

AMSfree

Exchange and exploitation of data from Asset Management Systems using vendor free format

Presentation of the Prototype

CEDR Transnational Road Research Programme / Call 2018
Final Conference May, 24th–25th 2022, Stockholm

Agenda

09:15	Introduction	UASKA	5 min
09:20	Poster of the whole Project	UASKA	5 min
09:25	Use Cases including Posters	IMC	15 min
09:40	Prototype	RUB	10 min
09:50	Live Demonstration of the Prototype	RUB / IMC	35 min
10:25	Discussion (Q&A)	all	20 min

Introduction

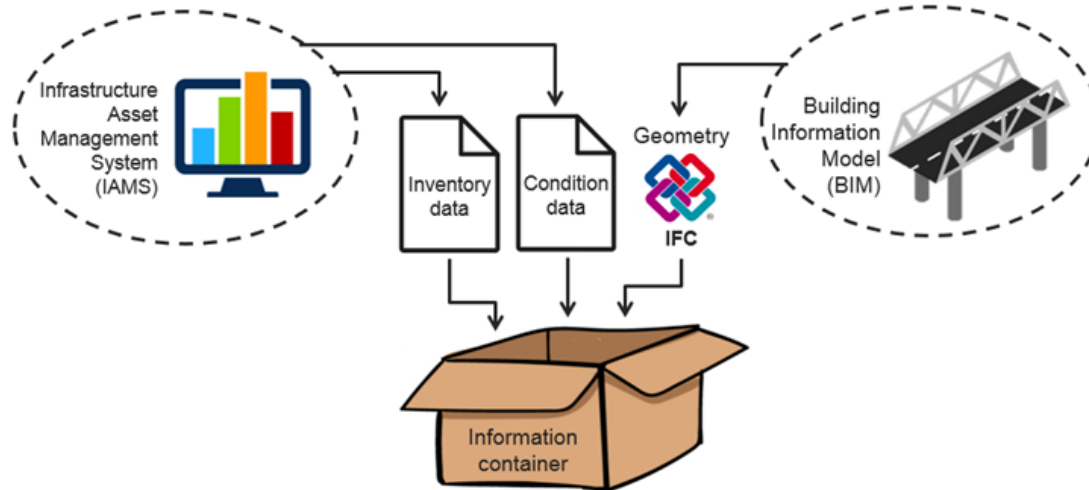
Data Management Challenges

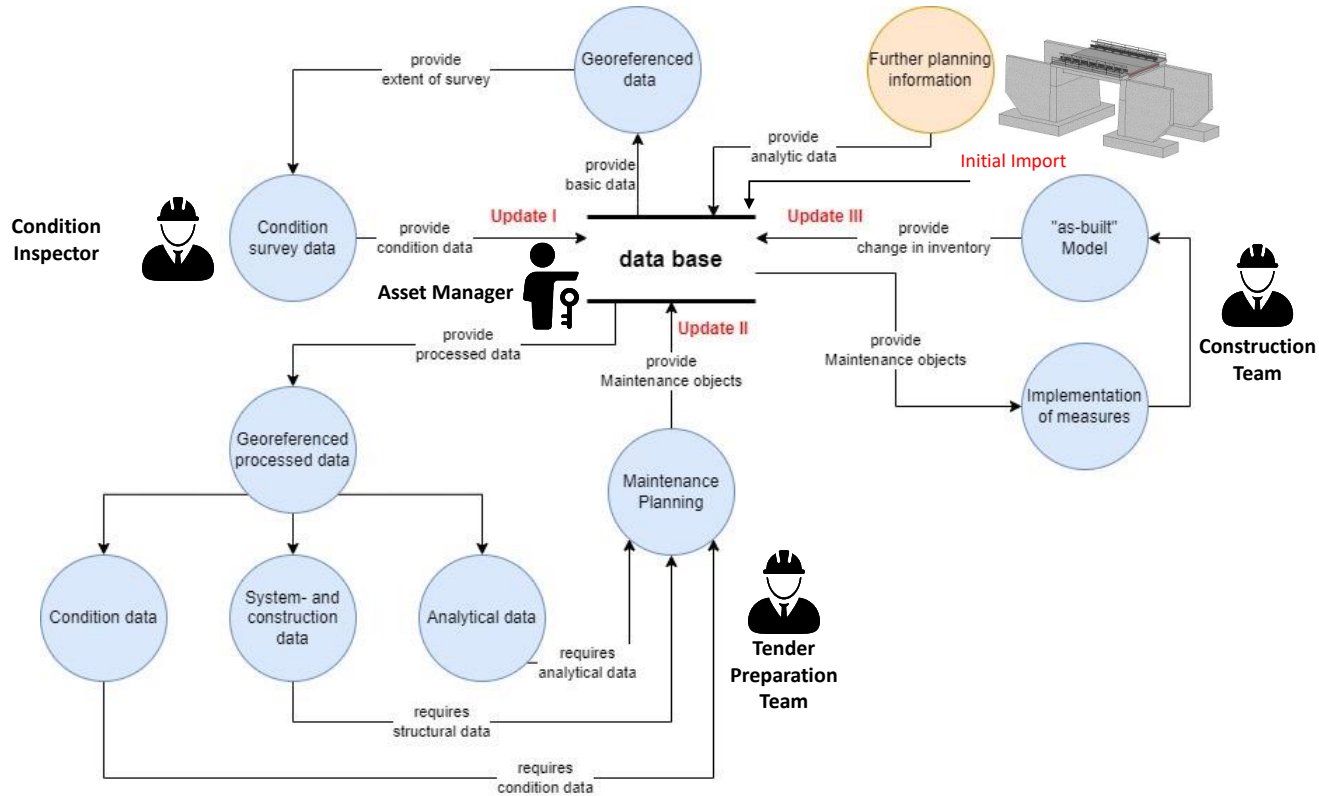
- Insufficient data transfer from the construction phase
- Different responsibilities for the management of information
- Decentralized storage and acquisition of information
- Consistency very difficult to maintain because data is stored redundantly
- Uniform access difficult because different vocabularies are used



Introduction

Solution concept





Exchange and Exploitation of Data from Asset Management Systems using Vendor Free Format



Project Summary

The aim of the AMSFree project is to develop a new approach based on information containers to combine asset management systems and BIM. Therefore, the processes and procedures existing within asset management systems as well as the related data flows were analysed and described by using process and data flow models. Three typical use cases were identified, and their data exchange was described. The interoperability and the connection with already existing databases or information systems are considered. Based on the example of a road section and a bridge, the consistency of the BIM concept and the implementation of rights of use are demonstrated. It is shown how existing national data formats (e.g., OKSTRA) for the management of road and bridges are linked to the IFC format during the entire life span. The approach differentiates between data that is directly contained in BIM and data that is linked to external databases.

Introduction

Planning, construction, operation, and maintenance of infrastructure require a significant commitment of both economic and human resources. For a targeted allocation of financial resources determined according to objective criteria, asset management systems (AMS) are used. One of the key aspects of asset management covered by most of these road authorities is the condition evaluation of assets and the assessment of related risks. While the condition-related data and data on inventory and traffic are stored in national asset management databases, data on materials from the maintenance planning and construction phase are often included in BIM models, documented as PDF or hosted in external databases. The exchange and update of these data are often time-consuming and error-prone. To combine the advantages of AMSs and BIM, a methodology based on standardized information containers was developed and tested.

Methodology

Based on the previously described potential to combine AMS with BIM, concepts for the integration of data from AMSs into BIM are introduced. First, the stakeholders within the context of asset management and its processes are described by using a process map. Three relevant update steps were defined on which an asset manager interacts with external contractors such as a inspector, a tender preparation team and a construction team. Based on the process analysis, the related data that needs to be exchanged at each update step and the national data formats are analyzed. The approach involves linking and transferring different data sources, models, or formats. This challenge cannot be solved in a universally valid way. The SWT is used to define ontologies for the description of domain-specific semantic information and link data from different data sources. It is shown how existing national

show how existing national data formats for managing road assets during the whole life span are linked with the IFC format. The approach was tested and validated in the context of use cases.

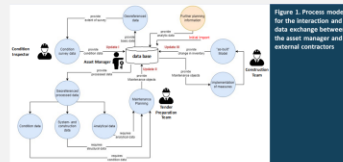


Figure 1: Process model for the interaction and data exchange between the asset manager and external contractors.

ICDD Container

A prototype was developed to evaluate the proposed concepts of sharing, exchanging and visualization of data between the asset manager and external contractors by using information containers. The ICDD provides an environment for capturing and linking data from different formats. File-based documents can be linked in this information container. Figure 2 shows the idea of using standardized information containers for the data exchange between an asset manager and external contractors.



Figure 2: Using standardized Information Containers for the data exchange between the asset manager and external contractors.

Use Cases

Assignment of the 3D Geometry to the Structure Elements
It is essential to consider the finest granularity of the asset management database to be able to link BIM with the different data models. For instance, Germany's ASB-ING's object classification is a hierarchical catalogue with a huge number of object type categories. The model is disassembled, and each bridge element and sub-element is associated with the corresponding ASB-ING catalogue type. The IFC entity types are exemplary shown in Figure 3.

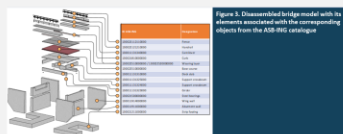


Figure 3: Disassembled bridge model with its elements associated with the corresponding objects from the ASB-ING catalogue.

1. Inspection

As part of the structural inspections for engineering structures, condition changes to the infrastructure objects are recorded in the asset management database. Update 1 as shown in Figure 1 includes the implementation of results of visual inspections into BIM. The condition of the infrastructure objects and their individual elements can be integrated into BIM.

2. Maintenance Plan

Update 2 includes the implementation of results of maintenance planning into BIM. One can then access specified data for type of maintenance measure, the timeframe, estimated costs and the cause for maintenance activity. Also, bundles of measures, which contain several assets, can be combined and exported together for the program planning and processed correspondingly.

