and to integrate this new line in its national network. The whole process shall be broken down in the following main steps: 1. Survey of the existing condition of the railway line 2. Identification of the infrastructural gap between the existing condition and the RFI standards 3. Analysis of the upgrading possibilities, with relative costs and benefits 4. Upgrade of the railway line The planned scope were steps from 1 to 3. The actual scope for the testing phase has been step 1 only, since it included all the concepts of interest for this storyline		
Project Phases (b)	☒ PL - Planning	☐ Build	

	☐ ID - Intermediate design ☐ DD - Detailed design	☒ Operation & Maintenance ☐ Dismiss
	The Operation & Maintenance phase is important because is part of the evaluation of the acquisition of the existing line. The existing line has an operated and maintained existing model and RFI has to evaluate if this model satisfies the standards or if it is necessary to change it and the impact of this change.	
Use Cases (c)	☒ ECM - Existing Condition Modelling ☐ RDM - Railway Design Modelling ☐ RDM.DD - Feasibility Study for Railway ☐ RDM.RIDM - Railway Intermediate Design Modelling ☐ RDM.RDDM - Railway Detailed Design Modelling ☐ ICM - Interference and Coordination Management ☒ 3DV - 3D Visualization ☒ QTO - Quantity Take-Off ☐ INMP - Handover from Builder to Maintainer (Information Needed for Maintenance Perspective)	
	3DV in the ECM is necessary to perceive the existing condition of the line. QTO in the ECM is necessary to identify the number of infrastructure components that are not compliant with the RFI standards.	
Domains	☒ Track (*)	Planned: Ballasted track, Turnout equipment, Level crossings Actual: only Ballasted track with Ballast, rail, sleepers, fastenings (The change was confirmed by RFI and ITF experts to simplify the test)
	☒ Signalling (*)	Planned: Level crossing, Signals and Signalling systems Actual: Signals and Signalling systems (the change was confirmed by RFI and ITF experts to simplify the test)
	☒ Energy (*)	Planned: Catenary Actual: Catenary, Pole, Cantilever assembly, Portal (Pole + crossbeam), Overhead contact line (the change was requested by RFI and ITF experts to test some complex elements modelling)
	☒ Telecom (*)	Planned: GSM-R, Wiring Actual: Trackside Telephony, Cables/ducts (the change was requested by RFI and ITF experts to test the most important elements modelling)
	☒ Alignment (*)	Actual: Alignment without cant
	☐ Other (*)	Planned: Bridge, Tunnel Actual: no extra elements (due to less time)
Tested Concepts (d)	The ticked concepts are the most important ones covered by the Storyline **Common Infra Unit Test topics** ☐ Geo-reference ☒ Alignment (Horizontal+Vertical) ☒ Linear Placement (Point) ☒ Linear Span Placement (From-To) ☒ Linear Placement with broken chainage	

	☐ Terrain ☐ Geotechnics ☐ Earthworks ☐ Subgrade **Railway Specific Unit Test topics** ☐ Cant Alignment (planned but not done) ☐ Linear Placement with Cant (planned but not done) ☒ Swept Area Solid Geometry ☒ Railway Spatial Structure and Spatial Zone ☒ System functional breakdown ☐ Wireless connection ☒ Track elements (a panel or very small section of track) ☒ Signal elements ☒ Overhead Contact Line elements (not planned but done) ☒ Telecom elements ☒ Energy elements **Existing concepts but essential for the storyline** ☒ System ☒ System of systems ☒ Assembly of assemblies

Test Leader TL (e)	**Palma Zaira Laterza**			
Domain Experts DE (e)	FEDERICA Di Giustino	RFI	Track	f.digiustino@rfi.it
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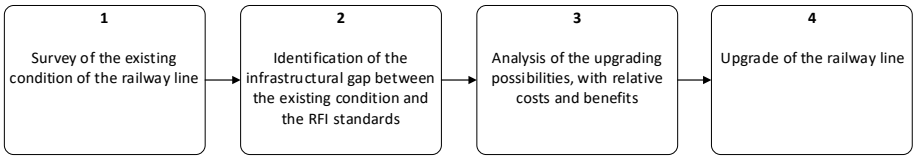
Technical Experts TE (e)	**Alfieri Evandro, Minnucci Giulia**			
Software Vendors SW (e)	**ACCA, Rail Complete, 12D, RDF, ESRI**			
Test Dataset (e)	RFI, ITF multiple departments			

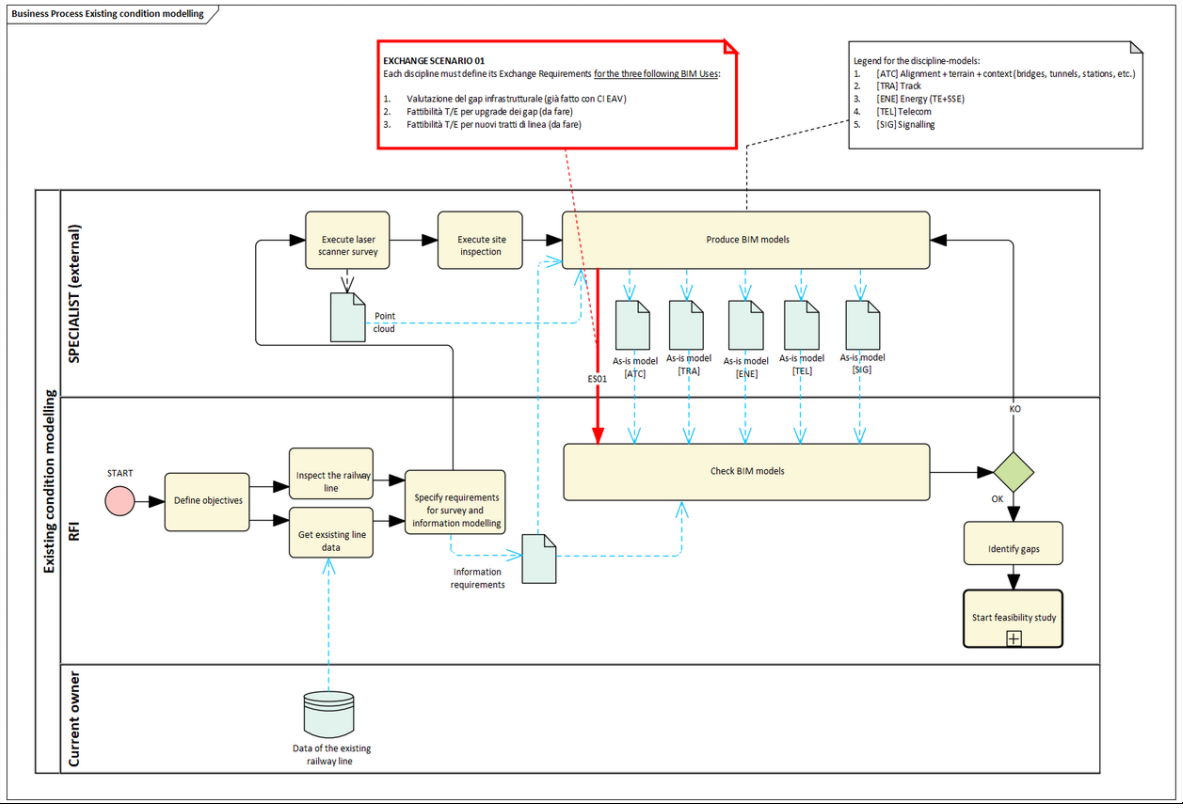
(a) 2 lines description (b) chose maxi 1 phase and 4 use cases (c) list only domains for the test (d) indicate Covered Unit Test Topics (e) specify names and companies

