CEDR
Conférence Européenne des Directeurs des Routes
Conference of European Directors of Roads

Final Event CEDR Call 2018 BIM

Project CoDEC
Connected Data for Effective Collaboration

Day 1 - 24th May 2022

Stockholm

CEDR Call 2018 BIM

Project CoDEC

1.CoDEC Project overview (10min)	Sukalpa Biswas (Project Co-Ordinator, TRL)
2. Stakeholders Engagement (5min)	Darko Kokot (WP4 Lead, ZAG)
3. CoDEC Data Dictionary (10min)	Sukalpa Biswas (Project Co-Ordinator, TRL)
4. CoDEC Data Ontology (10min)	Jose' Baraterio (WP 3 Lead, LNEC)
5. Pilot Projects (30 min)	Jelena Petrovic' (BEXEL), Darko Kokot (ZAG), Jose' Baraterio (LNEC) and Shubham Bhusari (RHDHV)
6. Project Recommendations & Dissemination Events (5 min)	Sukalpa Biswas (Project Co-Ordinator, TRL)
7. Feedback & Questions (20min)	All

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CoDEC Project Overview

CoDEC – Consortium

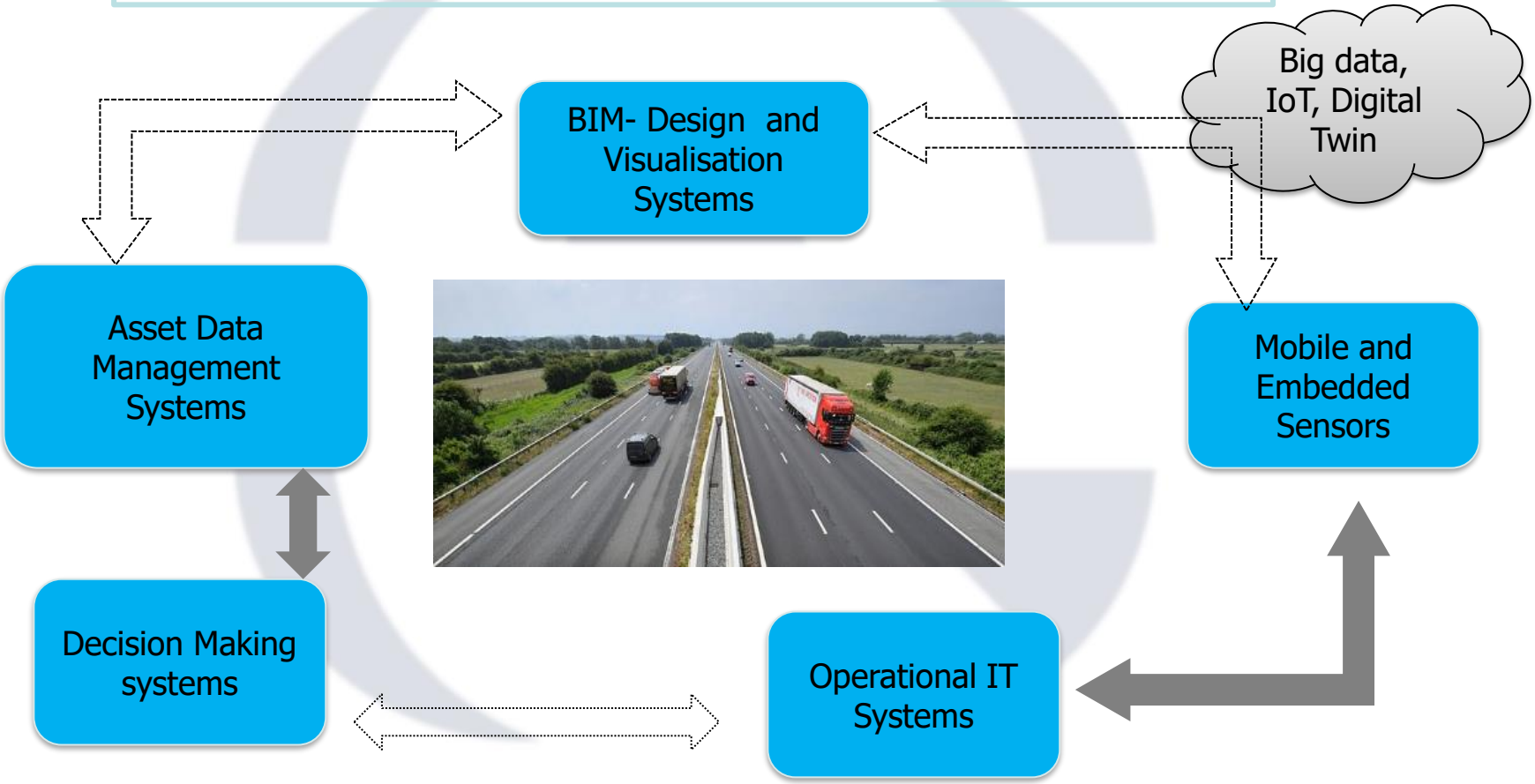
The Research has been undertaken by seven consortium partners

TRL THE FUTURE OF TRANSPORT
BEXEL CONSULTING
ZAG
FEHRL
LNEC LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL
Belgian Road Research Centre Together for sustainable roads
Royal HaskoningDHV Enhancing Society Together

www.codec-project.eu.

CoDEC Project Overview

Challenges for the Road Authorities



CoDEC Project Overview

Key aspirations of CEDR Call 2018

To develop a method so that asset data is..

Accessible: not trapped in a certain application

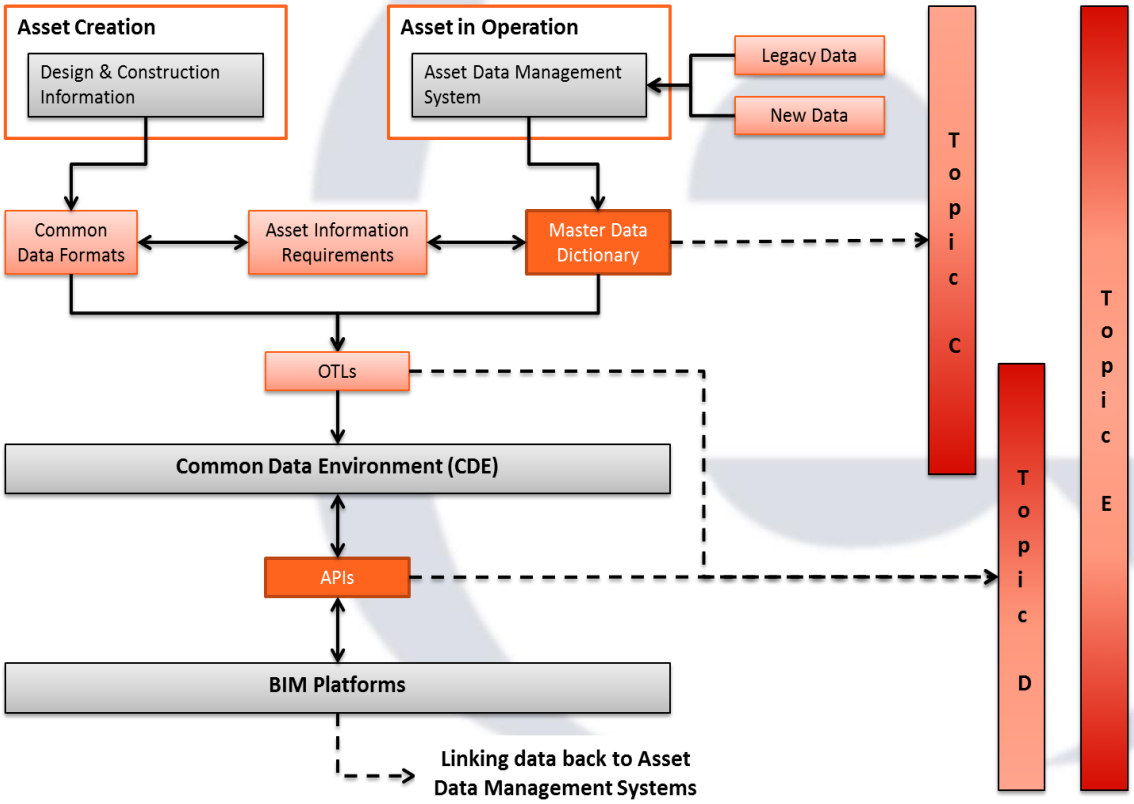
Interoperable: exchanged between stakeholders

Integrable: can be connected to and from different sources

Publishable: connected in a structured manner based on international standards

CoDEC Project Overview

Objective of the CEDR call 2018



OBJECTIVES STATED in the CALL :

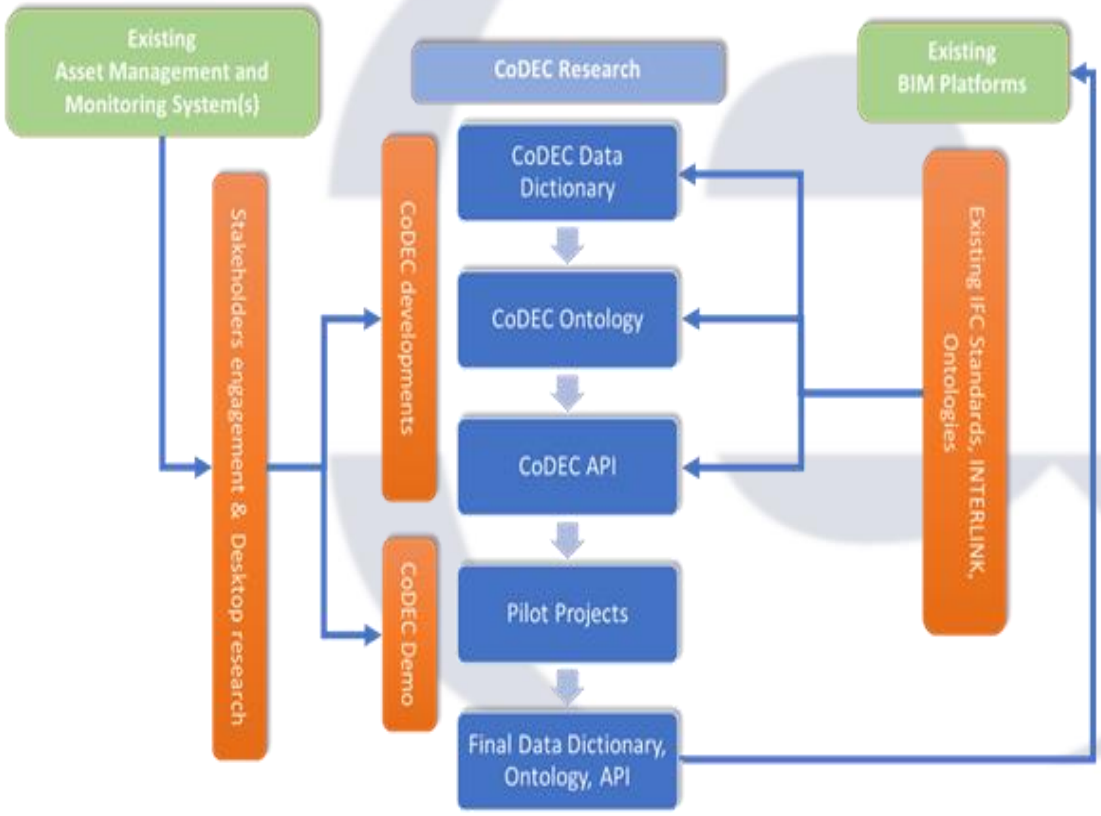
DoRN C: How to benefit from scanning/censoring data to enrich asset management systems with legacy data.