3. Maintenance Measures

Update 3 includes the implementation of an updated "as-built" model into BIM. As a result of the documentation of the construction work achieved, it includes all properties of the maintained elements of a bridge/road section.

Conclusion

In this project a new approach based on information containers was presented to combine AMSs and BIM. The processes and procedures existing within AMSs as well as the related data flows were analyzed. Afterwards, typical use cases were identified, and their data exchange was described. The interoperability and the connection with already existing databases or information systems were considered. Based on the example of a road section and a bridge, the consistency of the BIM concept is demonstrated. It is shown how existing national data formats for the management of road and bridges are linked to the IFC format during the entire life span. The approach differentiates between data that is directly contained in BIM and data that is linked to external databases. The benefits of connecting asset management processes with BIM are enormous. The combination and visualization of material related data within BIM its temporal classification and precise localization offer the possibility for a multitude of new analysis.

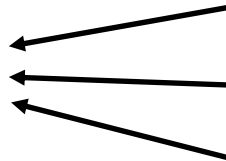
Acknowledgements

The authors gratefully acknowledge CEDR (Conference of European Directors of Roads) for funding this research. We would like to thank the consortium of the project AMSFree for their collaboration in the research of BIM-based AM concepts for roads and bridges.



Use Cases

Use Cases



Information Container for Linked Document Delivery (ICDD)



Condition Inspector



Tender preparation team



Construction team

Use Cases

ICDD Platform

Use Case 1 – Inspection Data Exchange by Using ICDD

Exchange and Exploitation of Data from Asset Management Systems using Vendor-free Format

The aim of the AMSP project is to develop a new approach based on information containers to combine asset management systems and BIM. Therefore, the processes and procedures relating to asset management systems will be defined. Data flows are defined and described by using process and data flow models. These typical use cases were developed, and their data exchange was described. The interoperability of the container with already existing databases or information systems are considered. Based on the results of a trial project and a PoC, the combination of the BIM concept and the implementation of ICDs for an information container is shown. Two existing external data formats (i.e. ODF/ISO) for the management of road and bridges are linked to the IC format during the entire life span. The approach differentiates between data that is directly contained in the data and data that is linked to external databases.

Activities for Inspection

The **asset manager** determines the need for an inspection on a bridge or road by an external contractor. For the inspection, the **IC** manager must provide necessary data to the contractor digitally.

The following data are required for this use case by using BIM:

- the IC model
- the elements of the bridge/road to be inspected
- the applicable technical assessment conditions
- the information requirement of result

To facilitate the recognition of mapping between the IC model and the distributed data and to facilitate this data exchange between the different participants, the ICDD manager requires a solution to collect the data linked in a whole package as a container named ICDD.

Once the inspection is commissioned, the prepared data can be delivered from the **asset manager** to the external contractor using the ICDD container.

The external contractor uses the ICDD Prototype in preparation for performing the work by:

- 1. Upload the delivered ICDD
- 2. Access the data
- 3. Use the ICDD to the result of the inspection

The following data are required as a result of an inspection:

- the inspection result
- the placement of the damage
- the links between the condition description and the elements of the model

The results data are updated additionally by received data from the **asset manager**.

Once the inspection is finished, the results can be given back from the external contractor to the **asset manager** by using the ICDD container.

The **asset manager** can review the inspection result on the ICDD platform. With certain queries, the manager can select the specified data, such as damage images related to the bridge element and sections.

Realization of the Data Collection and Exchange with the ICDD Prototype

Screenshots show the user interface for:

1. Open or create a project
2. Create a container
3. Upload of container related to container engineer

4. The user interface of the container management

The user interface for edition and modification of the container content with:

1. Container structure
2. Element form
3. Element type

5. The user interface of the container content with IC element and document overview

6. The user interface of the container content with IC element and document overview

ICDD Platform

Use Case 2 – Maintenance Plan Data Collection by Using ICDD

Exchange and Exploitation of Data from Asset Management Systems using Vendor-free Format

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Activities for Maintenance Plan

The **asset manager** provides data on the results of the condition surveys and assessment. These information are handed over to the team which is responsible for the detailed preparation of the plan.

The following data are required for this use case by using BIM:

- the IC model
- the actual team with condition assessment or bridge element linked with condition data can be used for the maintenance plan
- the defined technical assessment to be implemented

To facilitate the recognition of mapping between the IC model and the distributed data, and to facilitate the data exchange between the different participants, the ICDD manager requires a solution to collect the data linked in a whole package as a container named ICDD.

In order to define the type and amount of maintenance interventions by the bridge assessment team, the results of the condition survey are processed and updated in a SPSS file from the asset manager using the ICDD container. The data can now be used outside the model.

The **asset manager** provides data on the results of the condition surveys and assessment. These information are handed over to the team which is responsible for the detailed preparation of the plan.

In addition to the general need for maintenance interventions, economic considerations and constraints must then be applied. Thus, maintenance planning can be completed. The complete maintenance planning can now be linked to the model. Therefore, it is again necessary for the same information to be transferred during data exchange.

Once the maintenance intervention plan is finished, the results can be given back from the external contractor to the **asset manager** by using the ICDD container.

The **asset manager** can review the results of the finished maintenance planning on the ICDD platform. With defined queries, one can view the specified data by:

- 1. Type of maintenance plan
- 2. Element
- 3. Element status
- 4. Asset for maintenance activity

Realization of the Data Collection and Exchange with the ICDD Prototype

Screenshots show the user interface for:

1. Open or create a project
2. Form for connecting an existing database
3. Mapping from an existing database to container

4. Container copy, download and upload

5. Updated maintenance plan related to the IC element

6. Filter data with SPSS Query

7. Set the SQL Template

8. Filter data with SPSS Query

9. Generate SQL query and import the data into database

ICDD Platform

Use Case 3 – Maintenance Measures Connection with Existing Databases by Using ICDD

Exchange and Exploitation of Data from Asset Management Systems using Vendor-free Format

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Activities for Maintenance Measures

The **asset manager** provides the contractor with a planning model for the maintenance measures to be carried out. For this purpose, he processes the IC model with the elements to be replaced and their associated requirements on material properties.

To facilitate the recognition of mapping between the IC model and the distributed data, and to facilitate the data exchange between the different participants, the ICDD manager requires a solution to collect the data linked in a whole package as a container named ICDD.

Once the IC element is defined to be maintained, the prepared data can be delivered from the **asset manager** to the contractor team using the ICDD container.

The contractor team accesses the **asset manager's** prepared elements with the information container. The user uses the IC model created by the **asset manager** as a basis for documenting the construction work (work order of measures, installation quality, etc.).

Once the team has integrated all the data relevant to the construction process into the IC model, the updated IC model can be transferred to the **asset manager** using the information container.

As a result, the **asset manager** can access both the updated IC model and all the associated updated material data and integrate it into existing asset management databases.

Realization of the Data Collection and Exchange with the ICDD Prototype

Screenshots show the user interface for:

1. Open or create a project
2. Form for connecting an existing database
3. Mapping from an existing database to container

4. Container copy, download and upload

5. The default IC elements to be maintained

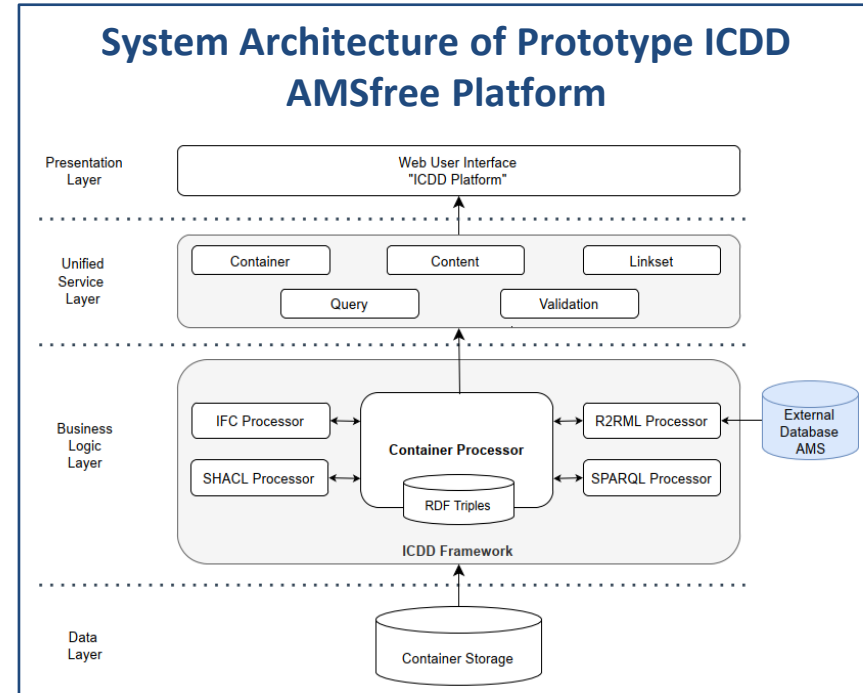
6. The updated IC model

Prototype

Prototype AMSfree Platform

System Description

- Based on ICDD Standard ISO 21597
- Data Layer – ICDD as a unit of information storage
- Business Logic Layer – Processing of the Linked Data, BIM model and data of external databases (IAMS)
- Unified Service Layer – functions of container creation, edition, querying, and validation
- Presentation Layer – web user interface



WP 7 Prototype ICDD – AMSfree Platform

User interface and functions

- Project-related management of the containers
- Edition of container content
- Connection with external databases
- Querying of container content

A screenshot of the AMSfree Platform user interface. The page is titled 'AMSfree Platform' and includes a 'Start' button. Below the title, there is a paragraph of introductory text: 'This is a toolkit for working with Information Container for linked Document Delivery (ICDD) according to ISO 21597-1:2020. The platform offers several functions for uploading, validating, editing, and exporting ICDD containers. The platform supports the information management according ISO 19650 and provides a DIN SPEC 91391 conform REST API for accessing information containers in external clients.' To the right of this text is a 'Quick start:' section with three buttons: 'Register a new user', 'Log in as a registered user', and 'Open or create a project'. Below this are four main functional cards, each with an icon and a title: 'Upload' (cloud and arrow icon), 'Validate' (checklist icon), 'View and Edit' (magnifying glass icon), and 'Export' (cloud and gear icon). Each card contains a brief description of the function.