(*) *specify further sub-disciplines*

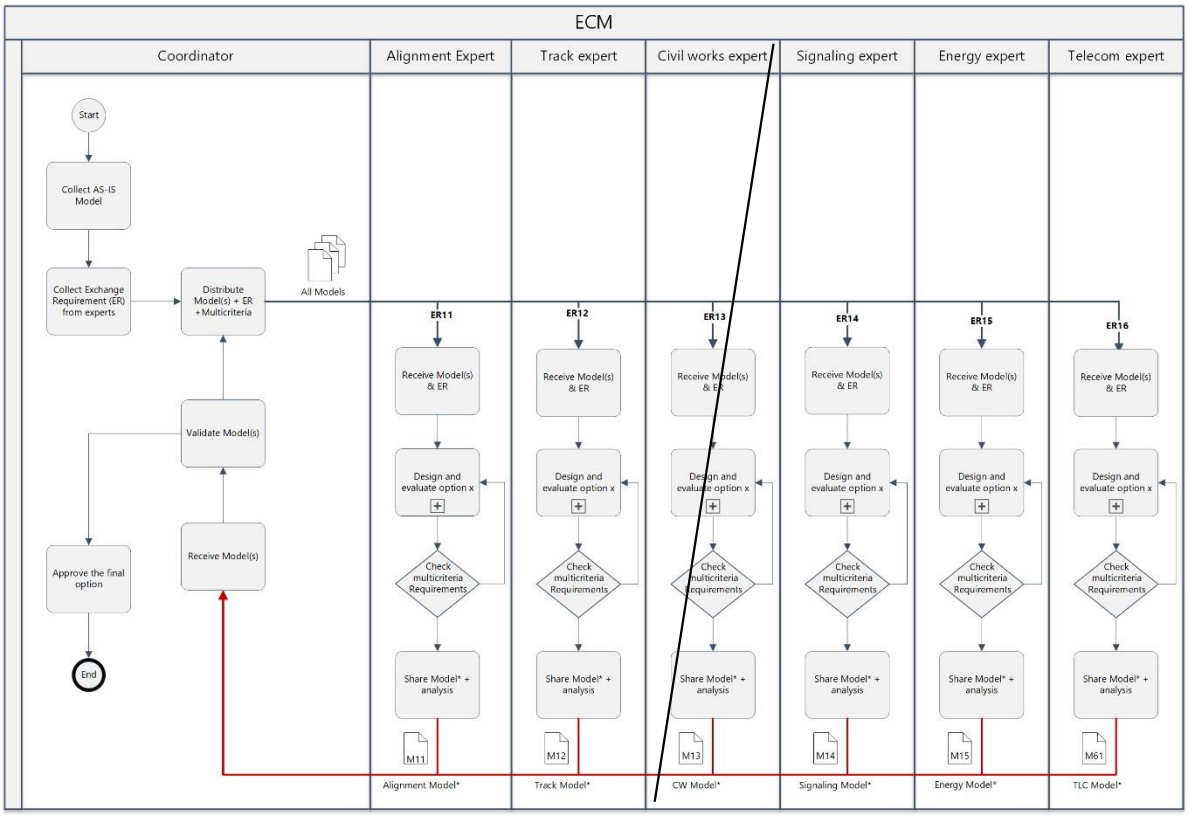
1.2 Updated Storyline Description

Description of the Business case	RFI is interested in the acquisition of a portion of a railway line currently managed by another company, and to integrate this new line in its national network. The whole process shall be broken down in the following main steps: 1. Survey and digital representation of the existing condition of the railway line 2. Identification of the infrastructural gap between the existing condition and the RFI standards 3. Analysis of the upgrading possibilities, with relative costs and benefits 4. Upgrade of the railway line The scope for the testing phase were planned to be only the steps 1 and 3. In the end, only step 1 was concluded.  Below are some data about the existing railway line “Cancello – Benevento” and a picture (in green is the railway line of RFI, in red the railway line owned and managed by another infrastructure manager). **Line name** — **Cancello - Benevento** **Length** — 47 km **Operational speed** — 80 km/h (segments at 70 km/h) **Signalling system** — Telephonic block **Electrified** — Yes **ERTMS** — No **N. of stations** — 12 (7 are just stops) **N. of bridges** — 3 **N. of viaducts** — 13 **N. of tunnels** — 6 **N. of level crossings** — 38 **N. of overpasses** — 2 **N. of underpasses** — 3

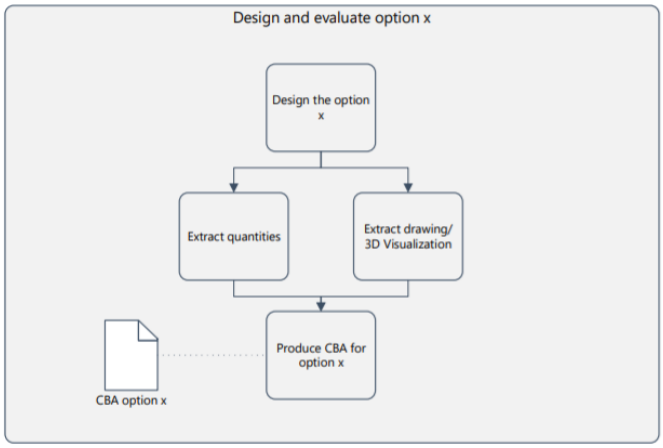
	 How the digital model of the railway line can support the 4 main steps: **STEP 1 – SURVEY OF THE EXISTING CONDITION** a) Digital representation of the alignment b) Digital representation of specific railway elements, the terrain, and the context **STEP 2 – IDENTIFICATION OF THE INFRASTRUCTURAL GAP BETWEEN THE EXISTING CONDITION AND THE RFI STANDARDS** c) Addition of specified properties to the modelled elements, for estimating the gap d) Addition of the existing technical documentation of the elements, for estimating the gap **STEP 3 – ANALYSIS OF THE UPGRADING POSSIBILITIES, WITH RELATIVE COSTS AND BENEFITS** e) Estimation of the cost of replacement/upgrade of specific elements or category of elements f) Simulation of the design alternatives for the removal of one or more curves g) Estimation of the cost of the new design alternatives h) Estimation of the travel time with the new design alternatives **STEP 4 – UPGRADE OF THE RAILWAY LINE** i) Support the creation of the design models j) Support the creation of the as-built models k) Support the creation of the as-to-be-maintained models
Duration	Planned: Some weeks only for the STEP 3 as step 1 was supposed to be already available. Actual: 7 months to conclude step 1 and realize a digital representation of the existing line according to the exchange scenario requirements.
Aim	**STEP 1** At the beginning RFI intended to experiment the use of IFC for the activities from e) to h). As soon as the testing phase started with the gathering of the input data for step 1, the aim was changed to focus on accomplishing step 1, to create an existing conditions model (ECM) of the railway line in IFC. As the business process map below shows, the process followed some specific passages: • First, data from the survey was gathered, adjusted, and shared by RFI with the external specialist, together with the general requirements to set-up the BIM model. • Then, as the ECM is composed by railway domains models, domain experts from RFI and ITF gathered and shared the specific detailed requirements for their domain with the external specialist, to produce domain BIM Models. • The external specialist produced the BIM models

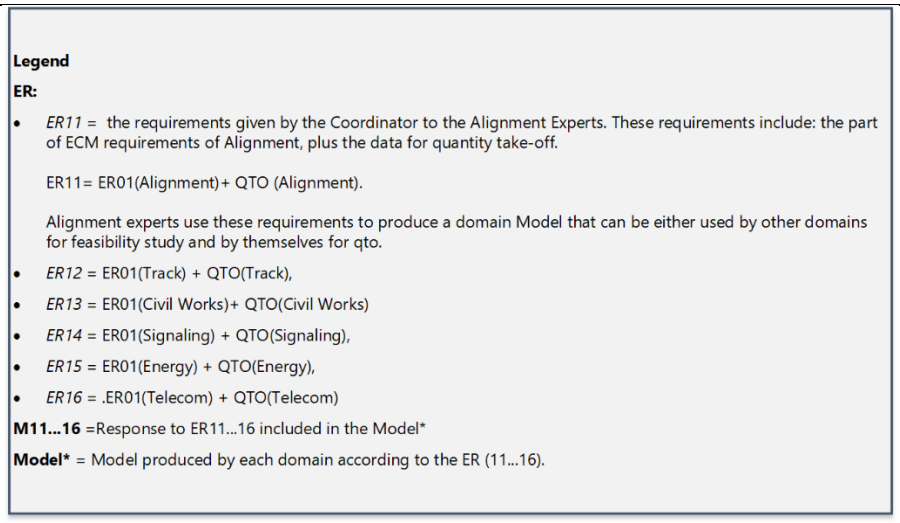
	• These models were then checked and validated by experts against the given requirements. The process maps below show both the high level process to produce the ECM and the exchange of railway domains requirements to produce the domain BIM models. The requirements defined by experts were conceived by keeping in mind the future feasibility study for steps from 2 to 4. As input for step 1 RFI provided datasets with information derived from the survey and from the domain experts, including: • A LandXml for the alignment • A csv file describing the portions of the line (Alignment Table) • Some specific requirements for Alignment setup (described in the storyline document) • Generic requirements for the geographic coordinate system • Generic requirements for the spatial structure of the project • Specific requirements for geometry, Ifc mapping and positioning of domain elements, selected by domain experts (RFI & ITF) The result of STEP 1 was the creation of domain models and ultimately of the ECM (Existing conditions model).
In Scope	• Major equipment of the involved disciplines • Alignment data without cant • ~~Substructure/ subgrade earthworks or civil infrastructures nearby such as Bridge, Tunnel or~~
Out of Scope	• Road crossings (construction of overpasses or underpasses in case of level crossing elimination) • Building – Station's renewal / Stations elimination • NEW: Substructure/ subgrade earthworks or civil infrastructures nearby such as Bridge, Tunnel
Specific Detailed Process Map for this Storyline *[process map that defines realistic exchange scenarios between software applications ; reference to general processes defined in the IFC Rail Requirements analysis report Chapter 2 : IFC Rail Process Map also called High-level Reference Process Map (HLRP)]*	
ECM  	