DoRN D: How to combine the strength of traditional techniques with the strength of Interlink approach based on Linked Data/ semantic web techniques

DoRN E : How to engage software industry to align their roadmap for development with the needs of CEDR members

CoDEC Project Overview

What CoDEC has Delivered



CoDEC has developed:

1. CoDEC Data Dictionary,
2. CoDEC Ontology,
3. CoDEC OpenAPI

CoDEC tested developed solutions through:

- three pilot projects

CoDEC developed solutions are :

- Future- proofed
- Expandable and Implementable

CoDEC Project Overview

CoDEC Deliverables

Work Package	Description		Deliverables
WP0	Project Co-ordination	D0.2A-H	Technical Progress Reports
		D0.4	Final Project Report
WP1	Develop Master Data Dictionary (MDD) for Legacy Data	D1A	Literature Review on Legacy Data and the Data Dictionary
		D1B	CoDEC Data Dictionary
WP2	Develop Master Data Dictionary (MDD) for Sensor/Scanner Data	D2A	Review of sensor technologies and their application
		D2B	CoDEC Data Dictionary
WP3	Applied Research through Pilot Projects	D3A	Pilot projects report and consolidated implementation resources
WP4	Stakeholder Engagement	D4A	Stakeholder Engagement Report
WP5	Dissemination	D5A	Dissemination Plan

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Stakeholders Engagement

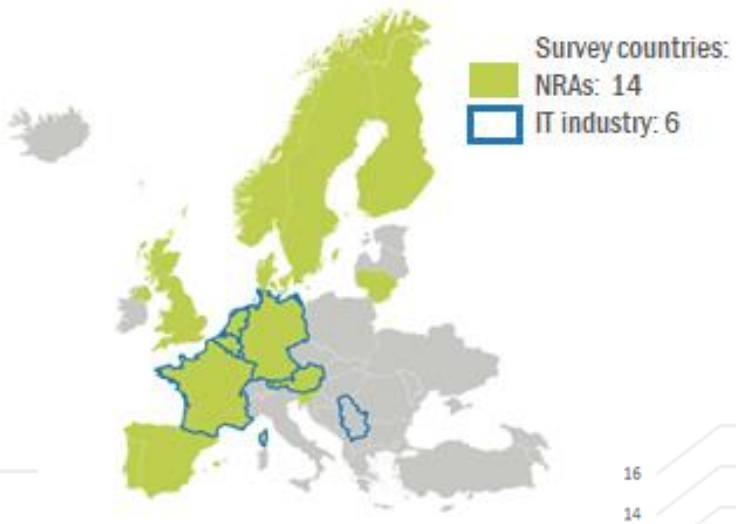
Objective:
To facilitate engagement between stakeholders with the aim to align future strategies and direction around BIM

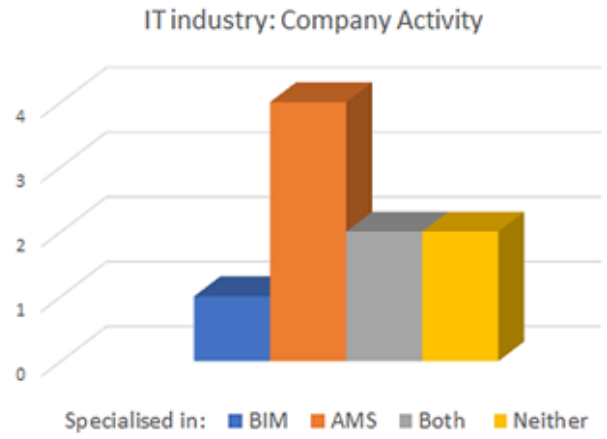
Stakeholders:
Road Authorities: NRAs and CEDR
Software companies: AMS and BIM

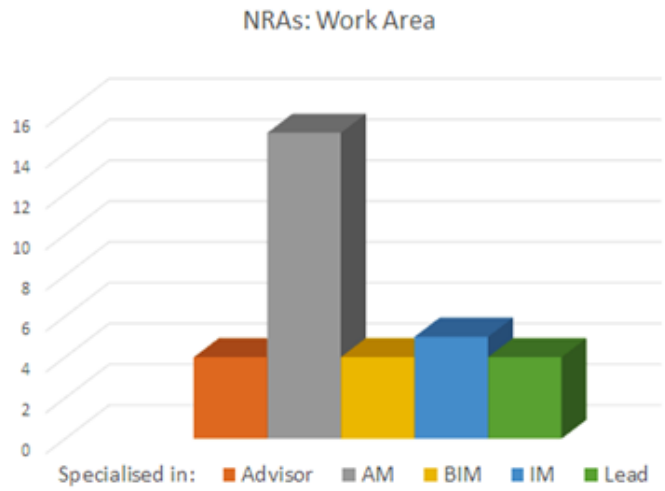
Process:
1. Online Survey for NRAs
2. Online Surveys for Software Industry
3. 1-1 Interviews with NRAs
4. 1-1 Interviews with Software Industry
5. Consultations with Implementation partners
6. Workshops with PEB and NRAs

Stakeholders Engagement

Stakeholders Engagement : Survey

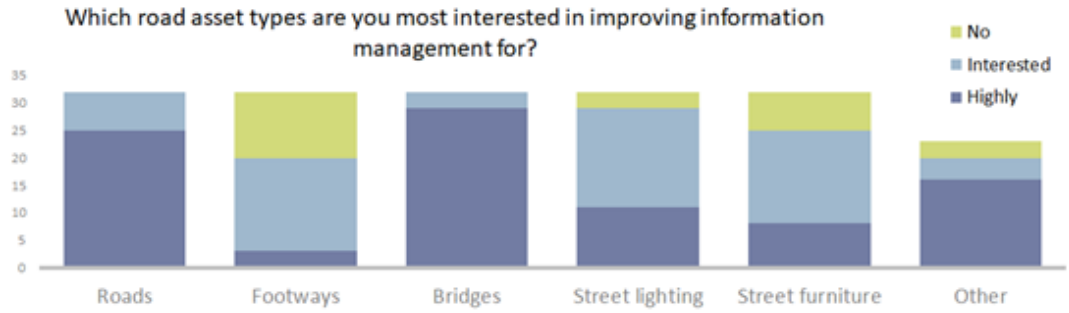


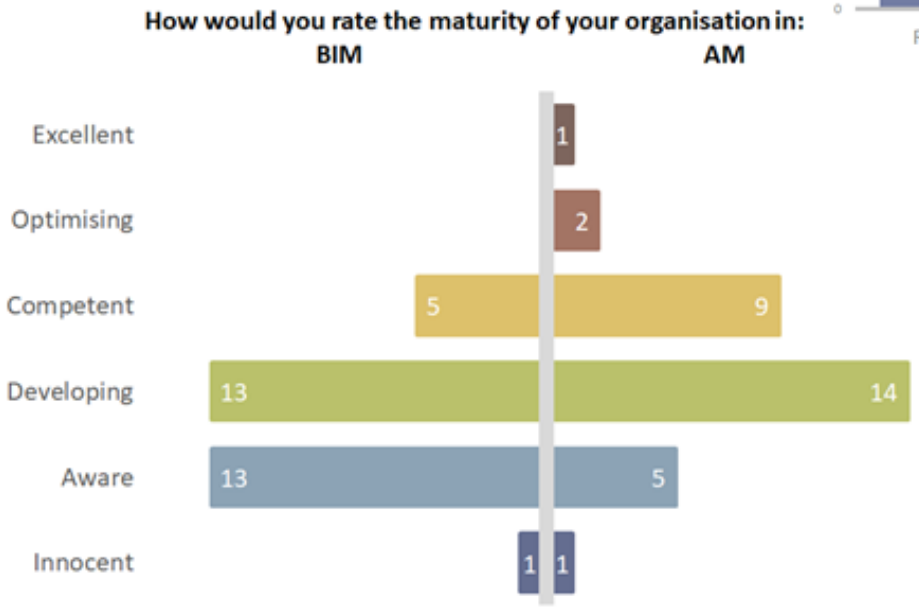


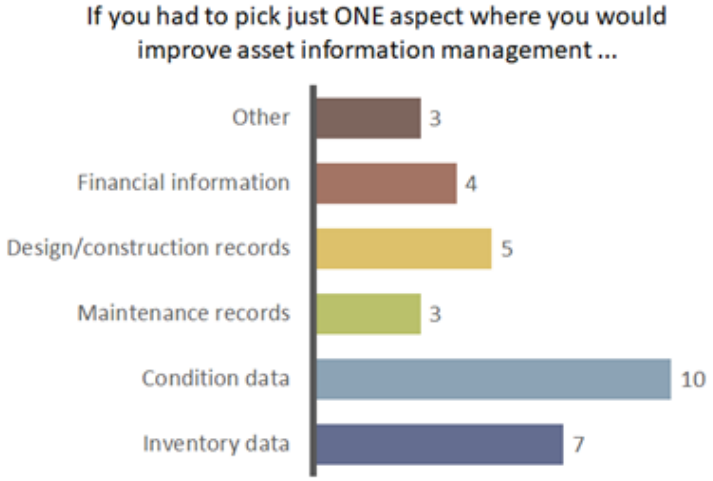


Stakeholders Engagement

Stakeholders Engagement : Selection of NRA Responses







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Stakeholders Engagement

Key points from Stakeholder Engagement Task

- Do NRAs need to get to a higher level with BIM Key questions: What higher level? Why do NRAs need that level?
- Expectations for the integration of BIM into daily NRA work Change management might be needed to make organizations and people more competent
- Benefits for NRAs through the implementation of BIM There is a need to systematically increase awareness about BIM on NRA and companies' sides
- Benefits of the integration of AMS with the BIM software … more consistency, more effective solutions, consideration of strategic goals…
- Risks and challenges in the integration of AMS with the BIM software Focus too much on data modelling and not on the objectives of the AMS / PMS
- What is needed from NRAs to better engage the software industry ... systematically increased awareness about BIM. NRAs are to mandate the use of BIM and open standards
- What are the risks and benefits for the two sectors to connect / get involved It is essential to provide clear expectations from both sectors and to align them

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Stakeholders Engagement

Key outcomes from Stakeholder Engagement Task

- CoDEC selection of 3 main asset types for the research (…asset types you are most interested in…) Road, Bridge and Tunnel
- Focus of research (…one aspect to improve…) Condition data for Tunnel and Bridge, Inventory data for Road
- Decided and agreed on 3 Implementation partner to support and work with the CoDEC research Team AWV / Belgium , RWS / The Netherlands, and FTIA / Finland
- Crucial role of Implementation partners Necessary data for research - a detailed 3D model of a tunnel, risk / condition / sensor data; Own and real needs and expectations
- Working hand in hand with Implementation partners Multi step collaboration process - shaping focus of the research, discussions on the way to go, evaluation of intermediate results – led to variety of valuable and satisfying project outcomes

Stakeholders Engagement

Key recommendations from Stakeholder Engagement Task

CODEC GUIDELINE TO ALIGN VISIONS AND AGENDAS…

…of the two main actors involved in the research:

- Make the decision to move to an appropriate level with BIM
- Common language - define the level of detail (LOD) … in line with the NRAs strategy
- Once we know what both sides want … establish bi-directional communication
- Train the workforce at NRAs
- Define business processes in a common framework
- Standardization? NRAs to mandate the use of BIM and open data standards

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CoDEC Data Dictionary

Objectives:

- Provide a structured unified framework for data
- Easily understandable by asset managers/asset owners
- Repeatable and extendable in future
- Include "Legacy Data" and "New Data" from sensors

Key Asset Types :
Road,
Bridge and Tunnel

Process:

- Literature Review of
  - Existing Data Dictionary developed/used by NRAs
  - Past/ongoing research
  - Supplemented information from stakeholder interviews
- Consortium's extensive knowledge on Asset Management process

Is built on:

- Data Dictionary for tunnels and bridges by AM4INFRA,2018
- The Highways England UK-ADMM Data Dictionary (Highways England, 2020)
- Data Standard for Road Management and Investment in Australia and New Zealand (DSRMI, for tunnels) (Austroads, 2019) and
- ifcRoad (buildingSMART, 2020)

CoDEC Data Dictionary

How does the CoDEC Data Dictionary help creating/improving the connection between BIM and AMS ?