Start

AMSfree Platform

This is a toolkit for working with Information Container for linked Document Delivery (ICDD) according to ISO 21597-1:2020. The platform offers several functions for uploading, validating, editing, and exporting ICDD containers. The platform supports the information management according ISO 19650 and provides a DIN SPEC 91391 conform REST API for accessing information containers in external clients.

Quick start:

- Register a new user
- Log in as a registered user
- Open or create a project

Upload

You can upload your *.icdd files right now by clicking the link below and start a new session.

Validate

Your file will be checked against conformance criteria delivered by the standard for the container in the active session. Validation performs SHACL Validation defined by ISO 21597-2:2020

View and Edit

Explore the contents of your file and manipulate meta data online for the container in the active session. Viewer supports JsonLD of Semantic Data and IFC viewer.

Export

Export the container back into standardized container format.

WP 7 Prototype ICDD – AMSfree Platform

Project-related management of containers

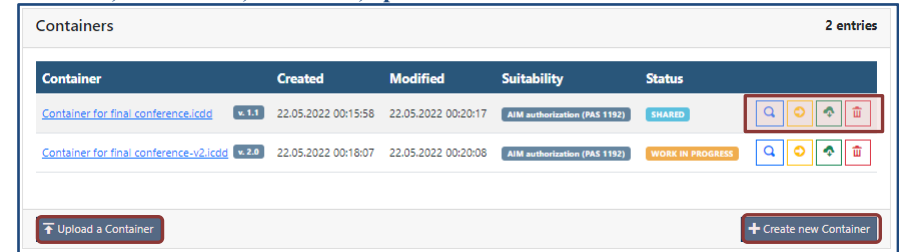
- Creation of project
- Management of containers in the project
 - Create a container with meta information
 - Inherit a container as a new version
 - Download or upload a container
 - Delete

Creation of project



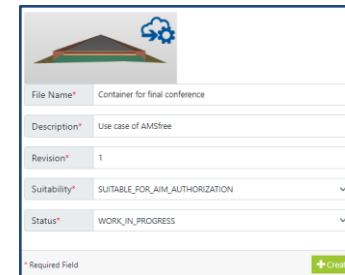
The screenshot shows a 'Project List' interface with a table header containing 'Project', 'Created', 'Modified', and 'Container'. Below the header is a search bar labeled 'Project name' and a 'Create Project' button.

Creation, inheritance, download, upload and cancel of container



The screenshot shows a 'Containers' interface with a table listing two containers. The table has columns for 'Container', 'Created', 'Modified', 'Suitability', and 'Status'. The first container is 'Container for final conference.icdd' with status 'SHARED'. The second is 'Container for final conference-v2.icdd' with status 'WORK IN PROGRESS'. Action icons (search, refresh, upload, delete) are visible for each row. At the bottom, there are buttons for 'Upload a Container' and 'Create new Container'.

Meta data of container

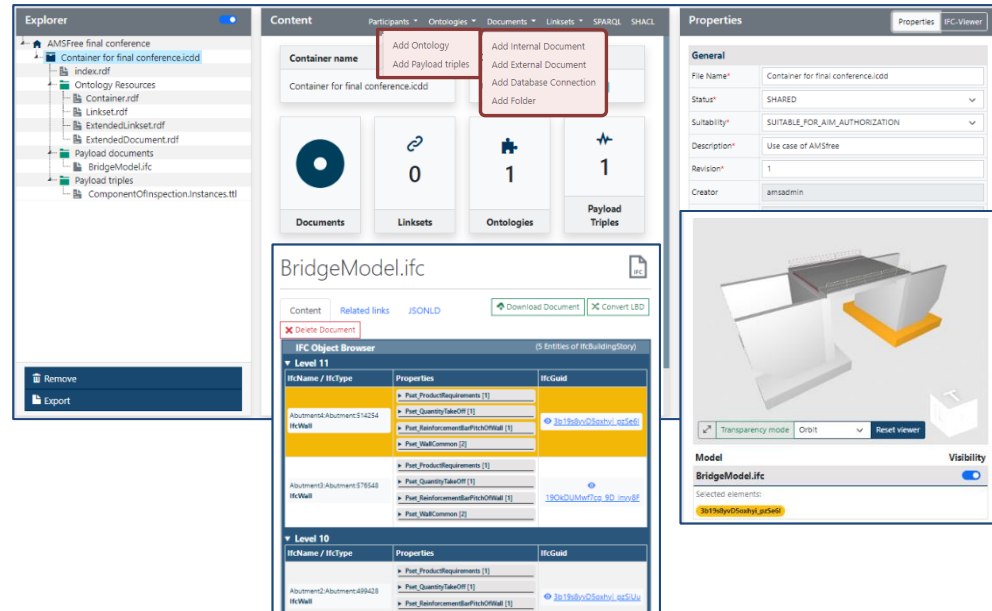


The screenshot shows a form for entering container meta data. It includes fields for 'File Name*' (Container for final conference), 'Description*' (Use case of AMSfree), 'Revision*' (1), 'Suitability*' (SUITABLE_FOR_AIM_AUTHORIZATION), and 'Status*' (WORK_IN_PROGRESS). A 'Create' button is at the bottom right.

WP 7 Prototype ICDD – AMSfree Platform

Edition of container content

- Preparation of the container structure based on ISO 21597
- Display of dashboard, document metadata, content, and BIM model
- Adding different data
 - Domain ontologies
 - Documents
 - Datasets based on ontologies



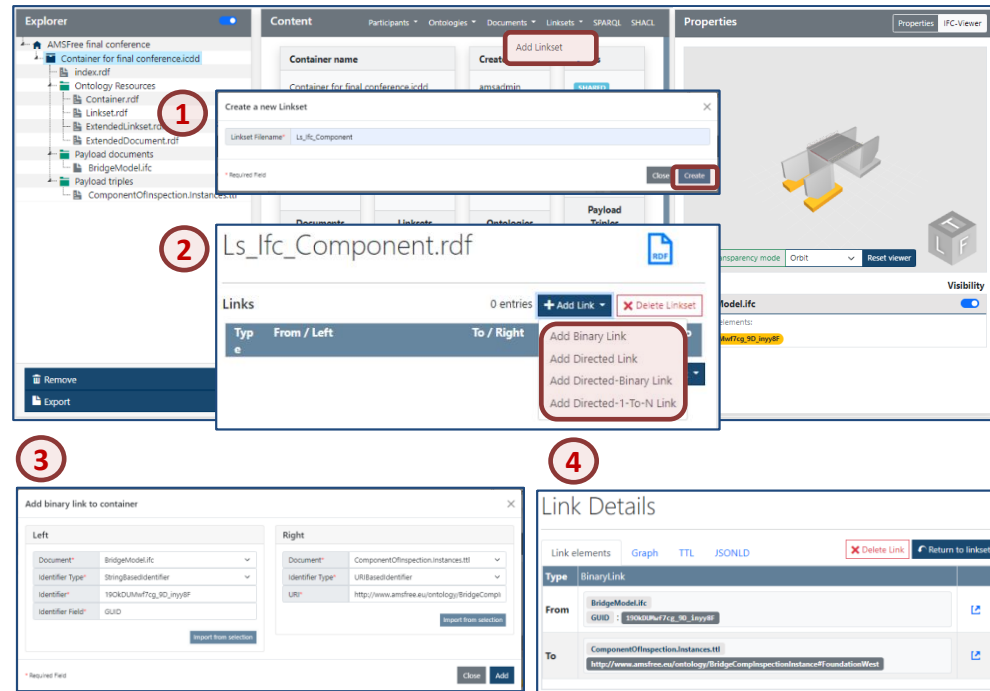
The screenshot displays the AMSfree platform interface, divided into three main sections:

- Explorer:** Shows a hierarchical tree structure for a container named 'Container for final conference.icdd'. The tree includes folders for 'index.rdf', 'Ontology Resources', 'Container.rdf', 'Linkset.rdf', 'ExtendedLinkset.rdf', 'Payload documents', 'BridgeModel.ifc', 'Payload triples', and 'ComponentOfInspectionInstances.ttl'. A 'Remove' button and an 'Export' button are visible at the bottom.
- Content:** Displays the 'Container for final conference.icdd' with a 'Container name' field. Below this, there are four large buttons: 'Documents' (0), 'Linksets' (0), 'Ontologies' (1), and 'Payload Triples' (1). A 'Delete Document' button is also present. The main content area shows the 'BridgeModel.ifc' document, which is expanded to show an 'IFC Object Browser' with 15 entities. The browser is organized into levels (Level 11 and Level 10) and lists IFC names, types, properties, and GUIDs. A 'Delete Document' button is highlighted in red.
- Properties:** Shows the 'Properties' panel for the selected document. It includes a 'General' section with fields for 'File Name*' (Container for final conference.icdd), 'Status*' (SHARED), 'Suitability*' (SUITABLE_FOR_AIM_AUTHORIZATION), 'Description*' (Use case of AMSfree), 'Revision*' (1), and 'Creator' (amsadmin). Below this is a 3D BIM model viewer showing a bridge structure. The 'Model' section includes 'BridgeModel.ifc' and a 'Visibility' toggle.

WP 7 Prototype ICDD – AMSfree Platform

Edition of container content

- Adding links between documents and data
 1. Define a linkset file
 2. Select a link type provided by setting links
 3. Set the document and an identifier for the link element
 4. View the detail of link



The screenshot illustrates the workflow for adding a linkset and defining a link in the AMSfree platform. It is divided into four numbered steps:

- Step 1:** A dialog box titled "Create a new Linkset" is shown. The "Linkset Filename" is set to "Ls_lfc_Component". The "Create" button is highlighted.
- Step 2:** The "Links" section of the "Ls_lfc_Component.rdf" linkset is shown. A dropdown menu is open, displaying options: "Add Binary Link", "Add Directed Link", "Add Directed-Binary Link", and "Add Directed-1-To-N Link".
- Step 3:** The "Add binary link to container" dialog is shown. It has two columns: "Left" and "Right".