Detail of ECM production



QTO & 3DV





HLRP	ES nbr	From	To	Note [optional]
	SLAC-PL-ECM-ES01	External Specialist	RFI Specialist	ECM - Existing Condition Modelling
	SLAC-PL-ECM-ES11	Coordinator	Alignment Designer	ECM QTO 3DV
	SLAC-PL-ECM-ES12	Coordinator	Track Designer	ECM QTO 3DV
	~~SLAC-PL-ECM-ES13~~	~~Coordinator~~	~~Civil Designer~~	~~ECM~~ ~~QTO~~ ~~3DV~~
	SLAC-PL-ECM-ES14	Coordinator	Signaling Designer	ECM QTO 3DV
	SLAC-PL-ECM-ES15	Coordinator	Energy Designer	ECM QTO 3DV
	SLAC-PL-ECM-ES16	Coordinator	Telecom Designer	ECM QTO 3DV

2 Exchange Scenario (ES) and Tests

ECM ES1 is the high level Exchange Scenario that allows to produce the existing condition model in IFC. Such model is accomplished through the progressive exchange of several models: starting from the alignment model, adding the track elements to form the track model, and then adding all the other domain-specific elements to form the signalling model, the energy model and the TLC model. Thus, this storyline has one major high level Exchange Scenario (ECM ES1) that encompasses multiple sub-scenarios (ES11 to ES16) in which detailed requirements are exchanged with different milestones, as already explained in the process maps.

RFI and ITF experts defined the general requirements for the high-level Exchange Scenario, so that the designers would be able to produce the model. Some of these general requirements pertain to the spatial structure of the model and the geographic coordinate system.
These general requirements apply also to every detailed exchange scenario, for which the experts defined also specific requirements to aid the designer in modelling the domains elements.
Each sub-scenario ended with the production of a domain model and each model was checked and validated by RFI and ITF experts, with support from Engisis.
For the scope of model validation regarding geometry and schema compliance some existing tools, such as KIT IFC Checking tool and RDF tool, were used. Moreover, a new validation tool was developed by Engisis to validate the semantic of the model, called "regola".
Overall, the final product of the Storyline test is an ECM that satisfies the needs and the expectations of the stakeholder.

Note: in the early storyline plan, there was another sub-scenario regarding the exchange requirements for civil works domain (ECM-ES13). However, this scenario was not tested.

Id	**SLAC-PL-ECM-ES1**
Exchange Scenario Description *[please describe the ES and define In/Out of Scope topics]*	
• When the survey data is adjusted and ready to use, it is shared with the external specialists to set-up the ECM model. • Each discipline (domain) must define its starting requirements for the ECM, considering also the subsequent three following use cases: - Infrastructural gap analysis - Feasibility study for the gap upgrade - Feasibility study for new line sections • The ER are then defined and shared by the RFI specialists with the External specialists to produce the model. The storyline testing plan was divided in 3 milestones, as described in the document "SLTP - Storyline testing plan_RFI_Acquisition and upgrade of an existing railway line".	
Geometry and positioning requirements *[General description / concepts => specific on Excel sheets]*	
• General requirements for the model (geographic coordinate system) are defined in the general requirements (in SL Document) • Geometry and positioning requirements are defined for each element in the specific requirements (in *Annex 3a_ Other Requirements Specific* and in the *Annex 3b_Components of complex groups.*).	
Spatial requirements *[General description of spatial element requirements => specific on Excel sheets]*	
• Spatial requirements for the model are defined in the general requirements (in SL Document)	
Physical and functional requirements *[General description of physical elements, functional elements and important information => specific on Excel sheets]*	
• General Data requirements are defined in Annex 1	
Covered Unit Test: to be filled by Technical Expert(s)	
ID	Unit Test

Test Completion (Specify level of completion and if reserves/punchlist opened, additional TS works….)

• All milestones were completed by the end of the testing phase (end of October 2021)
• Several Software Vendors participated to the test, such as: ACCA, 12d, Rail Complete, ESRI, Dassault, RDF
• Only some SV completed the milestones by producing models: ACCA, Rail Complete and 12d (only milestone 1)
• A document was created to report issues along the way: “SLI - Storyline Issues_RFI_Acquisition and upgrade of an existing railway line”
• As a result of the testing phase these models were produced:
  ○ Alignment model
  ○ Track model. The requested track elements were added on top of the alignment model.
  ○ Energy model. The requested energy elements were added on top of the track model.
  ○ Telecom model. The requested Telecom elements were added on top of the track model.
  ○ Signalling model. The requested signalling elements were added on top of the track model.
  ○ Final model. This model contains all requested elements on top of the alignment.
All these models were validated and approved by RFI and ITF experts with the support of the Technical Service.

Test Team and Test Leader Satisfaction (Specify the Box/Github links to find the test results or documents….)
STEP 1 was completed successfully, fully satisfying the expectations of the stakeholder. • Storyline issue document can be found here in Box: https://app.box.com/s/0aioos065zcsms8rydpkjmmf1g210i7v/folder/136013541119 • Storyline testing plan can be found here in Box: https://app.box.com/s/0aioos065zcsms8rydpkjmmf1g210i7v/folder/135164315232 • Storyline input documentation can be found here in Box: https://app.box.com/s/0aioos065zcsms8rydpkjmmf1g210i7v/folder/135164778738 • Recording and presentation of storyline meeting can be found here in Box: https://app.box.com/s/0aioos065zcsms8rydpkjmmf1g210i7v/folder/135243271636
Tests and Results Archives (Specify the Box/Github links to find the test results or documents….)
The Github repository for storyline test is here: https://github.com/IFCRail/IFC-Rail-Unit-Test/tree/master/8_Storylines%20Test%20(SL)/SL06_Acquisition%20and%20Upgrade%20of%20an%20Existing%20Railway%20Line

2.1 Updated Exchange Scenario: SLAC-PL-ECM-ES11

2.1.1 Updated Exchange Scenario

Id	**SLAC-PL-ECM-ES11**
Exchange Scenario Description *[please describe the ES and define In/Out of Scope topics]*	
• The multicriteria for the alignment design is defined. It is necessary to exchange the Alignment LandXML & Multicriteria Reqs with the external specialist (Alignment Designer)	

- The model should contain the Alignment Requirements of the ECM and the multicriteria defined by experts according to the use cases needed
- The model is produced by the Alignment Designer and checked by RFI and ITF experts

This exchange scenario was planned for milestone 1 of the testing plan, as follows:

	Input	Activity	Responsible	Output	Progress
1	- Alignment, as derived from survey (LandXML)	**ITF** select and prepare a portion of the alignment	(Italferr)	- Adjusted alignment (LandXML)	
2	- Adjusted alignment (LandXML) - Template for IFC-fashioned alignment table (CSV)	**RFI-ITF** provide the table (CSV) that describes the portion of the line.	(Italferr)	- Alignment table (CSV)	
3	- Adjusted alignment (LandXML) - Alignment table (CSV) - Temporary Spatial Structure	**Writer 1** produce an IFC file for the given alignment		- Alignment model 1.0 (IFC)	
4a	- Alignment model 1.0 (IFC) - Template for IFC-fashioned alignment table (CSV) - Alignment table (CSV)	**Engisis** develop rules for the alignment semantic validation **Engisis** import Alignment model 1.0 (IFC) and Alignment table (CSV) in BIMTester	Evandro (TS, Engisis)	- Validation report for semantic alignment	
4b	- Alignment model 1.0 (IFC)	**Reader 1** import Alignment model 1.0 and provide proof of import		- Screenshot of some details (or temporary access to the platform to check the result) - OPTIONAL: native file	
4c	- Alignment model 1.0 (IFC)	**Reader 2** import Alignment model 1.0 and export an IFC file (Alignment model 2.0)		- Alignment model 2.0 (IFC)	
5	- Alignment model 2.0 (IFC) - Template for IFC-fashioned alignment table to be filled in (CSV) - Alignment table (CSV)	**Engisis** check Alignment model 2.0 (IFC) in BIMTester	Evandro (TS, Engisis)	- Validation report for semantic alignment done through regola checking tool	
	FIRST MILESTONE – 7th MAY – ALIGNMENT MODEL EXCHANGED AND VALIDATED				