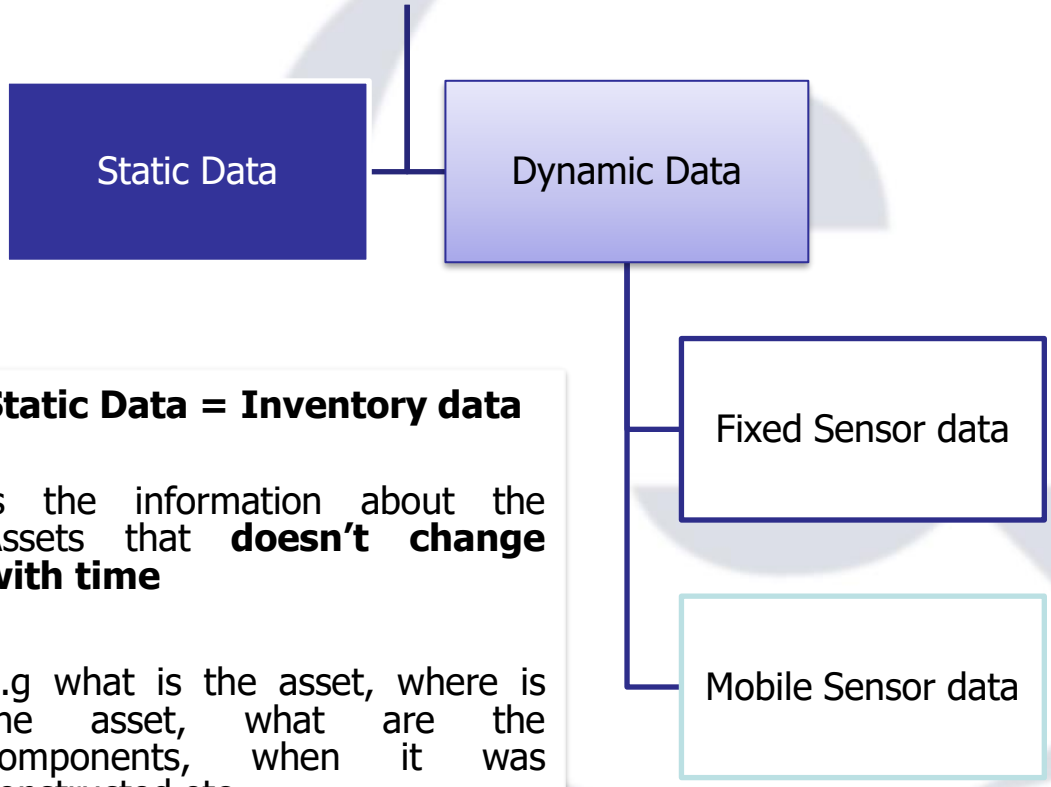
It provides a logical hierarchical system of data & metadata written in plain language

- to build "Data Queries" between Asset Management System and BIM
- based on the well-defined structure of legacy data within AMS and IFC Standard
- provides the list of data types and the connection to meta data for creating an Object Type Library (OTL) for the BIM platform
- helps both the Asset Managers and Software developers to translate the asset data into "Linked Data Environments" for a successful data integration process.
- The format is adaptable by different Organisations and easily extendable in future to cater new data types

CoDEC Data Dictionary is Implementable, Extendable and Future Proofed

CoDEC Data Dictionary

CoDEC Data Dictionary Structure



Static Data = Inventory data

is the information about the Assets that **doesn't change with time**

e.g what is the asset, where is the asset, what are the components, when it was constructed etc.

Dynamic Data = data collected on asset

- is the information on the asset condition, operation and maintenance that changes with time.
- is connected to Static Data by an "Unique ID".
- gives an universal framework for any data that can be captured by either "Fixed Sensor" or "Mobile Sensor"

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CoDEC Data Dictionary

Static Data Sample from the CoDEC Data Dictionary

This section defines the properties needed to describe Assets (Entities) and Asset Components (Elements)

Entity Class	Entity Sub-Class	Entity Types	Element Types	Property Class
Road entities	Bridges	Road sections	Kerb and traffic separatio...	Identification
Drainage and waste...	Carriageways	Bridge deck systems	Lanes	Location
Electrical power and...	Cycle pathways	Bridges	Pavement layer	Physical
Land managed entities	Drainage and wastewa...	Cycle pathway sections	Pavements	Time and Money
Structures	Footpaths	Drainage and wastewater collec...	Road studs	
	Land managed entities	Earthworks	Soft shoulders	
	Lighting	Electro-mechanical	Traffic signage and markin...	
	Tunnels	Fire-fighting system	Abutment Wall	
		Footpath sections	Approach Embankment	

Objects				*Properties*		
Entity Class	Entity Sub-Class	Entity Types	Element Types	Property Class	Property Name	Property Definition
Road entities	Carriageways	Road sections	Road studs	Identification	Component type ID	Unique identifier for the road studs
Road entities	Carriageways	Road sections	Road studs	Identification	Pavement section ID	Unique reference identifier for pavement section
Road entities	Carriageways	Road sections	Road studs	Identification	Lane ID	Unique reference identifier for lane section
Road entities	Carriageways	Road sections	Road studs	Physical	Geometry type	How the geometry of the asset/component is represented - a line segment
Road entities	Carriageways	Road sections	Road studs	Physical	Marking length	The actual distance between the start and end position defining the road studs interval
Road entities	Carriageways	Road sections	Road studs	Location	Latitude (Start)	Latitude coordinate, at the start of the road studs
Road entities	Carriageways	Road sections	Road studs	Location	Longitude (Start)	Longitude coordinate, at the start of the road studs
Road entities	Carriageways	Road sections	Road studs	Location	Altitude (Start)	Altitude, at the start of the road studs
Road entities	Carriageways	Road sections	Road studs	Location	Latitude (End)	Latitude coordinate, at the end of the road studs
Road entities	Carriageways	Road sections	Road studs	Location	Longitude (End)	Longitude coordinate, at the end of the road studs
Road entities	Carriageways	Road sections	Road studs	Location	Altitude (End)	Altitude, at the end of the road studs
Road entities	Carriageways	Road sections	Road studs	Location	Start chainage	Start chainage of the road studs
Road entities	Carriageways	Road sections	Road studs	Location	End chainage	End chainage of the road studs
Road entities	Carriageways	Road sections	Road studs	Physical	Class	Road studs class (e.g. prohibitory, warning, informatory, etc.)
Road entities	Carriageways	Road sections	Road studs	Physical	Colour	Colour of the road studs
Road entities	Carriageways	Road sections	Road studs	Time and Money	Construction date	The date of road studs installation
Road entities	Carriageways	Road sections	Road studs	Physical	Contractor	The details of the Contractor who had the responsibility to execute the works
Road entities	Carriageways	Road sections	Road studs	Physical	Commissioner	Name of the responsible for the commissioning of the road studs

CoDEC Data Dictionary

Dynamic Data Sample from the CoDEC Data Dictionary

This section defines the properties needed to describe Sensors

Object Sub-Class	Property Type	Property Name
Fixed-location sensors	Classifiers	Altitude (End)
Mobile sensors	Identifiers	Altitude (Start)
(blank)	Location	Array/Network description
		Array/Network ID
		Array/Network name
		Asset type
		Asset type(s)
		Component type
		Coordinate reference system

Objects		*Properties*						
Object Class	Object Sub-Class	Property Type	Property Name	Property Definition	Data Requirement	Formats	Unit (type)	Const
Monitoring and surveying equipment	Fixed-location sensors	Identifiers	Array/Network ID	Unique sensor array/network ID	Conditional	String		
Monitoring and surveying equipment	Fixed-location sensors	Identifiers	Array/Network name	A meaningful name for the sensor array/network		String		
Monitoring and surveying equipment	Fixed-location sensors	Identifiers	Array/Network description	Plain-text description of the sensor array/network		String		
Monitoring and surveying equipment	Fixed-location sensors	Identifiers	Sensor ID	Unique sensor ID	Mandatory	String		
Monitoring and surveying equipment	Fixed-location sensors	Identifiers	Sensor Name	A meaningful name for the sensor		String		
Monitoring and surveying equipment	Fixed-location sensors	Identifiers	Sensor Description	Plain-text description of the sensor		String		
Monitoring and surveying equipment	Fixed-location sensors	Identifiers	Manufacturer	The name of the manufacturer of the sensor		String		
Monitoring and surveying equipment	Fixed-location sensors	Classifiers	Sensor Class	Class of sensor		String		List
Monitoring and surveying equipment	Fixed-location sensors	Classifiers	Sensor Type	Type of sensor (more specific than class)		String		List
Monitoring and surveying equipment		Classifiers	Intended Application	Description of the intended applciation (use) of the sensor		String		
Monitoring and surveying equipment	Fixed-location sensors	Classifiers	Sensor Standard(s)	Standard(s) relevant to the sensor type		String		
Monitoring and surveying equipment	Fixed-location sensors	Classifiers	Asset type(s)	The type(s) of asset for which the data is collected		String		List
Monitoring and surveying equipment	Fixed-location sensors	Location	Coordinate reference system	Name/ID for the coordinate reference system used		String		List
Monitoring and surveying equipment	Fixed-location sensors	Location	Latitude (Start)	Easting coordinate of start point	Conditional	Decimal		
Monitoring and surveying equipment	Fixed-location sensors	Location	Longitude (Start)	Northing coordinate of start point	Conditional	Decimal		
Monitoring and surveying equipment	Fixed-location sensors	Location	Altitude (Start)	Altitude of start point		Decimal		
Monitoring and surveying equipment	Fixed-location sensors	Location	Latitude (End)	Easting coordinate of end point	Conditional	Decimal		
Monitoring and surveying equipment	Fixed-location sensors	Location	Longitude (End)	Northing coordinate of end point	Conditional	Decimal		
Monitoring and surveying equipment	Fixed-location sensors	Location	Altitude (End)	Altitude of end point		Decimal		
Monitoring and surveying equipment	Fixed-location sensors	Location	Section ref. label	Unique ID of the network section to which the sensor is associated for the purposes of network location referencing	Conditional	String		
Monitoring and surveying equipment	Fixed-location sensors	Location	Lane	Lane of the section to which the sensor is associated for the purposes of network location referencing	Conditional	String		
Monitoring and surveying equipment	Fixed-location sensors	Location	Start chainage	The along carriageway position corresponding to the beginning of a linear or polygon asset, as measured within the section	Conditional	Decimal	Distance	
Monitoring and surveying equipment	Fixed-location sensors	Location	End chainage	The along carriageway position corresponding to the termination of a linear or polygon asset, as measured within the section	Conditional	Decimal	Distance	
Monitoring and surveying equipment	Fixed-location sensors	Location	Offset (section centreline)	Lateral position defined by numerical offset from the section centreline		Decimal	Distance	

Title Page | Data Dictionary Structure | Entities and Elements | Sensors | Sensor Data | Example of Dynamic Data set | FAQs

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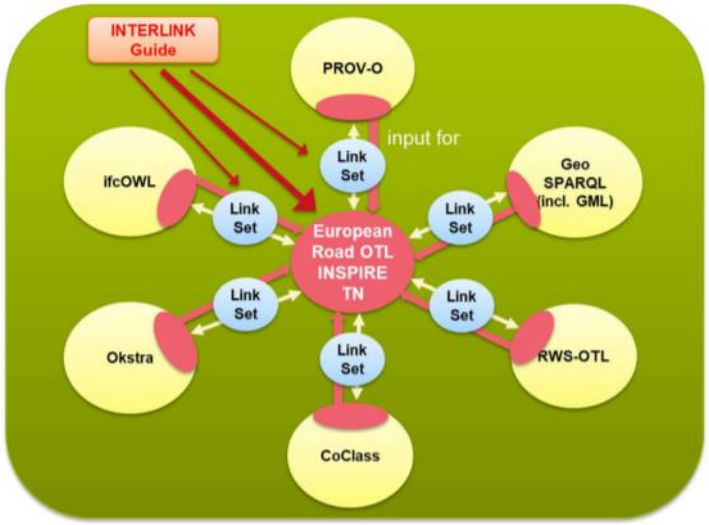
CoDEC Ontology

CoDEC Ontology Development Process

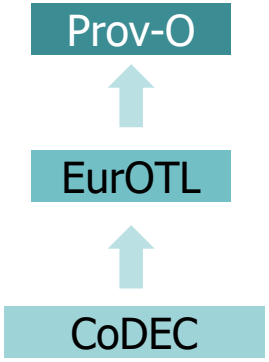
- CoDEC Ontology Development
- CoDEC's approach
- Technical architecture
- Test Concept

CoDEC Ontology Development



Ontology Development Process

- Data Dictionary as the input
- Concepts (Class), Relationships (Object Property), and Attributes (Data Property)
- Does it exist in EurOTL?
- If it does not, extend EurOTL concepts!