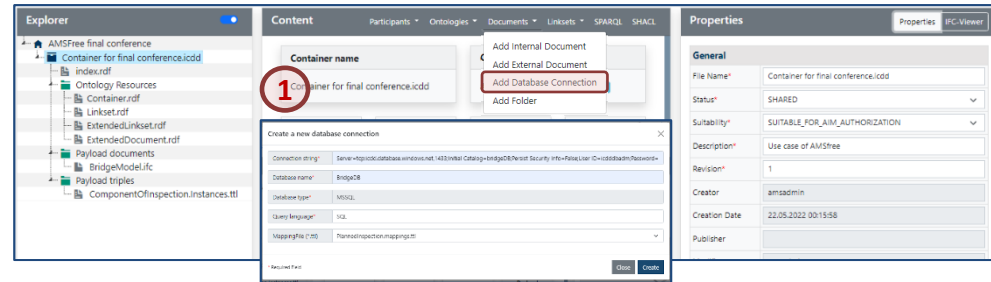
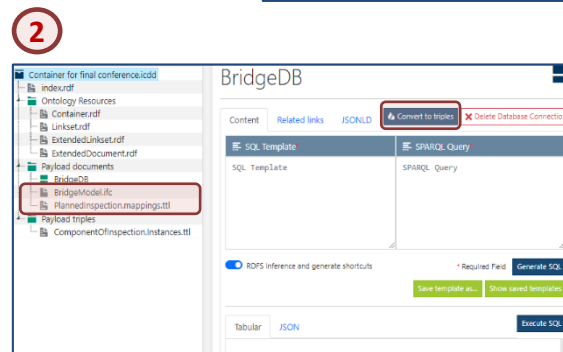

Left	Right
Document: BridgeModel.lfc	Document: ComponentOfInspectionInstances.ttl
Identifier Type: StringBasedIdentifier	Identifier Type: URIBasedIdentifier
Identifier: 190KDUAW7cg_9D_iny8F	URI: http://www.amsfree.eu/ontology/BridgeComp
Identifier Field: GUID	
- Step 4:** The "Link Details" view is shown, displaying the link elements in a table:

Type	From	To
BinaryLink	BridgeModel.lfc GUID 190KDUAW7cg_9D_iny8F	ComponentOfInspectionInstances.ttl http://www.amsfree.eu/ontology/BridgeCompInspectionInstanceOfFoundationWest

WP 7 Prototype ICDD – AMSfree Platform

Connection with external databases

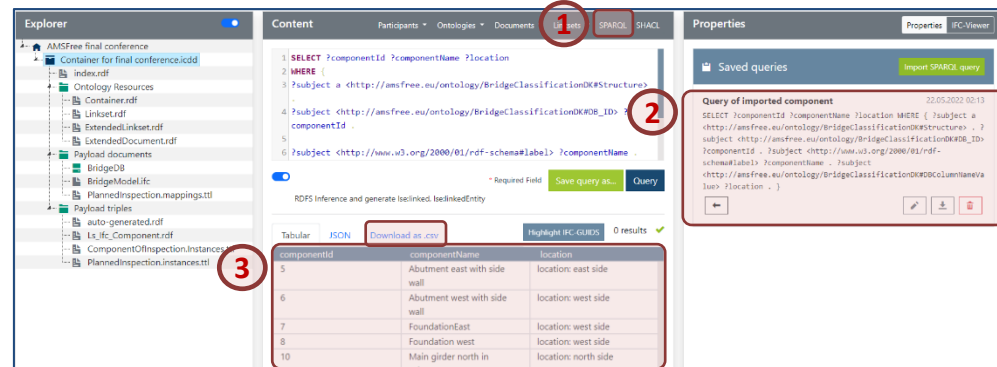
1. Add existing database with access data and mapping files
2. Export data into the container as semantic datasets
3. Import data into the database using SQL – SPARQL query templates

WP 7 Prototype ICDD – AMSfree Platform

Querying of container content
based on SPARQL query language

1. Using implemented SPARQL panel
2. Save query templates
3. Show the query results and download as a .csv file



The screenshot shows the AMSfree platform interface with three numbered callouts:

- 1**: Points to the SPARQL editor in the Content panel.
- 2**: Points to the 'Save query as...' button in the Content panel.
- 3**: Points to the 'Download as .csv' button in the Content panel.

The SPARQL query in the editor is:

```

1 SELECT ?componentId ?componentName ?location
2 WHERE {
3 ?subject a <http://amsfree.eu/ontology/BridgeClassificationDK#Structure> .
4 ?subject <http://amsfree.eu/ontology/BridgeClassificationDK#ID> ?
componentId .
5
6 ?subject <http://www.w3.org/2000/01/rdf-schema#label> ?componentName .

```

The results table shows the following data:

componentId	componentName	location
5	Abutment east with side wall	location: east side
6	Abutment west with side wall	location: west side
7	FoundationEast	location: west side
8	Foundation west	location: west side
10	Main glider north in	location: north side

The Properties panel shows a 'Query of Imported component' with the following SPARQL query:

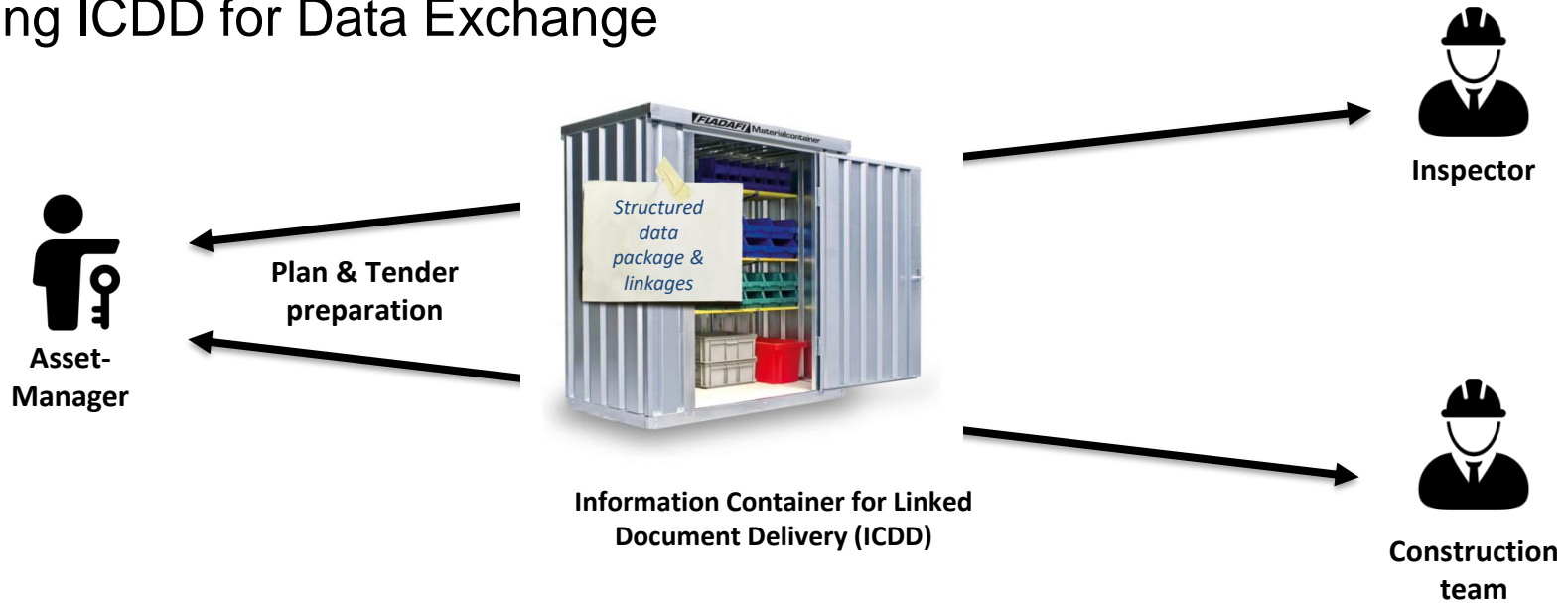
```

SELECT ?componentId ?componentName ?location WHERE { ?subject a
<http://amsfree.eu/ontology/BridgeClassificationDK#Structure> . ?
subject <http://amsfree.eu/ontology/BridgeClassificationDK#ID> ?
componentId . ?subject <http://www.w3.org/2000/01/rdf-
schema#label> ?componentName . ?subject
<http://amsfree.eu/ontology/BridgeClassificationDK#columnNameva
lue> ?location . }

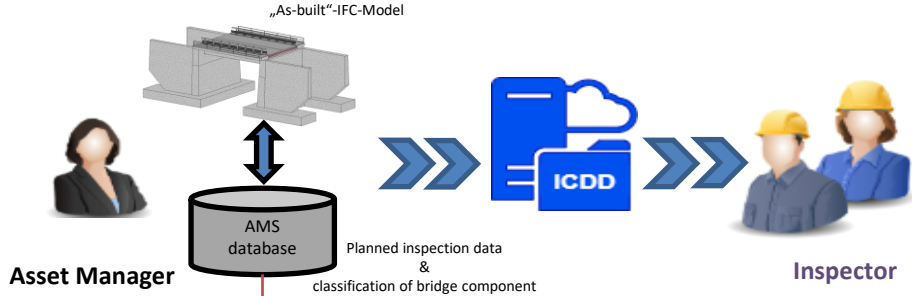
```