Geometry and positioning requirements

[General description / concepts => specific on Excel sheets]

The requirements are derived from the major exchange scenario SLAC-PL-ECM-ES1

Spatial requirements

[General description of spatial element requirements => specific on Excel sheets]

The requirements are derived from the major exchange scenario SLAC-PL-ECM-ES1

Physical and functional requirements

[General description of physical elements, functional elements and important information => specific on Excel sheets]

The requirements are derived from the major exchange scenario SLAC-PL-ECM-ES1

Covered Unit Test: to be filled by Technical Expert(s)

ID	Unit Test
UT_AWC_4	The unit test originally considered cant. Due to survey data not being reliable, cant was in the end excluded in SL.

2.1.2 ES Test description and results

Test Completion

(Specify level of completion and if reserves/punchlist opened, additional TS works….)

An Alignment model was produced by the following SV:

- 12d
- ACCA
- Rail Complete

All above mentioned SV successfully imported the LandXml and exported an alignment, fulfilling the role of “writer”.

They also successfully completed the role of “reader” by each importing the files produced by the others.

The models produced were checked and validated using regola (https://regola.io/) and other tools, such as KIT IFC Checking tool and RDF checking tool.

	Input	Activity	Responsible	Output	Progress
1	- Alignment, as derived from survey (LandXML)	**ITF** select and prepare a portion of the alignment	(Italferr)	- Adjusted alignment (LandXML)	**Completed**
2	- Adjusted alignment (LandXML) - Template for IFC-fashioned alignment table (CSV)	**RFI-ITF** provide the table (CSV) that describes the portion of the line.	(Italferr)	- Alignment table (CSV)	**Completed**
3	- Adjusted alignment (LandXML) - Alignment table (CSV) - Temporary Spatial Structure	**Writer 1** produce an IFC file for the given alignment	**Writer 1** role played by: - 12d, ACCA, RailCOMPLETE	- Alignment model 1.0 (IFC)	**Completed**
4a	- Alignment model 1.0 (IFC) - Template for IFC-fashioned alignment table (CSV) - Alignment table (CSV)	**Engisis** develop rules for the alignment semantic validation **Engisis** import Alignment model 1.0 (IFC) and Alignment table (CSV) in BIMTester	Evandro (TS, Engisis)	- Validation report for semantic alignment	**Completed**
4b	- Alignment model 1.0 (IFC)	**Reader 1** import Alignment model 1.0 and provide proof of import	**Reader 1** role played by: - 12d, ACCA, RailCOMPLETE,	- Screenshot of some details (or temporary access to the platform to check the result) - OPTIONAL: native file	**Completed**
4c	- Alignment model 1.0 (IFC)	**Reader 2** import Alignment model 1.0 and export an IFC file (Alignment model 2.0)	**Reader 2** role played by: - 12d,, ACCA, RailCOMPLETE	- Alignment model 2.0 (IFC)	**Completed**
5	- Alignment model 2.0 (IFC) - Template for IFC-fashioned alignment table to be filled in (CSV) - Alignment table (CSV)	**Engisis** check Alignment model 2.0 (IFC) in BIMTester	Evandro (TS, Engisis) Done through the use of different tools: • KIT IFC checking tool for schema compliance, • RDF checking tool for geometry, • Regola for semantic checking	- Validation report for semantic alignment done through regola checking tool	**Completed**
FIRST MILESTONE – 7th MAY – ALIGNMENT MODEL EXCHANGED AND VALIDATED					

Test Team and Test Leader Satisfaction

(Specify the Box/Github links to find the test results or documents….)

The 1st milestone of the storyline was successfully completed according to the stakeholder's expectations.

RFI and ITF experts produced some validation reports, by using "regola", that were given to the software vendors who participated in order to solve the issues that arose during the design.

Tests and Results Archives

(Specify the Box/Github links to find the test results or documents….)

- Dataset: shorturl.at/iuzD0
- Validation report (box): shorturl.at/muBIJ
- models (GitHub): shorturl.at/CWX26

2.2 Updated Exchange Scenario: SLAC-PL- ECM-ES12

2.2.1 Updated Exchange Scenario

Id	**SLAC-PL-ECM-ES12**

Exchange Scenario Description

[please describe the ES and define In/Out of Scope topics]

- After the Alignment model is done, it is necessary to define the multicriteria requirements for the Track domain.
- The alignment model produced, and the criteria are shared with the external Track Designer
- Track model quantities are also required for the QTO use case
- The Track model is produced and validated

The track model was planned for Milestone 2:

Step	Input	Activity	Responsible	Output	Progress
6a	- Alignment model 2.0 (IFC) - Definitive Spatial Structure - Object grouping - Dataset (minimum: shape + properties) of the physical elements: - **Rail profile** - **Sleeper type**	**Writer 2** import Alignment model 2.0 and add: - Substructure elements (subgrade) - Super-structure elements (ballast, rails, sleepers) Then, **export an IFC file** (Track model 2.0)	**Writer 2** role will be played by: - 12d, ACCA, RailCOMPLETE	- Track model 2.0 (IFC) - Screenshot of some details from the application of the Writer 2 - OPTIONAL: native file	
6b	- Alignment model 2.0 (IFC) - **Definitive Spatial Structure** - Object grouping - Dataset (minimum: shape + properties) of the physical elements: - **Rail profile** - **Sleeper type model** - **Ballast dimensions** - Track quantities template (CSV)	**Writer 2** import Alignment model 2.0 and add: - Substructure (subgrade) - Super-structure (ballast, rails, sleepers) Then, **extract some quantities based on the given template**	**Writer 2** role will be played by: - 12d, ACCA, RailCOMPLETE	- Track model 2.0 (IFC) - Track model quantities (CSV)	
7	- Track model 2.0 (IFC) - Track quantities template (CSV) - Track model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF Experts** check Track model 2.0 (IFC) and Track model quantities (CSV) thtough **regola**	TS, Engisis and RFI/ITF Experts	- Validation report for quantity take-off	
SECOND MILESTONE – 09th JULY – ALIGNMENT MODEL ENRICHED WITH TRACK ELEMENTS, EXCHANGED, AND VALIDATED					

Geometry and positioning requirements

[General description / concepts => specific on Excel sheets]

- Geometry and positioning requirements are defined for each element in the specific requirements (in *Annex 3a_ Other Requirements Specific* and in the *Annex 3b_Components of complex groups.*).
- Additional requirements are defined in the SL dataset.

Spatial requirements

[General description of spatial element requirements => specific on Excel sheets]

- Spatial requirements are defined in *Annex 2_Spatial requirements*

Physical and functional requirements

[General description of physical elements, functional elements and important information => specific on Excel sheets]

Physical and functional requirements are defined in the SL dataset.

Covered Unit Test: to be filled by Technical Expert(s)

ID	Unit Test
UT_RSS_1	Single domain spatial structure
UT_SYS_1	System breakdown and Group Assignment
UT_SYS_2	Group reference to spatial structure
UT_SYS_3	Property Sets for Groups (and Group types)

2.2.2 ES Test description and results

Test Completion

(Specify level of completion and if reserves/punchlist opened, additional TS works….)

Some track elements were chosen to be represented by domain experts:

- Rail
- Ballast
- sleeper

For each element type, specific requirements were defined:

- geometry & shape representation
- positioning
- property sets, with requested properties and accepted properties values

The track models were ultimately produced by ACCA and Rail Complete and validated by RFI and ITF experts, by opening the file and checking visually, as well as using regola (https://regola.io/) to check property and property sets requitements.