CoDEC Ontology Development

Linked data technologies, such as **ontologies**, are used to encode asset and sensor data in a formal, comprehensible, and explicit way.

Mapping CoDEC data dictionary to EUROTL ontology (extended if needed).

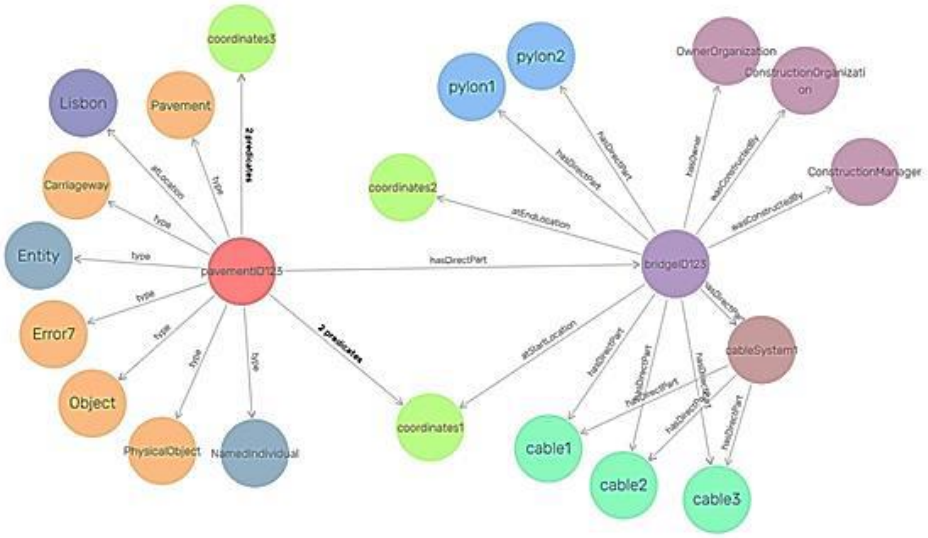
Data Dictionary			Ontology		
Property	Description	Format	Domain	Object/Data Property	Range
Bridge ID	The unique reference identifier for bridge	String	bridgeID	is-a	Bridge
Bridge name	The name of the bridge	String	bridgeID	rdfs:label	xsd:string
Environment	Classification of surrounding environment (e.g. Rural/Urban)	String	bridgeID	inEnvironment	xsd:string
Region/District/Area	Relevant geographical situation	String	bridgeID	prov:atLocation	eurotl:LocationByIdentifier
Owner	Owner of the asset	String	bridgeID	hasOwner	prov:Agent (person or Org.)

"Extensions" are "EUROTL sub-classes": guarantied operability CoDEC/EUROTL.

CoDEC Ontology Development

Integration of real data (using the ontology, API, etc.) – necessary step toward CoDEC pilot projects.

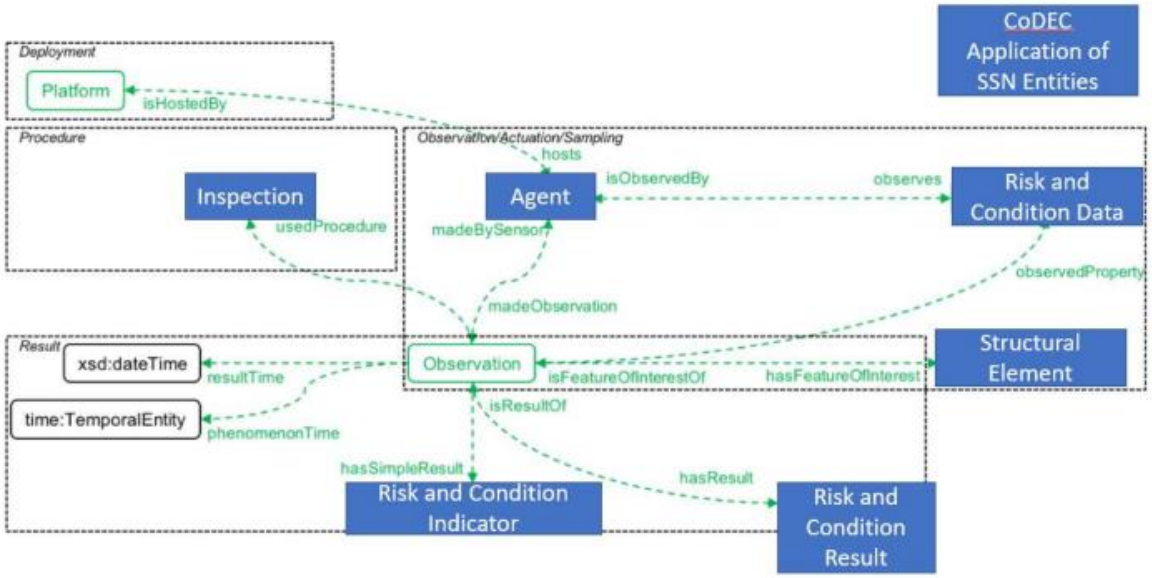
1. Ontology is populated with real data instances.
2. Data are made available in a linked data environment. CoDEC uses GraphDB = a database that follows RDF and SPARQL.
3. Data are then made accessible through the CoDEC API.



CoDEC Ontology Development

CoDEC Ontology includes:

- Structural Elements (Tunnel and Bridge Elements)
- Properties related to structure and structural elements representation
- Pavement Sections and Layers
- Risk and Condition Data (SSN Ontology extension)



CoDEC Approach

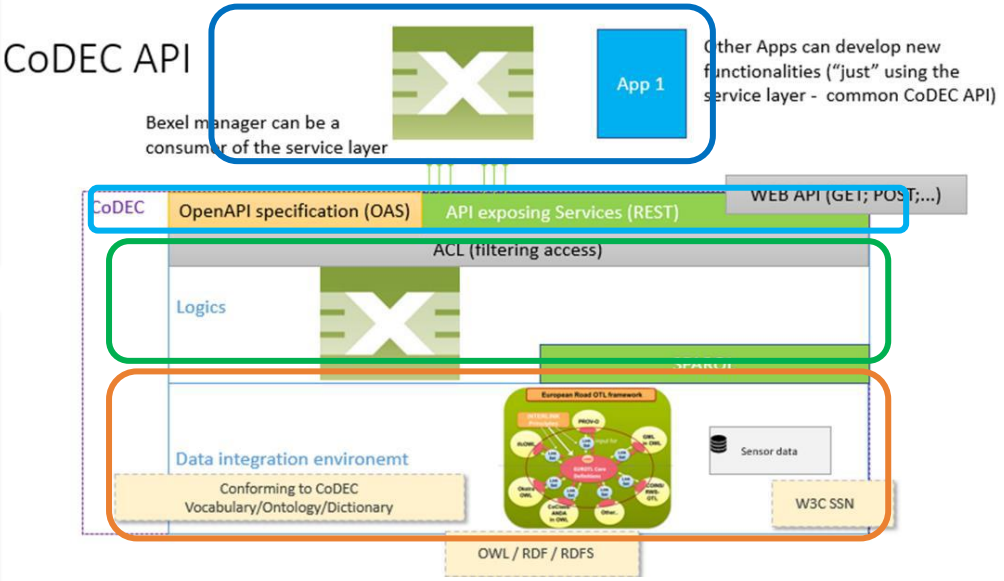
A layered architecture allows modifications to the linked data structures without affecting external applications.

Queries (SPARql) on linked data ontologies

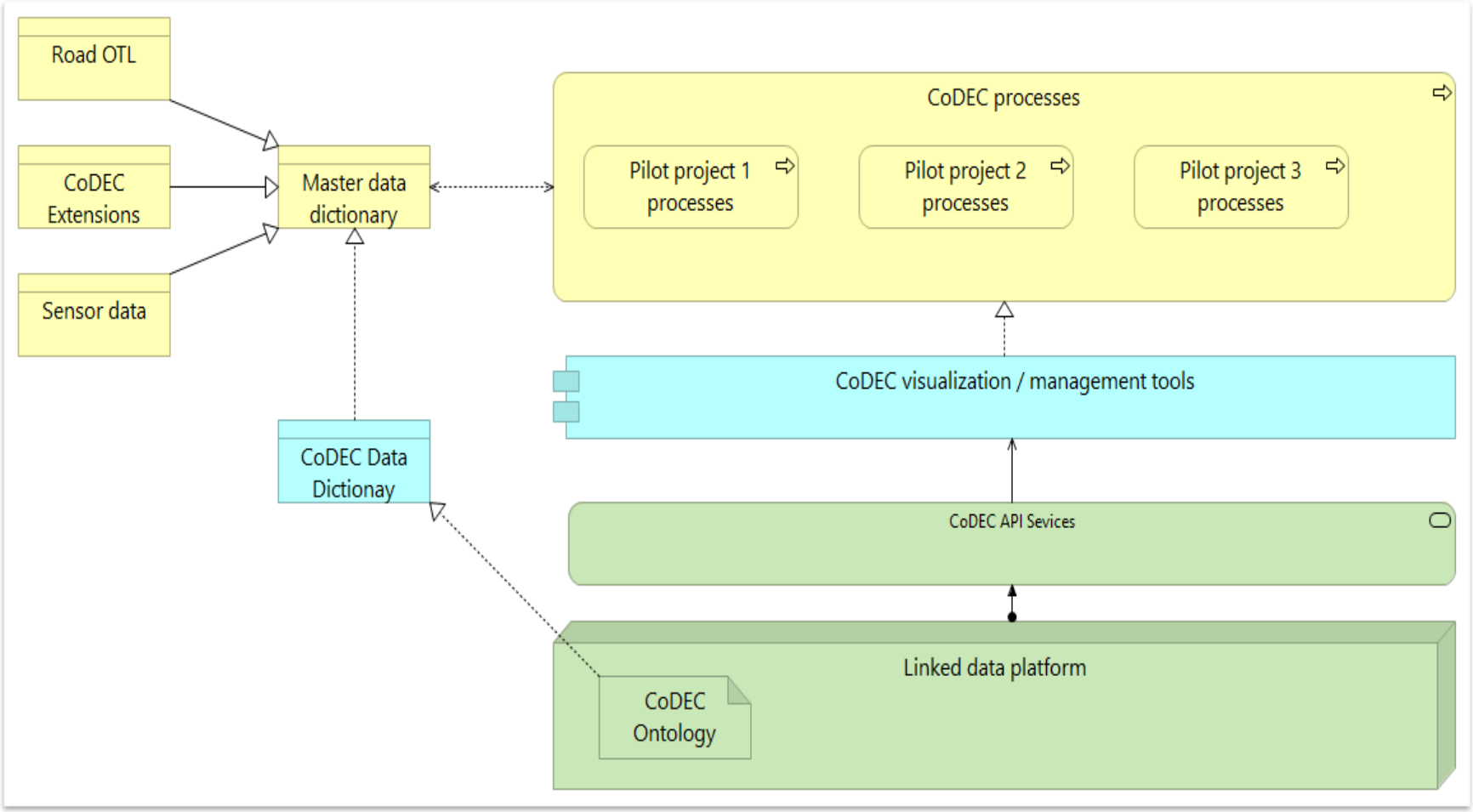
1. CoDEC ontology (CoDEC Data Dictionary)
2. EUROTL ontology
3. Sensor ontology (Sensor Network Ontology by Open Geospatial Consortium)

CoDEC API (Rest services) to queries.