Live demonstration of the prototype

Using ICDD for Data Exchange



Bridge inspection – Order



Containers 1 entries

Container	Created	Modified	Suitability	Status
Asset Management Inspection Containers				
Visual bridge inspection - requirement container.icdd	v. 1.0	16.05.2022 13:53:42	AM Inspection container	WORK IN PROGRESS

Upload a Container Create new Container

Visual bridge inspection - requirement container.icdd

- index.rdf
- Ontology Resources
 - Container.rdf
 - Linkset.rdf
 - ExtendedLinkset.rdf
 - BridgeClassification.ttl
 - ConditionClassification.ttl
 - DamageClassification.ttl
 - EUROTL.ttl
 - ExtendedDocument.rdf
- Payload documents
 - BridgeDB
 - BridgeModel.ifc
 - PlannedInspection.mappings.ttl
 - ReportTemplate.xsd
- Payload triples
 - Ls_Inspection_Report.rdf
 - auto-generated.rdf
 - Ls_ifc_Component.rdf
 - Ls_ifc_Inspection.rdf
 - ComponentOfInspection.Instances.ttl
 - PlannedInspection.Instances.ttl

Properties: BridgeModel.ifc

Selected elements:

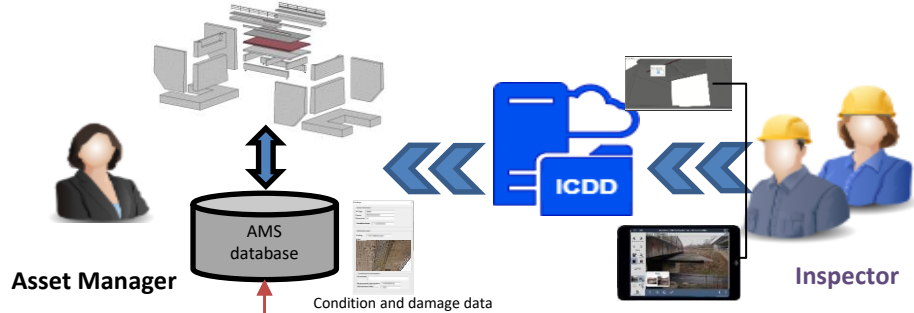
- visual inspection substructure
- inspection type
- inspreeet
- structure Identifier
- 2022
- inspection year

The container delivered to the inspector without DB connection



- Visual bridge inspection - requirement container.icdd
 - index.rdf
 - Container.rdf
 - Linkset.rdf
 - ExtendedLinkset.rdf
 - BridgeClassification.ttl
 - ConditionClassification.ttl
 - DamageClassification.ttl
 - EUROTL.ttl
 - ExtendedDocument.rdf
 - Payload documents
 - BridgeModel.ifc
 - ReportTemplate.xsd
 - Payload triples
 - Ls_Inspection_Report.rdf
 - Ls_ifc_Component.rdf
 - Ls_ifc_Inspection.rdf
 - ComponentOfInspection.Instances.ttl
 - PlannedInspection.Instances.ttl

Bridge inspection – Result



Containers 2 entries

Container	Created	Modified	Suitability	Status	
Asset Management Inspection Containers					
Visual bridge inspection - requirement container.icdd	v. 1.0	16.05.2022 13:53:42	AM Inspection container	SHARED	
Visual bridge inspection - result container.icdd	v. 1.0	16.05.2022 13:53:42	22.05.2022 03:15:29	AM Inspection container	WORK IN PROGRESS

[Upload a Container](#)
[Create new Container](#)

- Visual bridge inspection - result container.icdd
 - index.rdf
 - Ontology Resources
 - Container.rdf
 - Linkset.rdf
 - ExtendedLinkset.rdf
 - BridgeClassification.ttl
 - ConditionClassification.ttl
 - DamageClassification.ttl
 - EUROT.ttl
 - ExtendedDocument.rdf
 - Payload documents
 - BridgeDB
 - BridgeModel.ifc
 - ImageDamage.jpg
 - LocalPlacement.ifc
 - Report.xml
 - Payload triples
 - Ls_ifc_Damage_Placement_Image_Description.rdf
 - Ls_Inspection_Report.rdf
 - Ls_Component_Report.rdf
 - Ls_ifc_Component.rdf
 - Ls_ifc_Inspection.rdf
 - ComponentOfInspection.Instances.ttl
 - PlannedInspection.Instances.ttl
 - StructureComponentConditionDamage.ttl

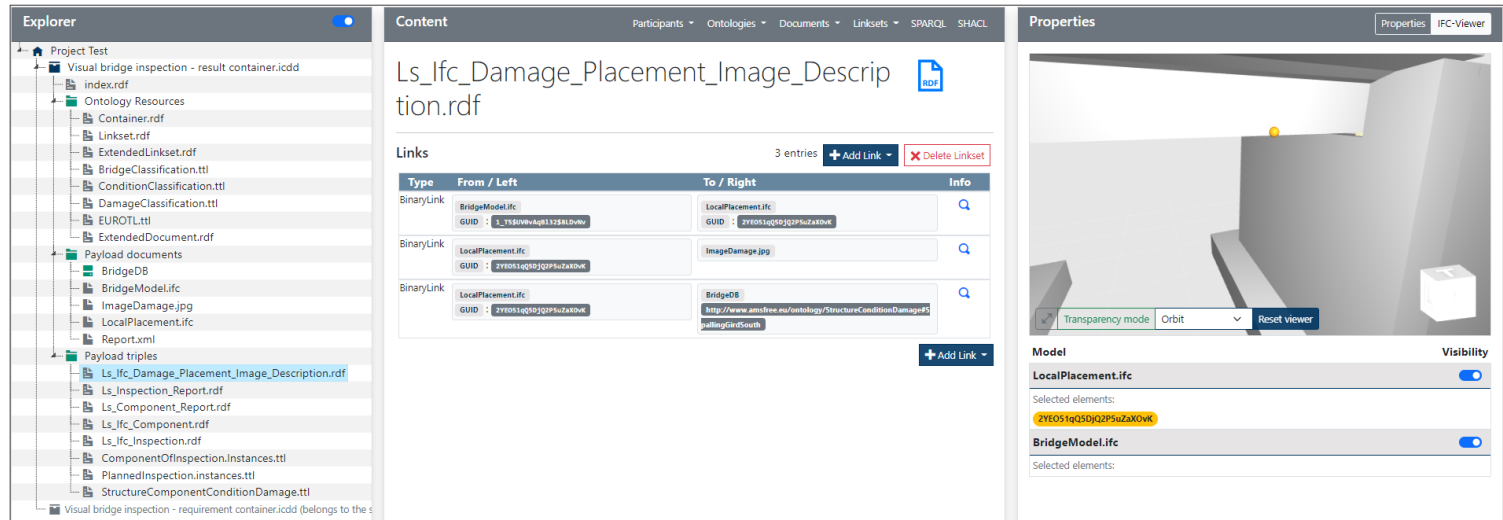
The screenshot shows a 3D model viewer interface. On the left, there is a file browser showing a folder named 'ImageDamage.jpg' with a 'Download Document' and 'Delete Document' button. The main view displays a 3D model of a bridge structure. Below the model, there are 'Properties' and 'IC-Viewer' tabs. The 'Properties' tab shows 'LocalPlacement.ifc' and 'BridgeModel.ifc' with 'Selected elements' lists. The 'IC-Viewer' tab shows a 3D view of the bridge structure with a 'Transparency mode' dropdown and a 'Reset viewer' button.



- Visual bridge inspection - result container.icdd
 - index.rdf
 - Ontology Resources
 - Container.rdf
 - Linkset.rdf
 - ExtendedLinkset.rdf
 - BridgeClassification.ttl
 - ConditionClassification.ttl
 - DamageClassification.ttl
 - EUROT.ttl
 - ExtendedDocument.rdf
 - Payload documents
 - BridgeModel.ifc
 - ImageDamage.jpg
 - LocalPlacement.ifc
 - Report.xml
 - Payload triples
 - Ls_ifc_Damage_Placement_Image.rdf
 - Ls_Inspection_Report.rdf
 - Ls_Component_Report.rdf
 - Ls_ifc_Component.rdf
 - Ls_ifc_Inspection.rdf
 - ComponentOfInspection.Instances.ttl
 - PlannedInspection.Instances.ttl
 - StructureComponentConditionDamage.ttl

Demonstration on the result container of bridge inspection

- Overview inspection documents and data
- Check damage with links
- Check results using a query
- Import condition data into the database

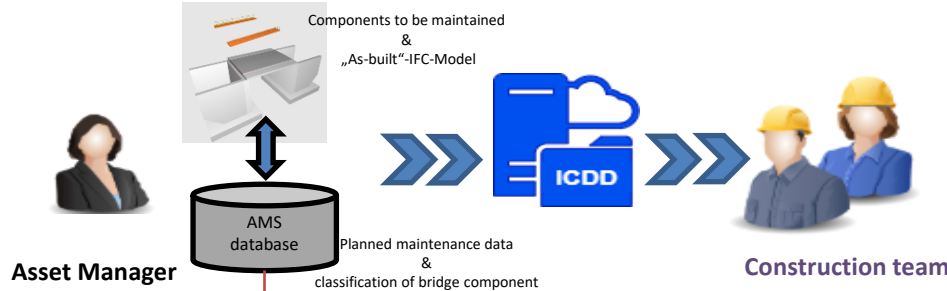


The screenshot displays the AMS interface with three main panels:

- Explorer:** Shows a tree view of the project structure. The selected file is `Ls_Ifc_Damage_Placement_Image_Description.rdf`.
- Content:** Displays the selected file's content, including a table of links.

Type	From / Left	To / Right	Info
BinaryLink	BridgeModel.Ifc GUID : 1_158090v4q1132810vW	LocalPlacement.Ifc GUID : 2YF051q6102qP5uZaX0vK	🔍
BinaryLink	LocalPlacement.Ifc GUID : 2YF051q6102qP5uZaX0vK	ImageDamage.jpg	🔍
BinaryLink	LocalPlacement.Ifc GUID : 2YF051q6102qP5uZaX0vK	BridgeDB http://www.amsfree.eu/ontology/StructureConditionDamage5 2a11mg0in-R0u0B	🔍
- Properties:** Shows a 3D visualization of the bridge structure. The **Model** panel lists `LocalPlacement.Ifc` and `BridgeModel.Ifc`, both with visibility toggles. Selected elements are listed below each model.