Step	Input	Activity	Responsible	Output	Progress
6a	- Alignment model 2.0 (IFC) - Definitive Spatial Structure - Object grouping - Dataset (minimum: shape + properties) of the physical elements: - **Rail profile** - **Sleeper type**	**Writer 2** import Alignment model 2.0 and add: - Substructure elements (subgrade) - Super-structure elements (ballast, rails, sleepers) Then, **export an IFC file** (Track model 2.0)	**Writer 2** role will be played by: - 12d, ACCA, RailCOMPLETE	- Track model 2.0 (IFC) - Screenshot of some details from the application of the Writer 2 - OPTIONAL: native file	**completed**
6b	- Alignment model 2.0 (IFC) - **Definitive Spatial Structure** - Object grouping - Dataset (minimum: shape + properties) of the physical elements: - **Rail profile** - **Sleeper type model** - **Ballast dimensions** - Track quantities template (CSV)	**Writer 2** import Alignment model 2.0 and add: - Substructure (subgrade) - Super-structure (ballast, rails, sleepers) Then, **extract some quantities based on the given template**	**Writer 2** role will be played by: - 12d, ACCA, RailCOMPLETE	- Track model 2.0 (IFC) - Track model quantities (CSV)	**completed**
7	- Track model 2.0 (IFC) - Track quantities template (CSV) - Track model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF Experts** check Track model 2.0 (IFC) and Track model quantities (CSV) thtough **regola**	TS, Engisis and RFI/ITF Experts	- Validation report for quantity take-off	**completed**
SECOND MILESTONE – 09th JULY – ALIGNMENT MODEL ENRICHED WITH TRACK ELEMENTS, EXCHANGED, AND VALIDATED					

Test Team and Test Leader Satisfaction

(Specify the Box/Github links to find the test results or documents….)

During the 2nd milestone, the experts checked the models and provided the SV with feedback, either offline, or during monthly meetings.
Feedback from experts inside the SL meeting presentations under the folder "meetings" (shorturl.at/lmCEY).
The 2nd milestone is considered to be successfully completed, since it conforms to expectations.

Tests and Results Archives

(Specify the Box/Github links to find the test results or documents….)

dataset (box): shorturl.at/fvyMQ
models (Github): shorturl.at/CWX26

2.3 Updated Exchange Scenario: SLAC-PL-ECM-ES14

2.3.1 Updated Exchange Scenario

Id	**SLAC-PL-ECM-ES14**

Exchange Scenario Description

[please describe the ES and define In/Out of Scope topics]

- After the Track model is done, it is necessary to define the multicriteria requirements for the Signalling domain.
- The Track model produced, and the requirements are shared with the external Signalling Designer.
- Signalling model quantities are also requires for the QTO use case.
- The Signalling model is produced and validated

The track model was planned for Milestone 3, together with Energy and Telecom model (and their quantity take-off)

Step	Input	Activity	Responsible	Output	Progress
7a	•Track model 2.0 (IFC) •Energy Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Energy objects Then, export an IFC file (Energy model 2.0)	**Writer 3**	•Energy model 2.0 (IFC)	
7b	•Track model 2.0 (IFC) •Energy quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Energy objects Then, extract some quantities based on a given template	**Writer 3**	•Energy model quantities (CSV)	
8a	•Track model 2.0 (IFC) •signal drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, export an IFC file (Signalling model 2.0)	**Writer 3**	•Signalling model 2.0 (IFC)	
8b	•Track model 2.0 (IFC) •Signalling quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, extract some quantities based on a given template	**Writer 3**	•Signalling model quantities (CSV)	
9a	•Track model 2.0 (IFC) •TLC Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, export an IFC file (Telecom model 2.0)	**Writer 3**	•Telecom model 2.0 (IFC)	
9b	•Track model 2.0 (IFC) •Telcom quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, extract some quantities based on a given template	**Writer 3**	•Telecom model quantities (CSV)	
10	•Energy/Signalling/Telecom model 2.0 (IFC) •Energy/Signalling/Telecom quantities template (CSV) •Energy/Signalling/Telecom model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF experts** check Energy/Signalling model 2.0 (IFC) and Energy/Signalling model quantities (CSV) in regola	TS, Engisis and RFI/ITF Experts	•Validation report for quantity take-off	
THIRD MILESTONE – 8th OCTOBER					

Geometry and positioning requirements

[General description / concepts => specific on Excel sheets]

- Geometry and positioning requirements are defined for each element in the specific requirements (in *Annex 3a_ Other Requirements Specific* and in the *Annex 3b_Components of complex groups.*).
- Additional requirements are defined in the SL dataset.

Spatial requirements

[General description of spatial element requirements => specific on Excel sheets]

- Spatial requirements are defined in *Annex 2_Spatial requirements*

Physical and functional requirements

[General description of physical elements, functional elements and important information => specific on Excel sheets]

Physical and functional requirements are defined in the SL dataset.

Covered Unit Test: to be filled by Technical Expert(s)

ID	Unit Test
UT_RSS_1	Single domain spatial structure
UT_SYS_1	System breakdown and Group Assignment
UT_SYS_2	Group reference to spatial structure
UT_SYS_3	Property Sets for Groups (and Group types)

2.3.2 ES Test description and results

Test Completion

(Specify level of completion and if reserves/punchlist opened, additional TS works….)

The experts chose to request 1 type of signal to represent in the model, for which they provided:

- Geometry requirements
- Some designs for shape representation
- Positioning rules
- QTO parameters
- Property sets, with properties and accepted values

As the second milestone, ACCA and Racil Complete successfully produced a model, designing the signals on top of the Track model from milestone 2.
The models were then checked and validated by RFI and ITF experts both visually and through regola.

Step	Input	Activity	Responsible	Output	Progress
7a	•Track model 2.0 (IFC) •Energy Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Energy objects Then, export an IFC file (Energy model 2.0)	**Writer 3** ACCA, RailComplete	•Energy model 2.0 (IFC)	**completed**
7b	•Track model 2.0 (IFC) •Energy quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Energy objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Energy model quantities (CSV)	**completed**
8a	•Track model 2.0 (IFC) •signal drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, export an IFC file (Signalling model 2.0)	**Writer 3** ACCA, RailComplete	•Signalling model 2.0 (IFC)	**completed**
8b	•Track model 2.0 (IFC) •Signalling quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Signalling model quantities (CSV)	**completed**
9a	•Track model 2.0 (IFC) •TLC Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, export an IFC file (Telecom model 2.0)	**Writer 3** ACCA, RailComplete	•Telecom model 2.0 (IFC)	**completed**
9b	•Track model 2.0 (IFC) •Telcom quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Telecom model quantities (CSV)	**completed**
10	•Energy/Signalling/Telecom model 2.0 (IFC) •Energy/Signalling/Telecom quantities template (CSV) •Energy/Signalling/Telecom model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF experts** check Energy/Signalling model 2.0 (IFC) and Energy/Signalling model quantities (CSV) in regola	TS, Engisis and RFI/ITF Experts	•Validation report for quantity take-off	**completed**
THIRD MILESTONE – 22nd OCTOBER					

Test Team and Test Leader Satisfaction

(Specify the Box/Github links to find the test results or documents….)

During the 3rd milestone, the experts checked the models and provided the SV with feedback, either offline, or during monthly meetings.
The feedback from experts is archived inside the SL meeting presentations under the folder "meetings" (shorturl.at/lmCEY).
This scenario was successfully completed by the participating SVs.

Tests and Results Archives

(Specify the Box/Github links to find the test results or documents….)

dataset: shorturl.at/syD67
models (Github): shorturl.at/CWX26
Feedback from experts inside the SL meeting presentations under the folder "meetings" (shorturl.at/lmCEY)

2.4 Updated Exchange Scenario: SLAC-PL-ECM-ES15

2.4.1 Updated Exchange Scenario

Id	**SLAC-PL-ECM-ES15**

Exchange Scenario Description

[please describe the ES and define In/Out of Scope topics]

- At the same time as the Signaling model is being produced, it is necessary to define the multicriteria requirements for the Energy domain.
- The Track model produced before, and the requirements are shared with the external Energy Designer.
- Energy model quantities are also required for the QTO use case.
- The Energy model is produced and validated

The Energy model was planned for Milestone 3, together with Signalling and Telecom model (and their quantity take-off)

Step	Input	Activity	Responsible	Output	Progress
7a	•Track model 2.0 (IFC) •Energy Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Energy objects Then, export an IFC file (Energy model 2.0)	**Writer 3**	•Energy model 2.0 (IFC)	
7b	•Track model 2.0 (IFC) •Energy quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Energy objects Then, extract some quantities based on a given template	**Writer 3**	•Energy model quantities (CSV)	
8a	•Track model 2.0 (IFC) •signal drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, export an IFC file (Signalling model 2.0)	**Writer 3**	•Signalling model 2.0 (IFC)	
8b	•Track model 2.0 (IFC) •Signalling quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, extract some quantities based on a given template	**Writer 3**	•Signalling model quantities (CSV)	
9a	•Track model 2.0 (IFC) •TLC Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, export an IFC file (Telecom model 2.0)	**Writer 3**	•Telecom model 2.0 (IFC)	
9b	•Track model 2.0 (IFC) •Telcom quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, extract some quantities based on a given template	**Writer 3**	•Telecom model quantities (CSV)	
10	•Energy/Signalling/Telecom model 2.0 (IFC) •Energy/Signalling/Telecom quantities template (CSV) •Energy/Signalling/Telecom model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF experts** check Energy/Signalling model 2.0 (IFC) and Energy/Signalling model quantities (CSV) in regola	TS, Engisis and RFI/ITF Experts	•Validation report for quantity take-off	
THIRD MILESTONE – 8th OCTOBER					

Geometry and positioning requirements

[General description / concepts => specific on Excel sheets]

- Geometry and positioning requirements are defined for each element in the specific requirements (in *Annex 3a_ Other Requirements Specific* and in the *Annex 3b_Components of complex groups.*).
- Additional requirements are defined in the SL dataset.