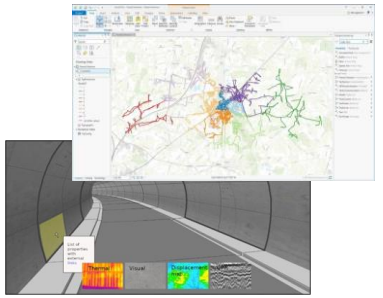
Applications make use of CoDEC API (e.g. demonstration by CoDEC consortium with "Bexel manager").

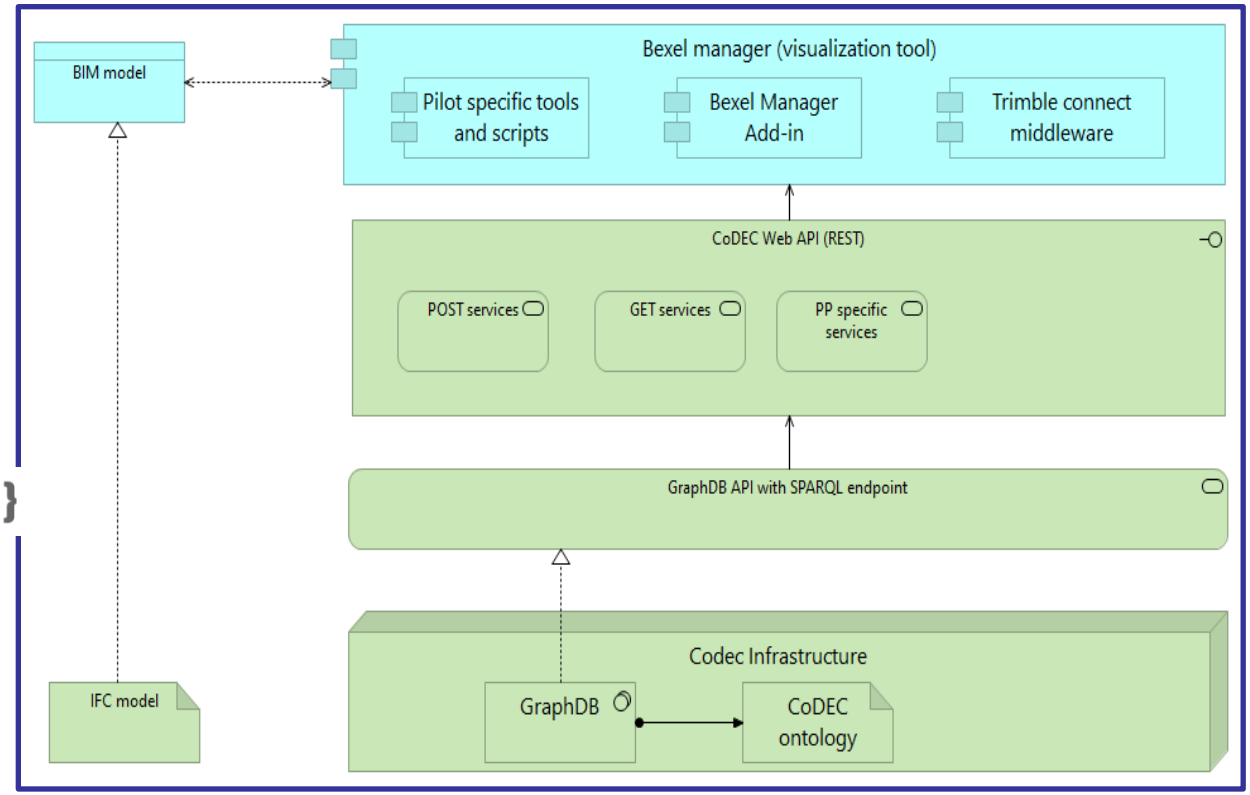


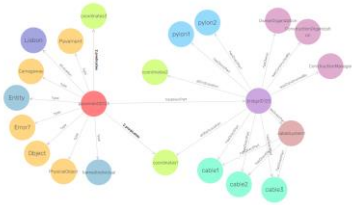
CoDEC Approach



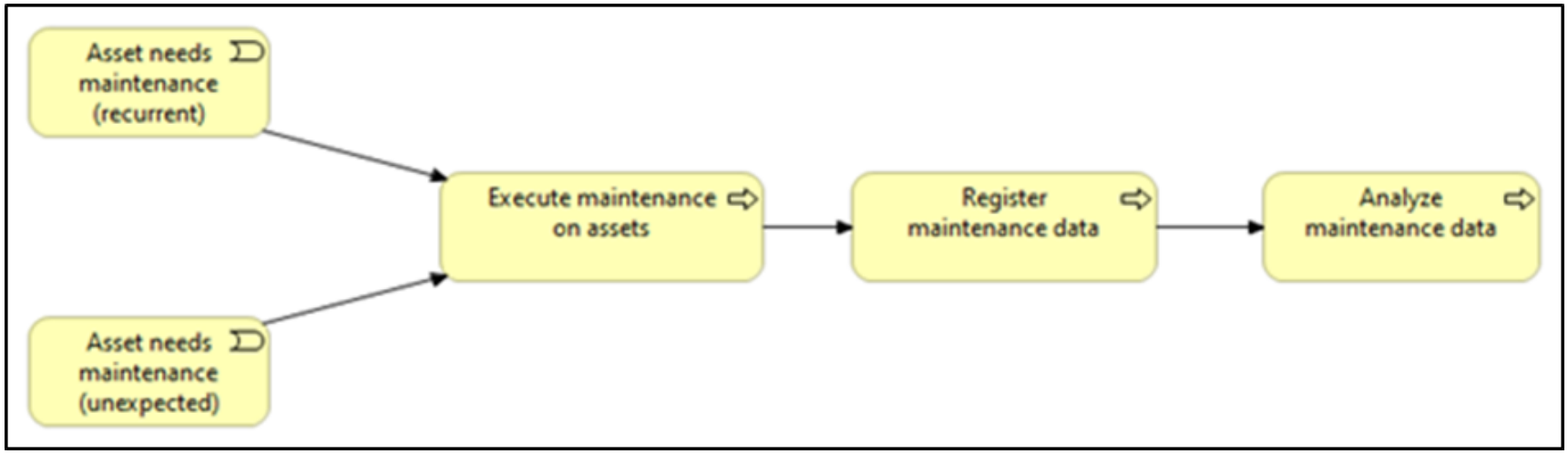
Technical Architecture



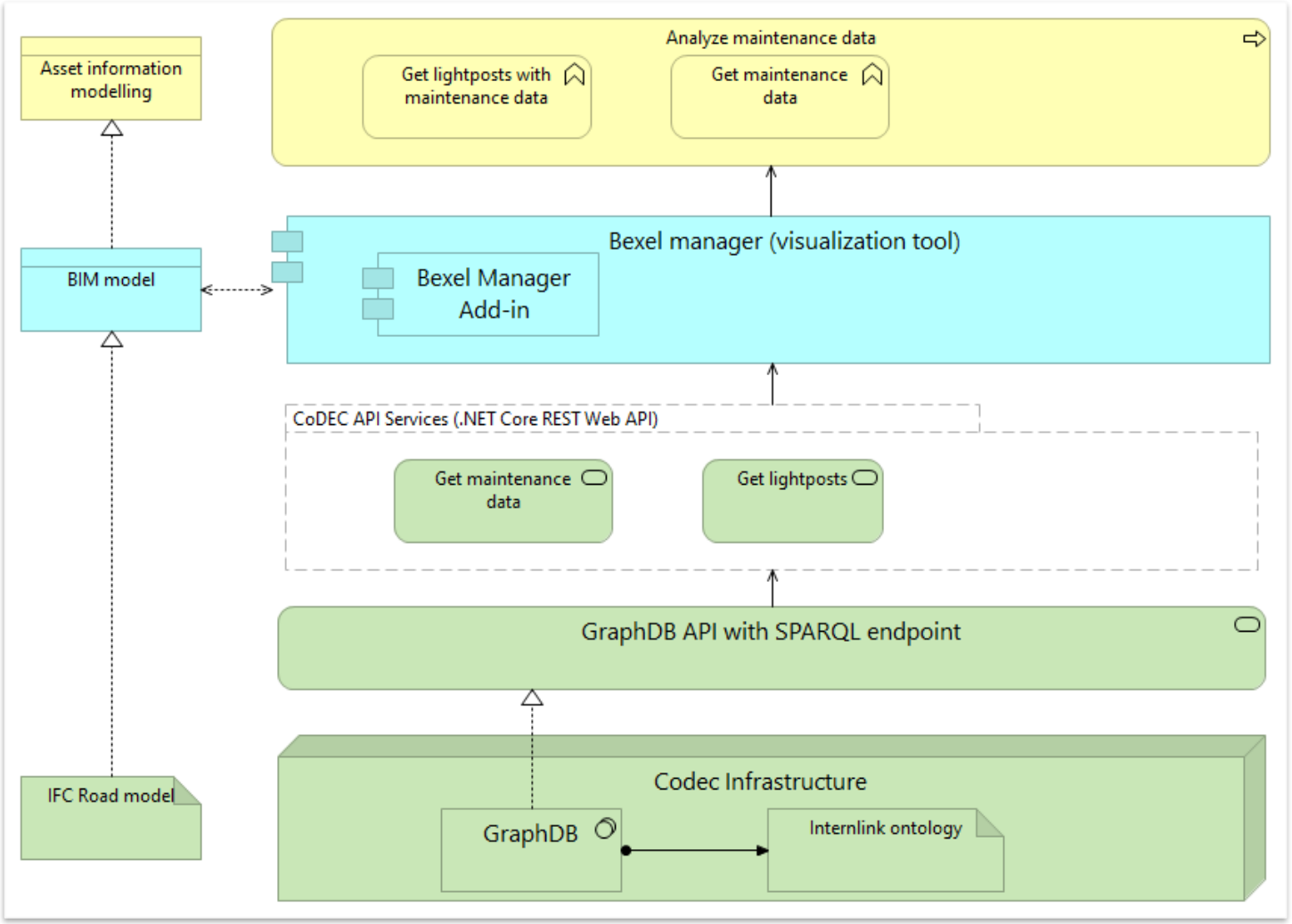




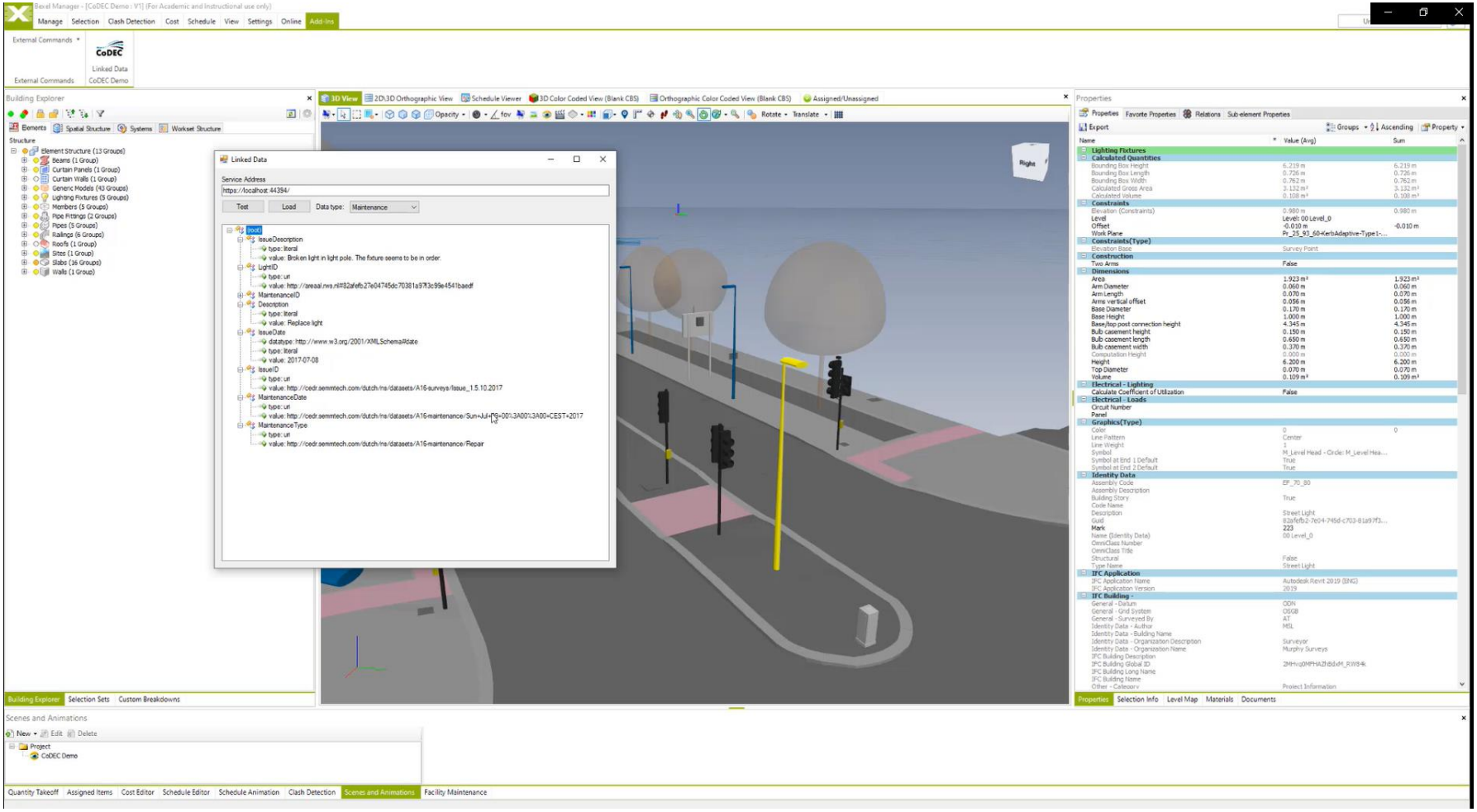
Test Concept



Test Concept



Test Concept



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7. Feedback & Questions (20min)	All

Pilot Projects

Pilot Projects' overview

Objectives:

- To demonstrate that the CoDEC solution is implementable for different Asset Types
- To demonstrate how integration of different data sets in one system can improve decision making.

Pilot projects :

- **Pilot Project 1**: Integration and 3D visualisation of sensor data in a BIM Model of a **Tunnel**
- **Pilot Project 2**: Linking and visualizing condition data with a **Bridge** BIM model
- **Pilot Project 3**: Enhancing legacy data by linking the BIM model of a **Road** to a GIS

Implementation Partners:

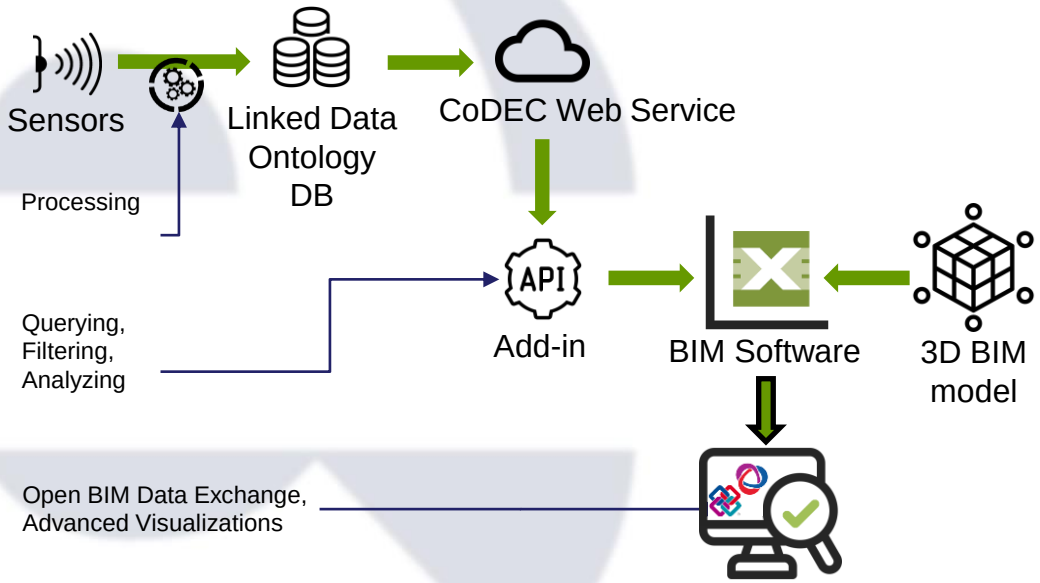