Bridge maintenance – Order



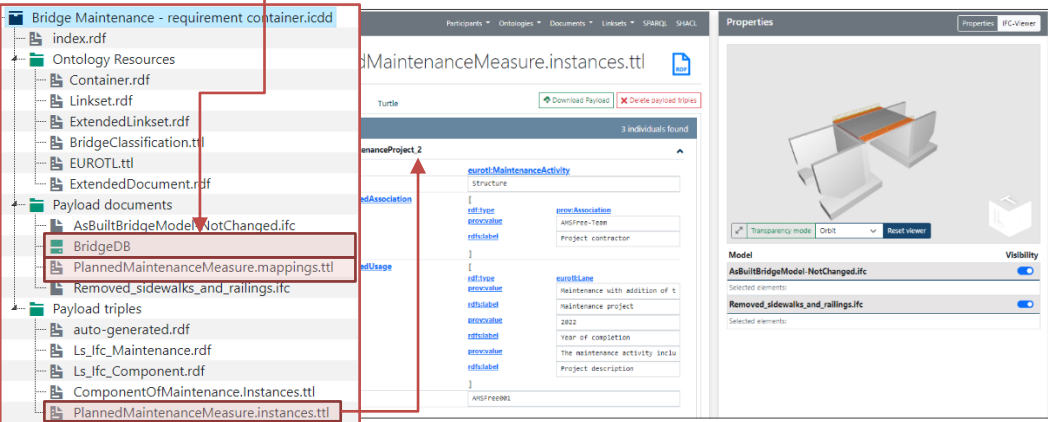
Containers 1 entries

Container	Created	Modified	Suitability	Status
Asset Management Maintenance Containers				
Bridge Maintenance - requirement container.icdd	16.05.2022 14:10:04		AM Maintenance container	WORK IN PROGRESS

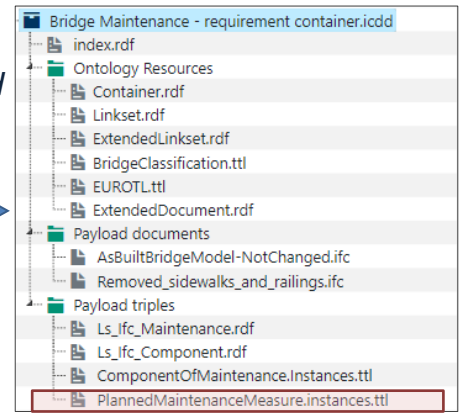
Buttons: Upload a Container, Create new Container

The container delivered to the construction team

without DB connection

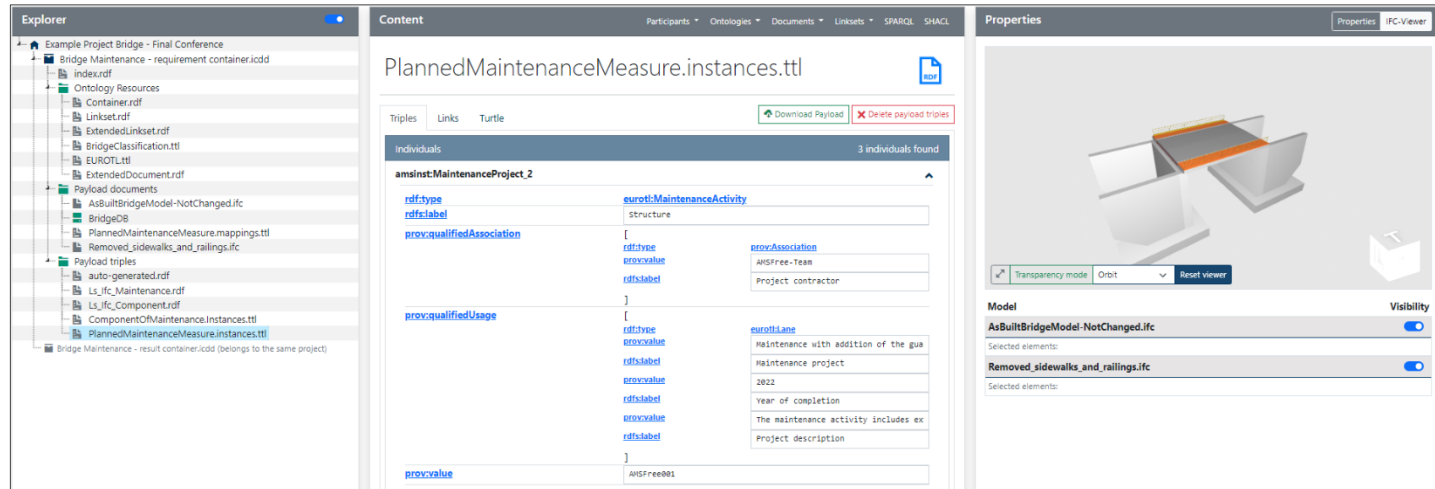
This block shows a file explorer on the left with a tree view of files. A red box highlights the file **PlannedMaintenanceMeasure.mappings.ttl**. In the center, a screenshot of a software interface shows a table of data for **PlannedMaintenanceMeasure.instances.ttl**. The table has columns for **rdf:type**, **erccounter**, **rdfs:label**, and **rdfs:label**. The first row shows **euroStMaintenanceActivity** with a value of **Project contractor**. The second row shows **euroStLane** with a value of **The maintenance activity inclu**.



This block shows a file explorer on the right with a tree view of files. A red box highlights the file **PlannedMaintenanceMeasure.instances.ttl**. The tree view includes files like **index.rdf**, **Container.rdf**, **Linkset.rdf**, **ExtendedLinkset.rdf**, **BridgeClassification.ttl**, **EUROTL.ttl**, **ExtendedDocument.rdf**, **Payload documents**, **AsBuiltBridgeModel-NotChanged.ifc**, **BridgeDB**, **PlannedMaintenanceMeasure.mappings.ttl**, **Removed_sidewalks_and_railings.ifc**, **Payload triples**, **auto-generated.rdf**, **Ls_ifc_Maintenance.rdf**, **Ls_ifc_Component.rdf**, **ComponentOfMaintenance.Instances.ttl**, and **PlannedMaintenanceMeasure.instances.ttl**.

Demonstration on the order container for bridge maintenance

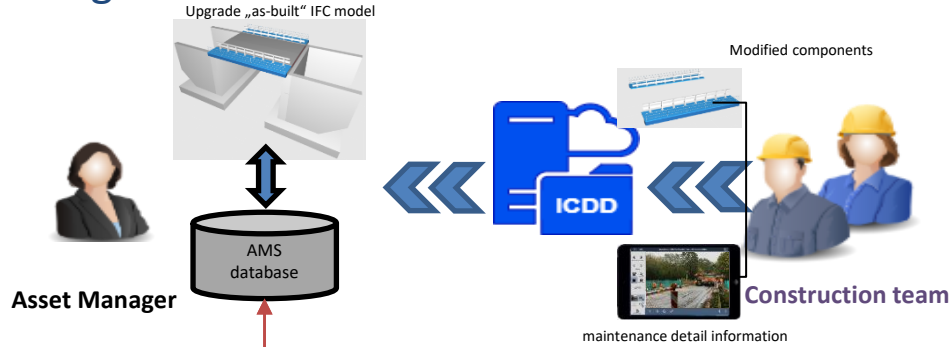
- Overview of the removed structure elements
- Export the data of the planned maintenance project from the database
- Create the link between the IFC model and the maintenance project



The screenshot displays a software interface with three main panels:

- Explorer:** Shows a hierarchical tree of files and folders. The selected file is `PlannedMaintenanceMeasure.instances.ttl` under the `Payload documents` folder.
- Content:** Displays the content of the selected file, `PlannedMaintenanceMeasure.instances.ttl`. It shows a table of individuals found, with 3 individuals found. The table has columns for `ref:type`, `ref:label`, and `prov:qualifiedAssociation`. The first individual is `amsinst:MaintenanceProject_2`, which is associated with `euroti:MaintenanceActivity`. The table also shows `prov:qualifiedUsage` and `prov:value` for the selected individual.
- Properties:** Shows the properties of the selected element, `AsBuiltBridgeModel-NotChanged.ifc`. It includes a 3D model of a bridge structure and a list of selected elements, including `Removed_sidewalks_and_railings.ifc`.