Spatial requirements

[General description of spatial element requirements => specific on Excel sheets]

- Spatial requirements are defined in *Annex 2_Spatial requirements*

Physical and functional requirements

[General description of physical elements, functional elements and important information => specific on Excel sheets]

Physical and functional requirements are defined in the SL dataset.

Covered Unit Test: to be filled by Technical Expert(s)

ID	Unit Test
UT_RSS_1	Single domain spatial structure
UT_SYS_1	System breakdown and Group Assignment
UT_SYS_2	Group reference to spatial structure
UT_SYS_3	Property Sets for Groups (and Group types)

2.4.2 ES Test description and results

Test Completion

(Specify level of completion and if reserves/punchlist opened, additional TS works….)

The experts chose to request the follwing energy elements:

- Pole
- Cantilever Assembly
- Portal (Pole + crossbeam)
- Overhead contact line (nice to have)

For each of them they provided:

- Geometry requirements
- Some designs for shape representation
- Positioning parameters

- QTO parameters
- Property sets, with properties and accepted values

As the second milestone, ACCA and Racil Complete successfully produced a model, designing the energy on top of the Track model from milestone 2.
The models were then checked and validated by RFI and ITF experts both visually and through regola.

Step	Input	Activity	Responsible	Output	Progress
7a	•Track model 2.0 (IFC) •Energy Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Energy objects Then, export an IFC file (Energy model 2.0)	**Writer 3** ACCA, RailComplete	•Energy model 2.0 (IFC)	**completed**
7b	•Track model 2.0 (IFC) •Energy quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Energy objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Energy model quantities (CSV)	**completed**
8a	•Track model 2.0 (IFC) •signal drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, export an IFC file (Signalling model 2.0)	**Writer 3** ACCA, RailComplete	•Signalling model 2.0 (IFC)	**completed**
8b	•Track model 2.0 (IFC) •Signalling quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Signalling model quantities (CSV)	**completed**
9a	•Track model 2.0 (IFC) •TLC Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, export an IFC file (Telecom model 2.0)	**Writer 3** ACCA, RailComplete	•Telecom model 2.0 (IFC)	**completed**
9b	•Track model 2.0 (IFC) •Telcom quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Telecom model quantities (CSV)	**completed**
10	•Energy/Signalling/Telecom model 2.0 (IFC) •Energy/Signalling/Telecom quantities template (CSV) •Energy/Signalling/Telecom model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF experts** check Energy/Signalling model 2.0 (IFC) and Energy/Signalling model quantities (CSV) in regola	TS, Engisis and RFI/ITF Experts	•Validation report for quantity take-off	**completed**
THIRD MILESTONE – 22nd OCTOBER					

Test Team and Test Leader Satisfaction
(Specify the Box/Github links to find the test results or documents….)

During the 3rd milestone, the experts checked the models and provided the SV with feedback, either offline, or during monthly meetings. Some issues were found in the early validation tests, that were then corrected by the SVs, who successfully completed this scenario.
Feedback from experts can be found inside the SL meeting presentations under the folder "meetings" (shorturl.at/lmCEY)

Tests and Results Archives
(Specify the Box/Github links to find the test results or documents….)

dataset: shorturl.at/syD67
models (Github): shorturl.at/CWX26
Feedback from experts inside the SL meeting presentations under the folder "meetings" (shorturl.at/lmCEY)

2.5 Updated Exchange Scenario: SLAC-PL-ECM-ES16

2.5.1 Updated Exchange Scenario

Id	**SLAC-PL-ECM-ES16**

Exchange Scenario Description
[please describe the ES and define In/Out of Scope topics]

- At the same time as the other domain models are being produced, it is necessary to define the multicriteria requirements for the Telecom domain.
- The Track model produced before, and the requirements are shared with the external Telecom Designer.

- Telecom model quantities are also required for the QTO use case.
- The Telecom model is produced and validated

The Telecom model was planned for Milestone 3, together with Signalling and Energy model (and their quantity take-off)

Step	Input	Activity	Responsible	Output	Progress
7a	•Track model 2.0 (IFC) •Energy Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Energy objects Then, export an IFC file (Energy model 2.0)	**Writer 3**	•Energy model 2.0 (IFC)	
7b	•Track model 2.0 (IFC) •Energy quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Energy objects Then, extract some quantities based on a given template	**Writer 3**	•Energy model quantities (CSV)	
8a	•Track model 2.0 (IFC) •signal drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, export an IFC file (Signalling model 2.0)	**Writer 3**	•Signalling model 2.0 (IFC)	
8b	•Track model 2.0 (IFC) •Signalling quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, extract some quantities based on a given template	**Writer 3**	•Signalling model quantities (CSV)	
9a	•Track model 2.0 (IFC) •TLC Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, export an IFC file (Telecom model 2.0)	**Writer 3**	•Telecom model 2.0 (IFC)	
9b	•Track model 2.0 (IFC) •Telcom quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, extract some quantities based on a given template	**Writer 3**	•Telecom model quantities (CSV)	
10	•Energy/Signalling/Telecom model 2.0 (IFC) •Energy/Signalling/Telecom quantities template (CSV) •Energy/Signalling/Telecom model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF experts** check Energy/Signalling model 2.0 (IFC) and Energy/Signalling model quantities (CSV) in regola	TS, Engisis and RFI/ITF Experts	•Validation report for quantity take-off	
THIRD MILESTONE – 8th OCTOBER					

Geometry and positioning requirements

[General description / concepts => specific on Excel sheets]

- Geometry and positioning requirements are defined for each element in the specific requirements (in *Annex 3a_ Other Requirements Specific* and in the *Annex 3b_Components of complex groups.*).
- Additional requirements are defined in the SL dataset.

Spatial requirements

[General description of spatial element requirements => specific on Excel sheets]

- Spatial requirements are defined in *Annex 2_Spatial requirements*

Physical and functional requirements

[General description of physical elements, functional elements and important information => specific on Excel sheets]

Physical and functional requirements are defined in the SL dataset.

Covered Unit Test: to be filled by Technical Expert(s)

ID	Unit Test
UT_RSS_1	Single domain spatial structure
UT_SYS_1	System breakdown and Group Assignment
UT_SYS_2	Group reference to spatial structure
UT_SYS_3	Property Sets for Groups (and Group types)

2.5.2 ES Test description and results

Test Completion

(Specify level of completion and if reserves/punchlist opened, additional TS works….)

The experts chose to request the follwing energy elements:

- Trackside telephony
- Cables/ducts

For each of them they provided:

- Geometry requirements
- Some designs for shape representation

- Positioning parameters
- QTO parameters
- Property sets, with properties and accepted values

As the second milestone, ACCA and Rail Complete successfully produced a model, designing the telecom on top of the Track model from milestone 2.
The models were then checked and validated by RFI and ITF experts both visually and through regola.