- PPI - AWV (Belgian-Flemish NRA);
- PP2- RWS (Dutch NRA)
- PP3- FTIA (Finnish NRA)

Pilot Projects

Pilot Project 1 : Tunnel Asset

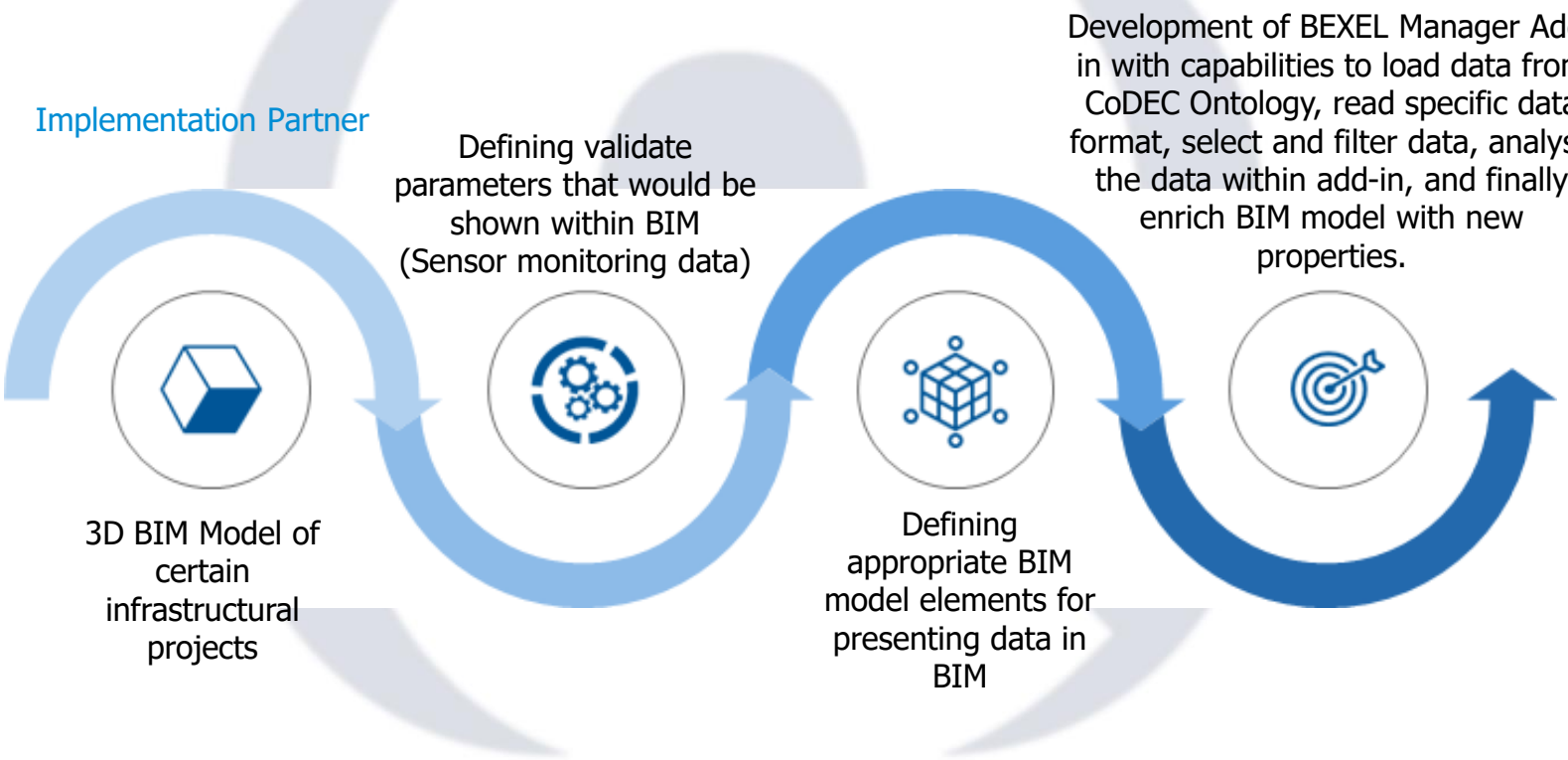
Objectives

- Enhance BIM model of a tunnel with CoDEC OTL
- Link BIM model with monitoring data
- Be able to query the data (CoDEC API)
- Advanced 3D visualisation of the entire BIM model



Pilot Projects

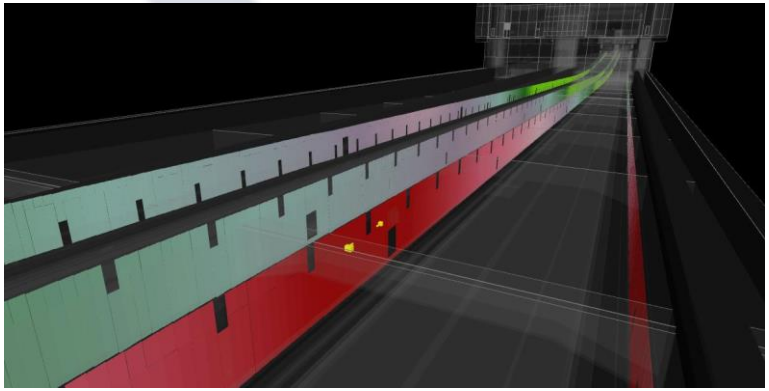
Pilot Project 1 : Process Highlights

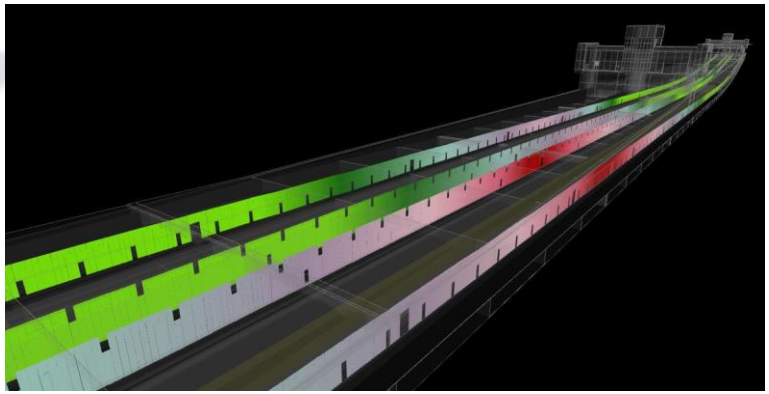


Pilot Projects

Pilot Project 1 : Key Challenges

- Specific challenges of PP1 relate to advanced visualisation of sensor data.
- How to actually visualize the sensor data to show condition obtained from 'real time' measurements? We determined specific elements (wall panels) for the purpose and developed an automated process to apply sensor values to colour the appearance of elements using user pre-defined colour scheme.
- How to visualize data on elements located between consecutive single point sensors? We developed a process to interpolate sensor data.
- How to view sensor data across time? We developed timeline functionality for that.