Bridge maintenance – Result



Containers 2 entries

Container	Created	Modified	Suitability	Status
Asset Management Maintenance Containers				
Bridge Maintenance - replacement container.icdd	v. 1.0 16.05.2022 14:10:04	22.05.2022 04:17:03	AM Maintenance container	SHARED
Bridge Maintenance - result container.icdd	v. 1.0 16.05.2022 14:10:04		AM Maintenance container	WORK IN PROGRESS

Upload a Container Create new Container

- Bridge.Maintenance - result container.icdd
 - index.rdf
 - Ontology Resources
 - Container.rdf
 - Linkset.rdf
 - ExtendedLinkset.rdf
 - BridgeClassification.ttl
 - EUROTL.ttl
 - ExtendedDocument.rdf
 - Payload documents
 - AsBuiltBridgeModel-NotChanged.ifc
 - BridgeDB
 - Removed_sidewalks_and_railings.ifc
 - Renewed_Sidewalks_and_guardrail.ifc
 - Payload triples
 - auto-generated.rdf
 - Ls_ifc_Maintenance.rdf
 - Ls_ifc_Component.rdf
 - ComponentOfMaintenance.Instances.ttl
 - MaintenanceDetail.ttl
 - PlannedMaintenanceMeasure.instances.ttl

Details

Participants Ontologies Documents Links SPARQL SHACL

Events Graph TTL JSONLD Delete Link Return to list

BinaryLink

Removed_Sidewalks_and_railings.ifc

GUID: 898C8F1350C9C9847613

BridgeDB

http://www.amsfree.eu/ontology/ontology/AsBuiltBridgeModel-NotChanged.ifc

Properties

Properties IFCViewer

Model

AsBuiltBridgeModel-NotChanged.ifc

Visibility

Selected elements:

Removed_sidewalks_and_railings.ifc

Selected elements:

Renewed_Sidewalks_and_guardrail.ifc

Selected elements:

AsBuiltBridgeModel-NotChanged.ifc

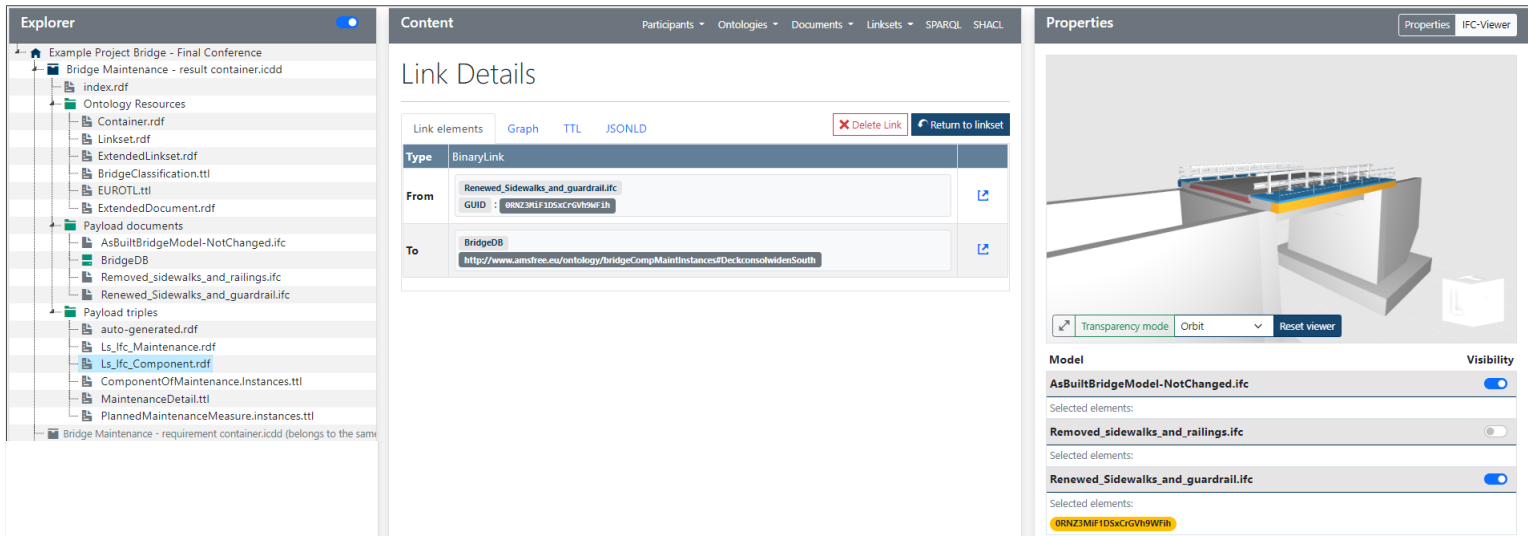
Transparency mode Orbit Reset view



- Bridge.Maintenance - result container.icdd
 - index.rdf
 - Ontology Resources
 - Container.rdf
 - Linkset.rdf
 - ExtendedLinkset.rdf
 - BridgeClassification.ttl
 - EUROTL.ttl
 - ExtendedDocument.rdf
 - Payload documents
 - AsBuiltBridgeModel-NotChanged.ifc
 - Removed_sidewalks_and_railings.ifc
 - Renewed_Sidewalks_and_guardrail.ifc
 - Payload triples
 - Ls_ifc_Maintenance.rdf
 - Ls_ifc_Component.rdf
 - ComponentOfMaintenance.Instances.ttl
 - MaintenanceDetail.ttl
 - PlannedMaintenanceMeasure.instances.ttl

Demonstration on the result container for bridge maintenance

- Overview of new construction elements on the model
- Check results of construction using a query
- Import the changed elements data into the database



The screenshot displays the AMS interface with three main panels:

- Explorer:** Shows a tree view of the project structure. The selected item is `Bridge Maintenance - result container.icdd`. Underneath, there are sections for `Ontology Resources` (including `Container.rdf`, `Linkset.rdf`, `ExtendedLinkset.rdf`, `BridgeClassification.ttl`, `EUROTL.ttl`, and `ExtendedDocument.rdf`), `Payload documents` (including `AsBuiltBridgeModel-NotChanged.ifc`, `BridgeDB`, `Removed_sidewalks_and_railings.ifc`, and `Renewed_Sidewalks_and_guardrail.ifc`), and `Payload triples` (including `auto-generated.rdf`, `Ls_ifc_Maintenance.rdf`, `Ls_ifc_Component.rdf`, `ComponentOfMaintenance.Instances.ttl`, `MaintenanceDetail.ttl`, and `PlannedMaintenanceMeasure.instances.ttl`).
- Content:** Displays `Link Details` for a `BinaryLink`. The `From` property is `Renewed_Sidewalks_and_guardrail.ifc` with GUID `0RNZ3MIF1D5xGvH9WfA`. The `To` property is `BridgeDB` with URL `http://www.amsfree.eu/ontology/bridgeCompMaintInstances#DeckConsolidationSouth`. Buttons for `Delete Link` and `Return to linkset` are visible.
- Properties:** Shows a 3D visualization of a bridge structure. Below the visualization, there are controls for `Transparency mode`, `Orbit`, and `Reset viewer`. A `Model` list shows:
 - `AsBuiltBridgeModel-NotChanged.ifc` (Visible)
 - `Removed_sidewalks_and_railings.ifc` (Hidden)
 - `Renewed_Sidewalks_and_guardrail.ifc` (Visible)

Conclusion of use cases for bridge

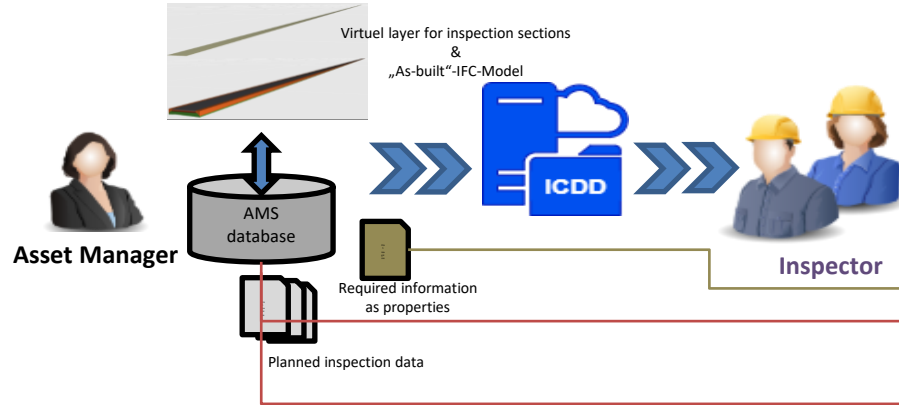
The technical approach to data preparation and exchange :

- Required information as ontology-based data collected by a contractor
- Changed model provided by a contractor
- Necessary domain ontology provided by asset manager
- As-built model provided by asset manager
- Planned activities as semantic data from IAMS

Short introduction of use cases for pavement

- the ICDDs prepared for self-testing

Pavement inspection



Containers 2 entries

Container	Created	Modified	Suitability	Status
Asset Management Inspection Containers				
Pavement Inspection Order - requirement container.icdd	08.04.2022 15:47:25		AM Inspection container	STARTED
Pavement Inspection Result - result container.icdd	08.04.2022 15:47:25		AM Inspection container	WORK IN PROGRESS

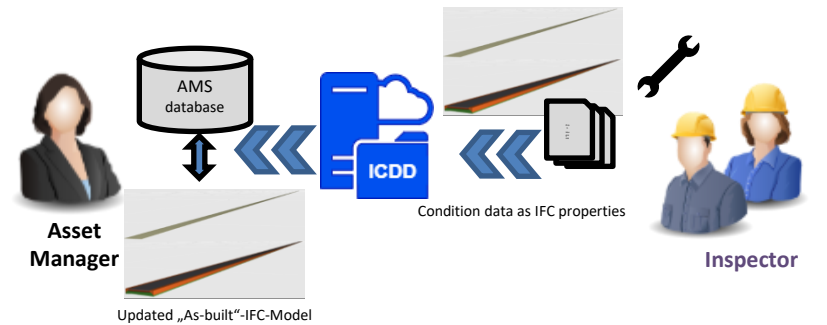
Buttons: Upload a Container, Create new Container

This screenshot shows the software interface with three main panels:

- Explorer:** A tree view showing the project structure, including folders like 'Pavement Inspection Order - requirement container.icdd' and 'Pavement Inspection Result - result container.icdd'. Specific files like 'PavementConditionProperty.xml' and 'PlannedInspection.mappings.ttl' are highlighted with red boxes.
- Content:** A central workspace showing a 3D model of a road cross-section.
- Properties:** A panel on the right displaying the properties of the selected model, such as 'RoadInspectionSection.ic' and 'As_builtRoadModel.ic'.