Step	Input	Activity	Responsible	Output	Progress
7a	•Track model 2.0 (IFC) •Energy Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Energy objects Then, export an IFC file (Energy model 2.0)	**Writer 3** ACCA, RailComplete	•Energy model 2.0 (IFC)	**completed**
7b	•Track model 2.0 (IFC) •Energy quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Energy objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Energy model quantities (CSV)	**completed**
8a	•Track model 2.0 (IFC) •signal drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, export an IFC file (Signalling model 2.0)	**Writer 3** ACCA, RailComplete	•Signalling model 2.0 (IFC)	**completed**
8b	•Track model 2.0 (IFC) •Signalling quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Signalling objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Signalling model quantities (CSV)	**completed**
9a	•Track model 2.0 (IFC) •TLC Drawings, images, parameters	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, export an IFC file (Telecom model 2.0)	**Writer 3** ACCA, RailComplete	•Telecom model 2.0 (IFC)	**completed**
9b	•Track model 2.0 (IFC) •Telcom quantities template (CSV)	**Writer 3** import Track model 2.0 and add: •Telecom objects Then, extract some quantities based on a given template	**Writer 3** ACCA, RailComplete	•Telecom model quantities (CSV)	**completed**
10	•Energy/Signalling/Telecom model 2.0 (IFC) •Energy/Signalling/Telecom quantities template (CSV) •Energy/Signalling/Telecom model quantities (CSV)	**Engisis** develop rules for quantities validation **Engisis** and **RFI/ITF experts** check Energy/Signalling model 2.0 (IFC) and Energy/Signalling model quantities (CSV) in regola	TS, Engisis and RFI/ITF Experts	•Validation report for quantity take-off	**completed**
THIRD MILESTONE – 22nd OCTOBER					

Test Team and Test Leader Satisfaction
(Specify the Box/Github links to find the test results or documents….)

During the 3rd milestone, the experts checked the models and provided the SV with feedback, either offline, or during monthly meetings. Some issues were found in the early validation tests, that were then corrected by the SVs, who successfully completed this scenario.
Feedback from experts can be found inside the SL meeting presentations under the folder "meetings" (shorturl.at/lmCEY)

Tests and Results Archives
(Specify the Box/Github links to find the test results or documents….)

dataset: shorturl.at/syD67
models (Github): shorturl.at/CWX26
Feedback from experts inside the SL meeting presentations under the folder "meetings" (shorturl.at/lmCEY)

3 Supporting Files and Storyline Archives

3.1 Exchange Requirements (ER)

Annex 1_Data requirements: 2 sheets added (Civil Works, Other requirements)

3.2 SL Data archives

All files and Data are archived in:

BOX directory:
https://app.box.com/s/0aioos065zcsms8rydpkjmmf1g210i7v/folder/119147123352
GITHUB:
https://github.com/IFCRail/IFC-Rail-Unit-Test/tree/master/8_Storylines%20Test%20(SL)/SL06_Acquisition%20and%20Upgrade%20of%20an%20Existing%20Railway%20Line

3.3 Test Dataset(s)

All the Test Datasets utilized in this Storyline to achieve the SL Tests.

Alignment Dataset
1. Adjusted Alignment CSV table_Horizontal_radiants.csv 2. Adjusted Alignment CSV table_Vertical_circular arcs.csv 3. Adjusted Alignment LandXML v.1.2 file_vertical circular arcs + radiant.xml 4. Adjusted Alignment LandXML v.2.0 file_vertical circular arcs + radiant.xml 5. Alignment table_Bentley_Parabole cubiche.xlsx 6. Alignment LandXML file_V.1.2_Parabole cubiche.xml 7. Cant.pdf 8. Cant transition.pdf 9. RFI-DTC.SIA0011P20190002567_3_Formule Transizioni.pdf
Dataset description
1. Horizontal Alignment in csv table format with angles in radians 2. Vertical Alignment in csv table format with circular curves 3. Horizontal and Vertical Alignment in LandXML v.1.2 format with angles in radians and 4. circular arcs 5. Horizontal and Vertical Alignment in LandXML v.2.0 format with angles in radians and 6. circular arcs 7. Horizontal and Vertical Alignment in csv table format with parabolic curves 8. Horizontal and Vertical Alignment in LandXML v.1.2 format with parabolic curves 9. Diverse horizontal and cant layout: Only the standard case (single spiral or double spiral) 10. Rotation point for cant: Lower Rail – Railhead 11. Doucine / smoothing curves for linear ramps: No - Linear transitions 12. Extract of the Manual with the formulas for applying the transitions
Dataset links
All datasets: shorturl.at/syD67

Track Dataset
1. Track control parameters.xlsx 2. Stations mileage_for Spatial Structure_v1.xlsx 3. Section.pdf 4. 60E1.dwg 5. Rail profile 60 UIC.JPG 6. Sleeper (concrete) RFI 230.JPG 7. Object placement diagram_Key for Annex 3a.png 8. Sleeper position in respect5 to rails.JPG 9. Span between sleepers.JPG
Dataset description

1. Request to extract information from the model for parameter control
2. Information extraction from the model for parameter control
3. Section type single track from the manual
4. Rail geometry in DWG format
5. Rail geometry in JPG format
6. Geometry of the RFI230 sleeper
7. Schemes for the position of objects along the railway line
8. Schemes for positioning the sleepers with respect to the rail
9. Schemes for the spacing of the sleepers

Dataset links
All datasets: shorturl.at/syD67

Signalling Dataset
1. Signal shape.jpg 2. Signal position.jpg 3. Signal support pole.jpg 4. Signalling control parameters.xlsx 5. Detail of support pole (first page).pdf
Dataset description
Position image shows the required position relevant to the station. Some designs of the support pole of the signal are provided to aid the designer.
Dataset links
All datasets: shorturl.at/syD67

Energy Dataset
1. Portal 1 track.pdf (cannot be published) 2. Section catenary.pdf (cannot be published) 3. Pole LSU18a (only for use IFC Rail project).pdf (cannot be published) 4. Placement parameters.xlsx 5. PostOriginForRotation.jpg 6. layoutLevelSpan.PNG (cannot be published) 7. PosdtWithCantilever.PNG (cannot be published) 8. contactWireHeight.PNG (cannot be published) 9. Cantilever (only for use of IFC Rail project).pdf 10. LateralAndVerticalOffset.png (cannot be published) 11. Energy control parameters.xlsx 12. Example of layout plan.pdf (cannot be published) 13. Formula catenary.pdf (cannot be published) 14. ENE_requirements.txt
Dataset description
excel file: placement parameters attachment: pdf file for Catenary formula. Useful to model the catenary wire attachment LateralAndVerticalOffset:image that shows the lateral and vertical offset attachment layoutLevelSpan:image that shows the layout of the Level Span attachment contactWireHeight:image that shows the parameters hCW and stagger attachment PostOriginForRotation:image that shows the origin rotation for the pole attachment PostWithCantilever:image that shows the pole with cantilever

pdf file Post LSU18a (only for use of IFC Rail project): drawing of pole type LSU18a
pdf file Cantilever (only for use of IFC Rail project): drawing of cantilever
pdf file Section (catenary): drawing of sections for the catenary
excel file Energy control parameters: quanity control parameters

Dataset links

All datasets: shorturl.at/syD67

Telecom Dataset

Trackside Telephony

1. Telephone mileage_v1.xlsx
2. VTR box drawing TT22550-1.pdf
3. TT 3166-bis_watertight selective phone case.pdf
4. TT 3157 – pole assembly installation.pdf
5. TT 3156_selective telephone floorplan.pdf
6. Control parameters.xlsx
7. Telephone in watertight case.png
8. Trackside telephone positioned along the railway.jpg

Cables-ducts

9. TT 3136-Cable ducts plan.png
10. Duct and cable laying.xlsx
11. Control parameters.xlsx
12. V 317 – small base tunnel.pdf
13. Example of tunnel and cable vs pole.jpg
14. TT 3134 – big tunnel.pdf
15. Example of copper cable.docx

Dataset description

Trackside Telephony:
excel file: placement parameters
attachment: pdf file for Catenary formula. Useful to model the catenary wire
attachment LateralAndVerticalOffset:image that shows the lateral and vertical offset
attachment layoutLevelSpan:image that shows the layout of the Level Span
attachment contactWireHeight:image that shows the parameters hCW and stagger
attachment PostOriginForRotation:image that shows the origin rotation for the pole
attachment PostWithCantilever:image that shows the pole with cantilever

pdf file Post LSU18a (only for use of IFC Rail project): drawing of pole type LSU18a
pdf file Cantilever (only for use of IFC Rail project): drawing of cantilever
pdf file Section (catenary): drawing of sections for the catenary
excel file Energy control parameters: quanity control parameters

Cable-ducts:
Drawing of tunnel v317: tunnel section with dimensions
Drawing of tunnel TT3134: tunnel section with dimesnions
Drawing of the cable ducts plan (TT3136)