Pilot Projects

Pilot Project 1 : Key achievements

- With PP1, we demonstrate not only that one can visualize external sensor/monitoring data alongside a (tunnel) 3D model, but also that one can query multiple data via a ready-made API.

- We have taken a step forward in visualizing sensor/monitoring data on 3D model elements of the tunnel, including simple interpolation of data along "non-sensor" tunnel regions; and "timeline" functionality that allows sensor data to be viewed across time.

Pilot Projects

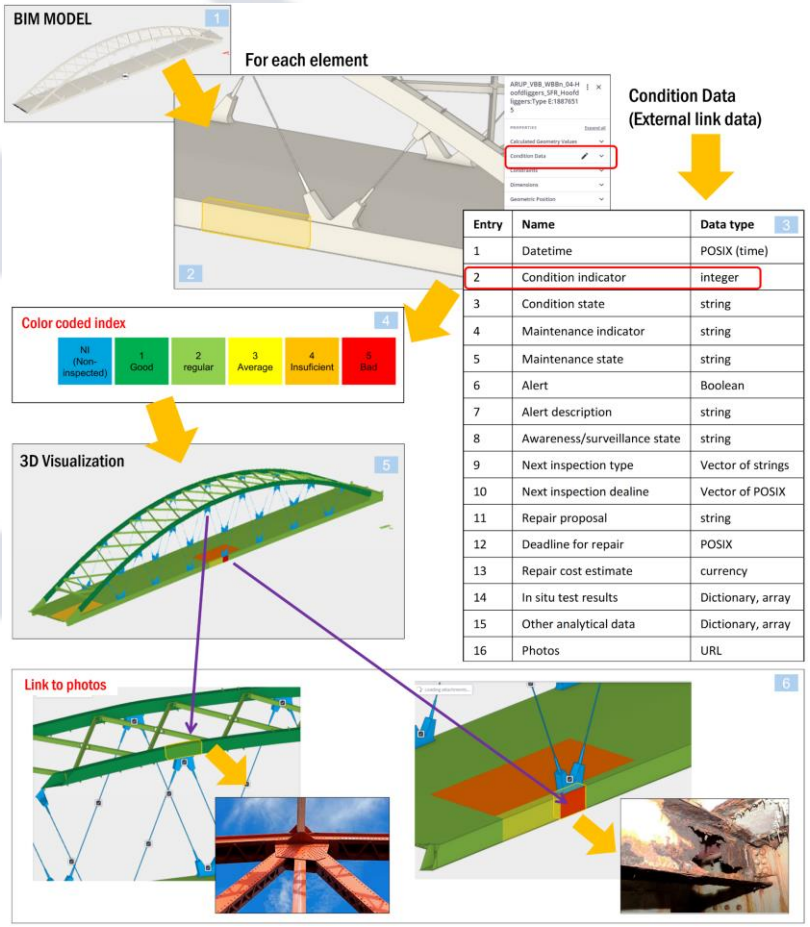
Pilot Project 1 : Demo in Bexel Manager

Pilot Projects

Pilot Project 2 : Bridge Asset

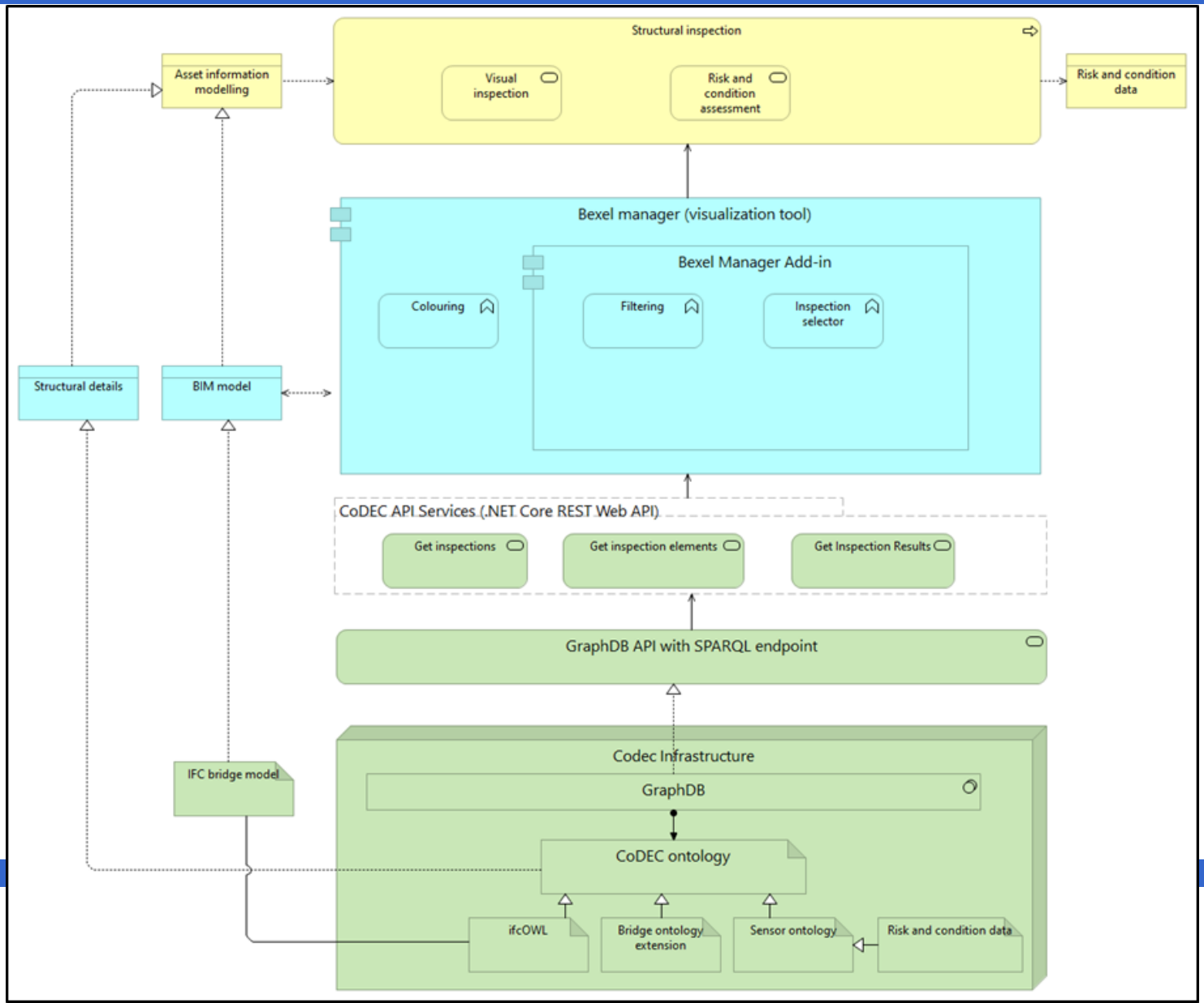
Objectives

- Enhance BIM model of a bridge with CoDEC OTL
- Link BIM model with risk and condition data
- Be able to query the data (CoDEC API)
- 3D visualisation of the entire BIM model, exploring risk and condition data



Entry	Name	Data type
1	Datetime	POSIX (time)
2	Condition indicator	integer
3	Condition state	string
4	Maintenance indicator	string
5	Maintenance state	string
6	Alert	Boolean
7	Alert description	string
8	Awareness/surveillance state	string
9	Next inspection type	Vector of strings
10	Next inspection dealine	Vector of POSIX
11	Repair proposal	string
12	Deadline for repair	POSIX
13	Repair cost estimate	currency
14	In situ test results	Dictionary, array
15	Other analytical data	Dictionary, array
16	Photos	URL

Pilot Projects



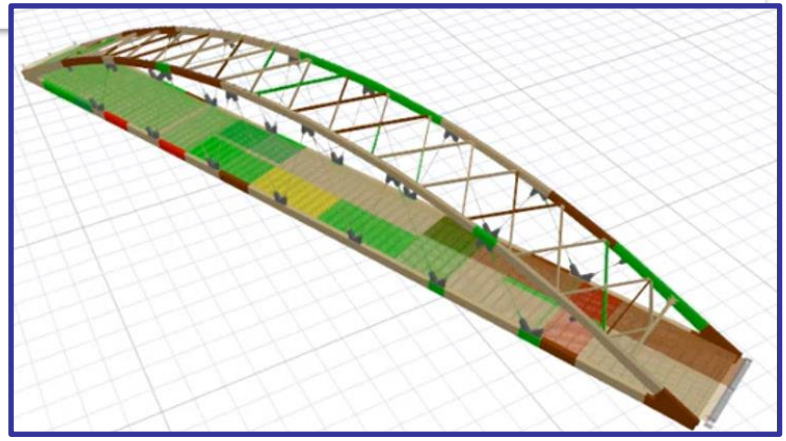
Pilot Project 2 : Process Highlights

Pilot Projects

Pilot Project 2 : Key Challenges

- How to connect risk and condition data (managed by external systems) with the BIM model? Using the CoDEC ontology and ifcOWL.
- How to model risk and condition data? Using Semantic Sensor Network (SSN).
- How to integrate linked data into a 3D BIM environment hiding the internal complexity of ontologies? CoDEC API with specific services to access and manipulate the ontology.

- How to visualize risk and condition data in a 3D environment? Bexel manager Add-in uses the CoDEC API to provide an integrated environment where users can browse and navigate through BIM elements and risk and condition data.



Pilot Projects

Pilot Project 2 : Key Achievements

- Visualize Risk and Condition data alongside a (bridge) 3D model
- API can be used to query multiple data
- Use ifcOWL to map BIM with other ontologies (including CoDEC ontology)
- Extension with other ontologies:
  - Semantic Sensor Network (SSN) Ontology (used for Risk and Condition data)
- Flexible and layered solution that can be extended to include new concepts (ontology), new analytical queries and reasoning (API) and new visualization capabilities (visualization tool with BIM data connected to linked data)

Pilot Projects

Pilot Project 2 : Demo in Bexel Manager

Pilot Projects

Pilot Project 3 : Road Asset

Current situation: BIM models can contain a lot of useful information about road assets. However, roads are primarily managed in GIS-based systems in the operational phase. Currently there are few practical links between the two "worlds" of BIM and GIS.

We want to: link useful data from BIM models to road asset records in GIS-based Asset Management Systems, using CoDEC tools and methodology.