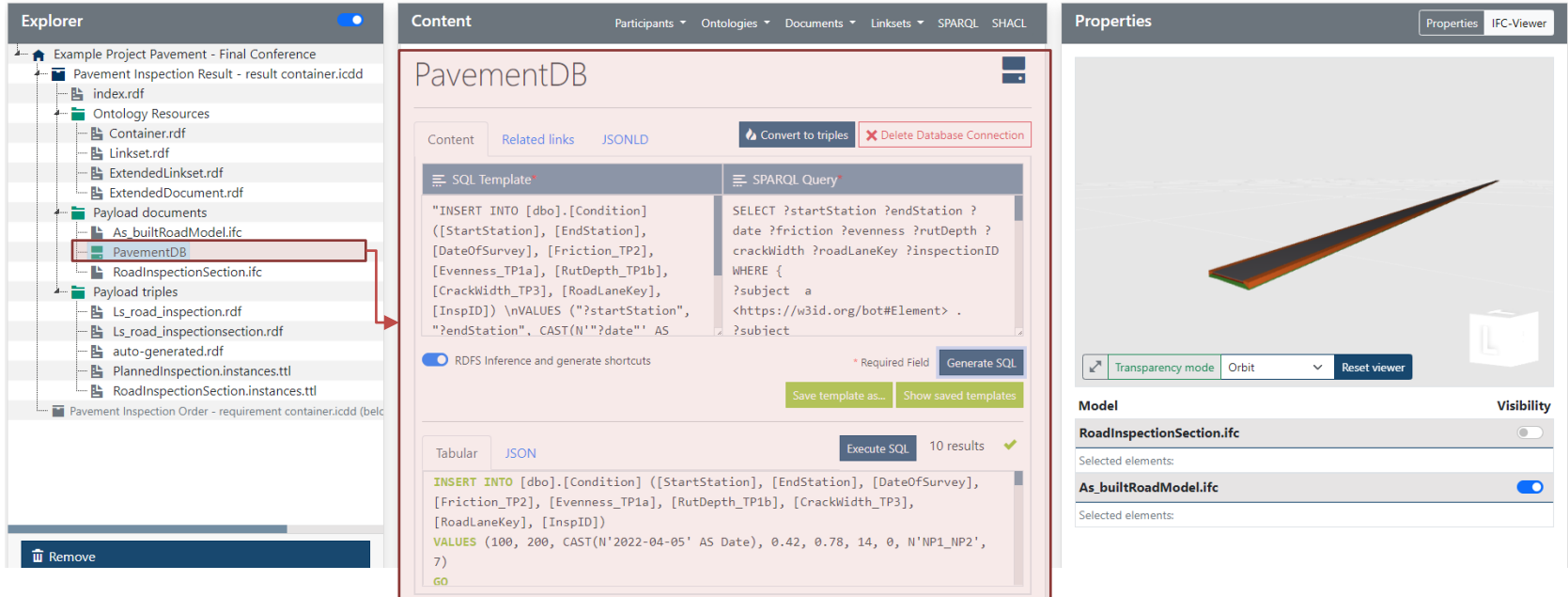
This screenshot shows a detailed view of the software interface:

- IFC Object Browser:** A tree view showing the IFC model structure, with 'Inspection layer' selected.
- Properties:** A panel displaying the properties of the selected 'Inspection layer', including 'Inspection type', 'EndStations', 'Friction', 'CrackWidth', and 'PVI_BAUTEILTYYP: inspection layer'.



Pavement inspection result

- Check condition assessment
- Import the condition data into the database



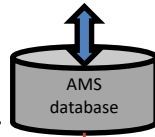
The screenshot displays a web application interface with three main panels:

- Explorer:** Shows a project structure for "Example Project Pavement - Final Conference". A red box highlights the "PavementDB" folder under "Payload documents".
- Content:** Displays the "PavementDB" interface. It includes a "SQL Template" field with an SQL insert statement, a "SPARQL Query" field with a query, and a "Generate SQL" button. Below, it shows "Execute SQL" with "10 results" and a "GO" button.
- Properties:** Shows a 3D model of a road section. The "Model" section lists "RoadInspectionSection.ifc" and "As_builtRoadModel.ifc".

Pavement maintenance measure

Pavement section to be maintained
&
„As-built“-IFC-Model

Asset Manager



Required information
as properties

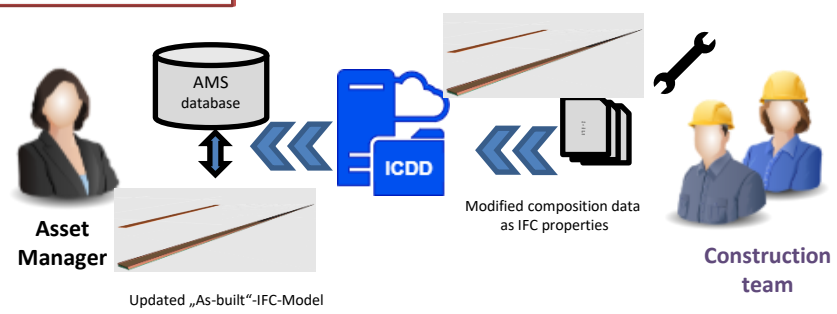
Planned maintenance data



Construction team

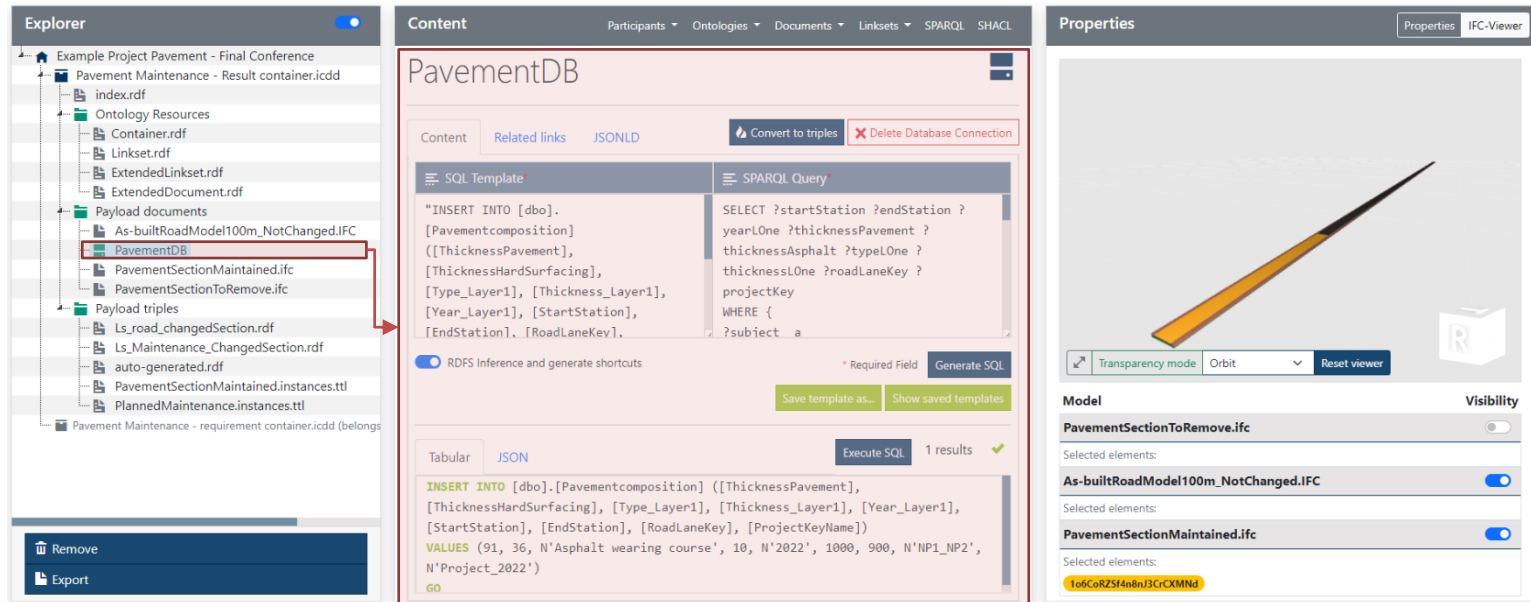
Container	Created	Modified	Suitability	Status
Asset Management Maintenance Containers				
Pavement Maintenance - requirement container.icdd	v. 1.0	16.05.2022 13:37:48	AM Maintenance container	ONLINE
Pavement Maintenance - Result container.icdd	v. 1.0	16.05.2022 13:37:48	AM Maintenance container	WORK IN PROGRESS

- index.rdf
- Ontology Resources
- Container.rdf
- Linkset.rdf
- ExtendedLinkset.rdf
- ExtendedDocument.rdf
- Payload documents
- As-builtRoadModel100m_NotChanged.IFC
- CrossSectionCompositionProperty.xml
- PavementDB
- PavementSectionToRemove.ifc
- PlannedMaintenance.mappings.ttl
- Payload triples
- Ls_road_changedSection.rdf
- Ls_Maintenance_ChangedSection.rdf
- auto-generated.rdf
- Ls_Maintenance_RequiredProperties.rdf
- PlannedMaintenance.instances.ttl



Pavement maintenance measure

- Check the modified section and related data
- Import the changed composition data into the database



The screenshot displays a web application interface with three main panels:

- Explorer:** A file tree on the left showing a project structure. The file `PavementDB` is highlighted with a red box and a red arrow pointing to the Content panel.
- Content:** The central panel titled "PavementDB" shows a SQL editor. The "SQL Template" tab is active, displaying an `INSERT INTO` statement. The "SPARQL Query" tab is also visible. Below the editor, there are buttons for "Execute SQL" (which shows "1 results"), "Save template as...", and "Show saved templates". A checkbox for "RDFS Inference and generate shortcuts" is checked.
- Properties:** The right panel, titled "Properties", shows a 3D visualization of a road segment. Below the visualization, there are controls for "Transparency mode", "Orbit", and "Reset viewer". A "Visibility" section lists three models:
 - `PavementSectionToRemove.ifc` (visibility off)
 - `As-builtRoadModel100m_NotChanged.IFC` (visibility on)
 - `PavementSectionMaintained.ifc` (visibility on)

Conclusion of use cases for pavement

The technical approach to data preparation and exchange:

- Required Data as property set template provided by asset manager
- Planned activities as semantic data from IAMS
- IFC-Model provided by asset manager
- Enriched IFC-Model with properties by a contractor

Q&A



AMS
FREE

THANK YOU FOR YOUR ATTENTION!