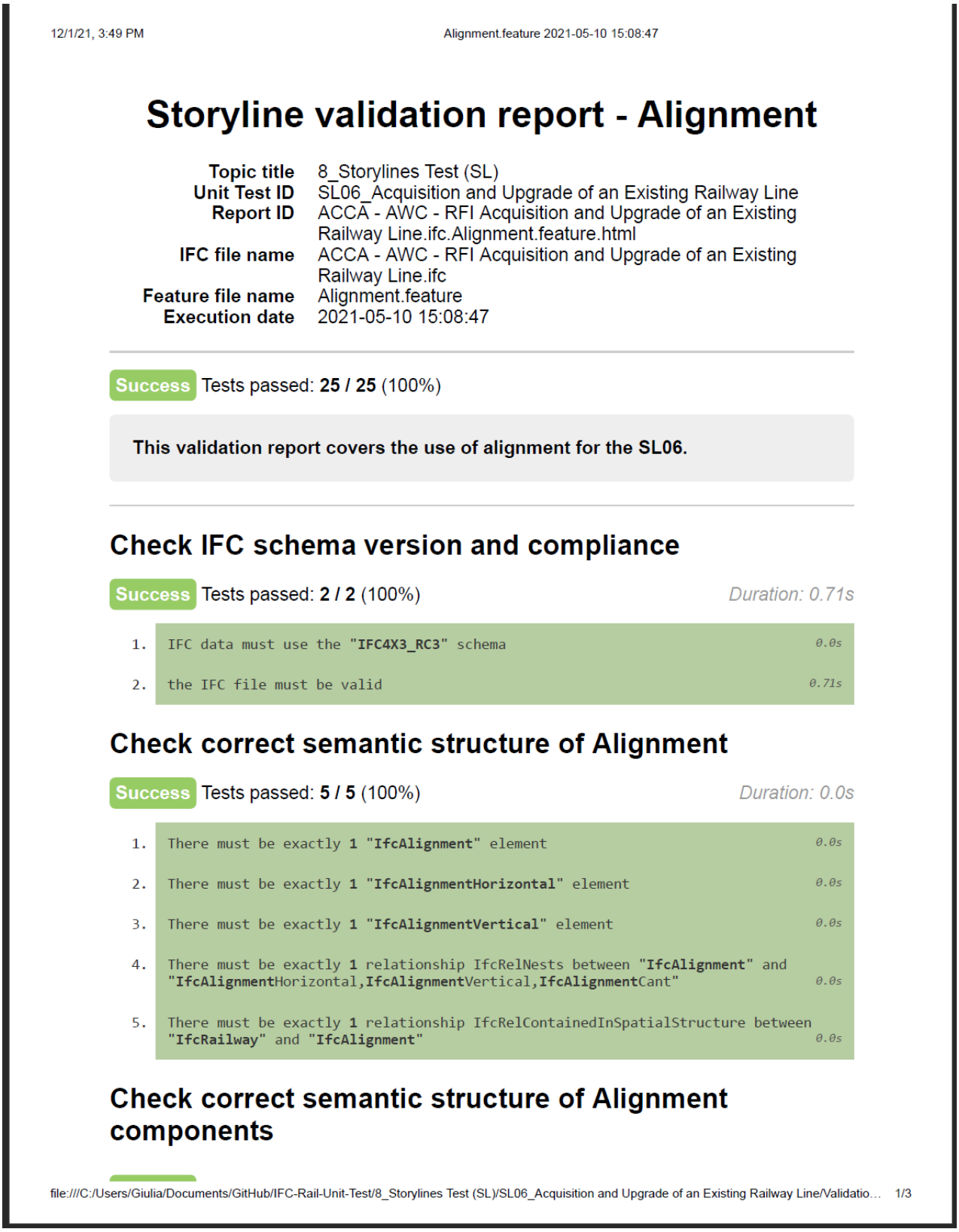
image. eaxmple of tunnels position Excel table: posistion and dimension of cable joints. This position, together with the drawing of the plan, helps to position the tunnels along the pk
Dataset links
All datasets: shorturl.at/syD67

4 Appendices

4.1 Storyline Issues

See the document:
SLI - Storyline Issues_RFI_Acquisition and upgrade of an existing railway line.docx
https://app.box.com/folder/136013541119?s=ogf1d26ng3jbezisgfzwcp0ibpw7ax1p

4.2 Example of alignment report by regola



12/1/21, 3:49 PM Alignment.feature 2021-05-10 15:08:47

Storyline validation report - Alignment

Topic title	8_Storylines Test (SL)
Unit Test ID	SL06_Acquisition and Upgrade of an Existing Railway Line
Report ID	ACCA - AWC - RFI Acquisition and Upgrade of an Existing Railway Line.ifc.Alignment.feature.html
IFC file name	ACCA - AWC - RFI Acquisition and Upgrade of an Existing Railway Line.ifc
Feature file name	Alignment.feature
Execution date	2021-05-10 15:08:47

Success Tests passed: **25 / 25** (100%)

This validation report covers the use of alignment for the SL06.

Check IFC schema version and compliance

Success Tests passed: **2 / 2** (100%) *Duration: 0.71s*

1. IFC data must use the "**IFC4X3_RC3**" schema *0.0s*
2. the IFC file must be valid *0.71s*

Check correct semantic structure of Alignment

Success Tests passed: **5 / 5** (100%) *Duration: 0.0s*

1. There must be exactly **1** "**IfcAlignment**" element *0.0s*
2. There must be exactly **1** "**IfcAlignmentHorizontal**" element *0.0s*
3. There must be exactly **1** "**IfcAlignmentVertical**" element *0.0s*
4. There must be exactly **1** relationship IfcRelNests between "**IfcAlignment**" and "**IfcAlignment**Horizontal,**IfcAlignment**Vertical,**IfcAlignment**Cant" *0.0s*
5. There must be exactly **1** relationship IfcRelContainedInSpatialStructure between "**IfcRailway**" and "**IfcAlignment**" *0.0s*

Check correct semantic structure of Alignment components

file:///C:/Users/Giulia/Documents/GitHub/IFC-Rail-Unit-Test/8_Storylines Test (SL)/SL06_Acquisition and Upgrade of an Existing Railway Line/Validatio… 1/3

Success Tests passed: **3 / 3** (100%) *Duration: 0.01s*

1. "**IfcAlignmentHorizontal**" must nest only instances of "**IfcAlignmentHorizontal**Segment" *0.01s*
2. "**IfcAlignmentVertical**" must nest only instances of "**IfcAlignmentVertical**Segment" *0.0s*
3. "**IfcAlignmentCant**" must nest only instances of "**IfcAlignmentCant**Segment" *0.0s*

Check correct semantic structure of the horizontal segments

Success Tests passed: **7 / 7** (100%) *Duration: 0.03s*

1. Given a set of **horizontal** segments taken from the file "**Dataset/Adjusted Alignment CSV table_Horizontal_radiants.csv**" *0.0s*
2. Given a start point tolerance of "**0.001**" m *0.0s*
3. Given a start direction tolerance of "**0.00001**" rad *0.0s*
4. Given a radius of curvature tolerance of "**0.001**" m *0.0s*
5. Given a segment length tolerance of "**0.001**" m *0.0s*
6. there must be a relationship IfcRelNests between "**IfcAlignmentHorizontal**" and the **horizontal** segments *0.0s*
7. the **horizontal** segments must have a matching PredefinedType and be within the given tolerances *0.03s*

Check correct semantic structure of the vertical segments

Success Tests passed: **8 / 8** (100%) *Duration: 0.01s*

1. Given a set of **vertical** segments taken from the file "**Dataset/Adjusted Alignment CSV table_Vertical_circular arcs.csv**" *0.0s*
2. Given a distance tolerance of "**0.001**" m *0.0s*
3. Given a horizontal length tolerance of "**0.001**" m *0.0s*
4. Given a height tolerance of "**0.001**" m *0.0s*
5. Given a gradient tolerance of "**0.001**" m *0.0s*
6. Given a radius of curvature tolerance of "**0.001**" m *0.0s*
7. there must be a relationship IfcRelNests between "**IfcAlignmentVertical**" and the **vertical** segments *0.0s*

8. the **vertical** segments must have a matching PredefinedType and be within the given tolerances *0.01s*

This validation report is automatically generated by BIMTester. It is the result of checking the IFC file above against the scenarios and steps contained in the feature file.