Main benefits:

- Enhancing legacy data with new data
- Making data available in the platform where assets are primarily managed
- A key enabling step for full digital twins in Highways Asset Management

These objectives are completely aligned with those of our implementation partner (FTIA)

Pilot Projects

Pilot Project 3 : Process Highlights

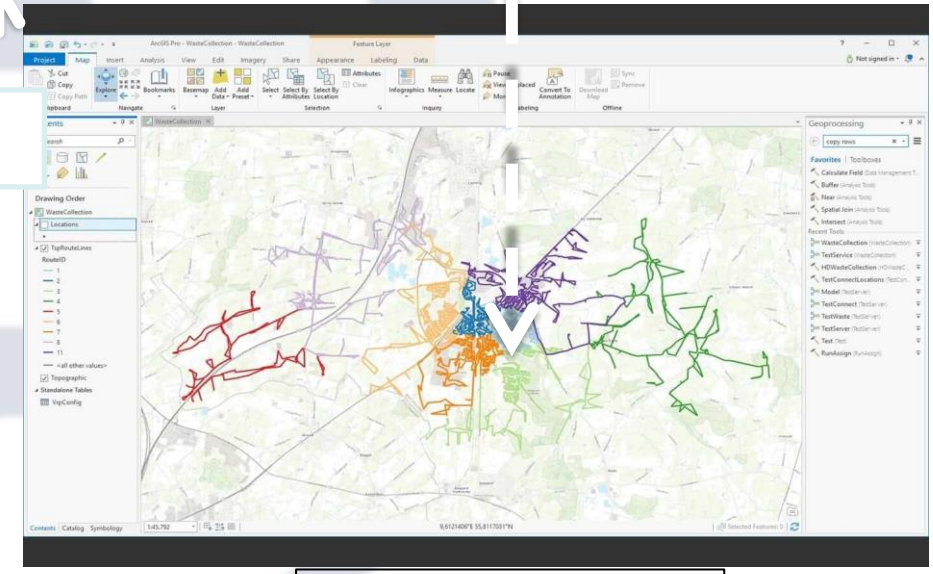
Road element section

Link with correct network section (and subsection)

CoDEC

Link attribute to section/subsection

Surface material info



BIM model created from LiDAR scans of TRL's SMLL site in London

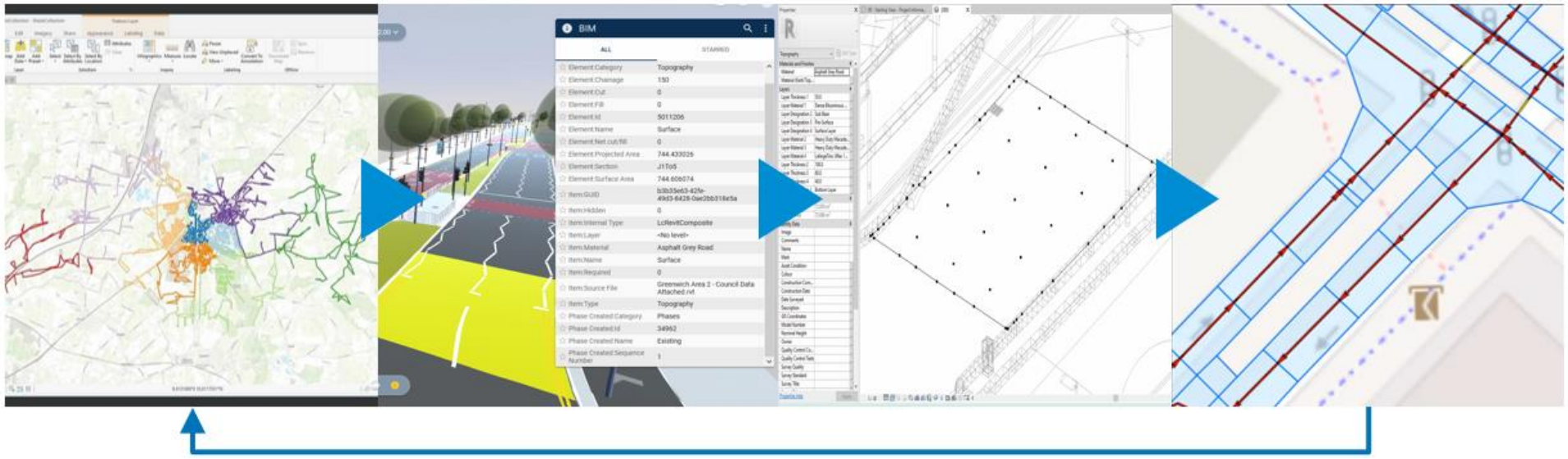
Linking BIM & GIS

AMS with network information provided by Greenwich Borough Council

Pilot Projects

Pilot Project 3 : Key Challenges

- How to accurately map location of object in BIM to equivalent in GIS?
- How to ensure we can extract 'useful' data from BIM models (gradient, crossfall etc. – 3D information)?
- How to integrate IFC Road (which is not finalised yet) into our methodology?



Pilot Projects

Pilot Project 3 : Key Achievements

- Successfully solved the specific technical challenges arising from linking from BIM to GIS
- Developed a method for accurately mapping location of objects in BIM to a linear alignment in GIS
- Developed methods for calculating geometric properties of BIM objects and making them available for linking
- Demonstrated the use of the CoDEC ontology for successfully linking data between BIM and GIS

Pilot Projects

Pilot Project 3 : Demonstration

Pilot Projects

Pilot Projects' Key recommendations

- Structure and organize heterogeneous data from multiple sources? Use CoDEC ontology aligned with reference ontologies (e.g., Semantic Sensor Network) and Road OTL ensuring alignment and being able to build on top of existing ontology instances.
- Integrate data in a BIM environment, in an accessible, scalable and independent way (allowing interoperability with any BIM environment)? CoDEC API to create an abstraction layer for access (reading and writing) to data described by the CoDEC ontology. Provides Technological independence / Reduced complexity / Easy scalability and extension of services / Easy scalability and extension of the ontology / easy testing and validation .

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6. Project Outcome and Recommendations (5 min)	Sukalpa Biswas (Project Co-Ordinator, TRL)
7. Feedback & Questions (20min)	All

Project Outcome and Recommendations

Challenges

Challenges:

- BIM models are not created to accommodate asset data automatically
- BIM standards are not developed with the knowledge and aspects of Asset Management
- There is no standard way to define data from new technologies to easily connect to Asset Management or to BIM
- IFC standards are not equipped to cater Asset Management data or the new sensor data.
- Software stakeholders are not that keen to share knowledge/collaborate

Project Outcome and Recommendations

Key Outcomes of CoDEC

CoDEC has provided

- Future-proof, practical and implementable outcomes to NRAs
- An universal structured framework for "legacy" and "Sensor" data
- Applications to integrate data from different systems used by NRAs
- Limitations of current systems and the need for developments for future exploitation of the CoDEC
- Guidelines for collaboration and increase common understanding of the data requirement across the stakeholders

DoRN C → Data Dictionary

DoRN D → Data Ontology and API

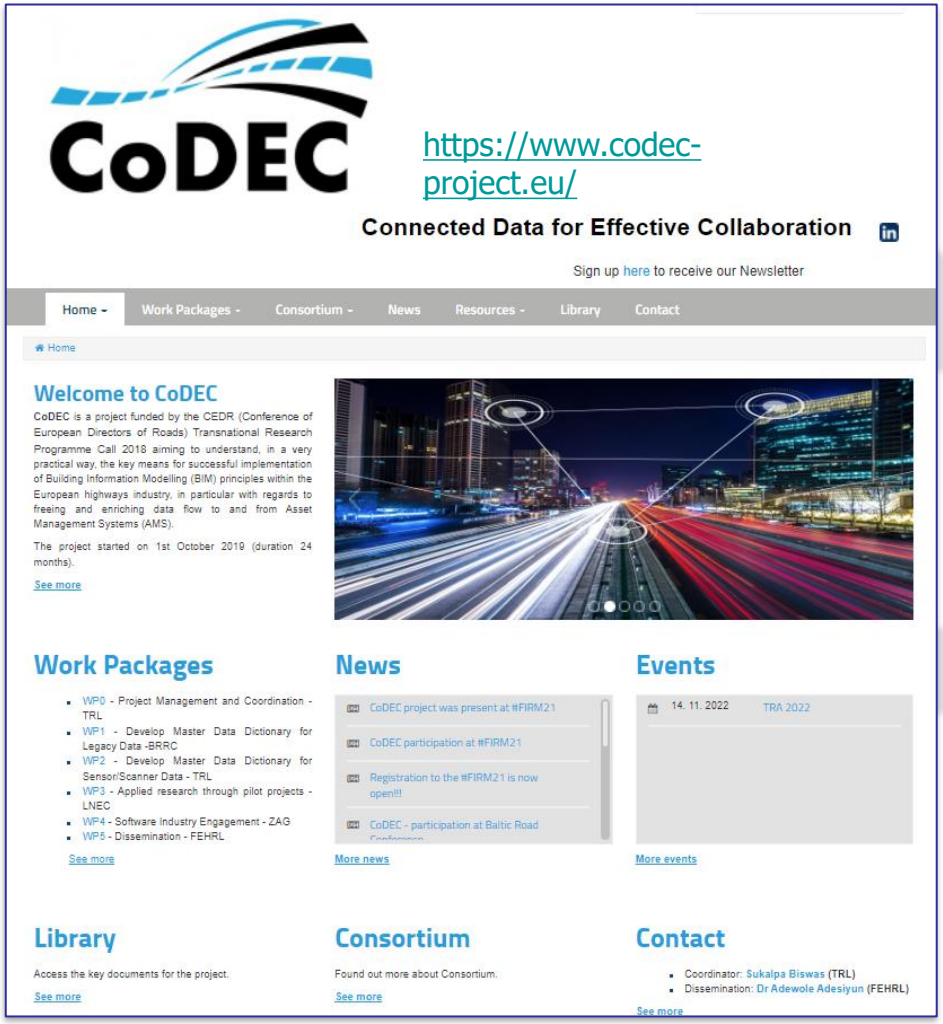
DoRN E → Pilot Projects

CoDEC Recommendations

CoDEC recommendations are:

- **Encourage collaboration** between asset owners, standardisation bodies (ISO and IFC) and the software technology industry to understand the practical needs of asset managers/owners.
- **Simplify level of detail within BIM models**: BIM model designers develop elements with the appropriate level of detail for visualisation
- **Normalisation and standardisation of conventions and nomenclature:** BIM solution manufacturers provide advanced filtering mechanisms for generating ifcOWL from BIM models.
- **Automation**: Whilst the current solution is adequate, it requires effort in data synchronization with distinct data sources that limits a fully automated method. Automating all steps in the process would increase the ability to exploit the results of the CoDEC project - allowing a real-time approach.

CoDEC Dissemination



CoDEC Presentation and Publications

- 30th International Baltic Road Conference, August 2021, Riga, Latvia.
- 18th World Meeting of the International Road Federation, Nov 2021, Dubai.
- German EU Council, the Federal Ministry of Transport and Digital Infrastructure (BMVI) conference for "Open Data for Smart Mobility in Europe, Jan 2022
- TRA 2022 Lisbon (Nov 2022)

- OCW mededelingen/Bulletin du CRR published by BRRC
- FEHRL Infrastructure Research Meeting – FIRM2021, 2022
- Institute of Asset Management, UK, Nov 2021
- PIARC Routes/Roads magazine special issue, 2022

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CEDR
Conférence Européenne des Directeurs des Routes
Conference of European Directors of Roads

Feedback and Questions

CoDEC

Connected Data for Effective Collaboration

THANK YOU!