Open BIM Standards for Infrastructure

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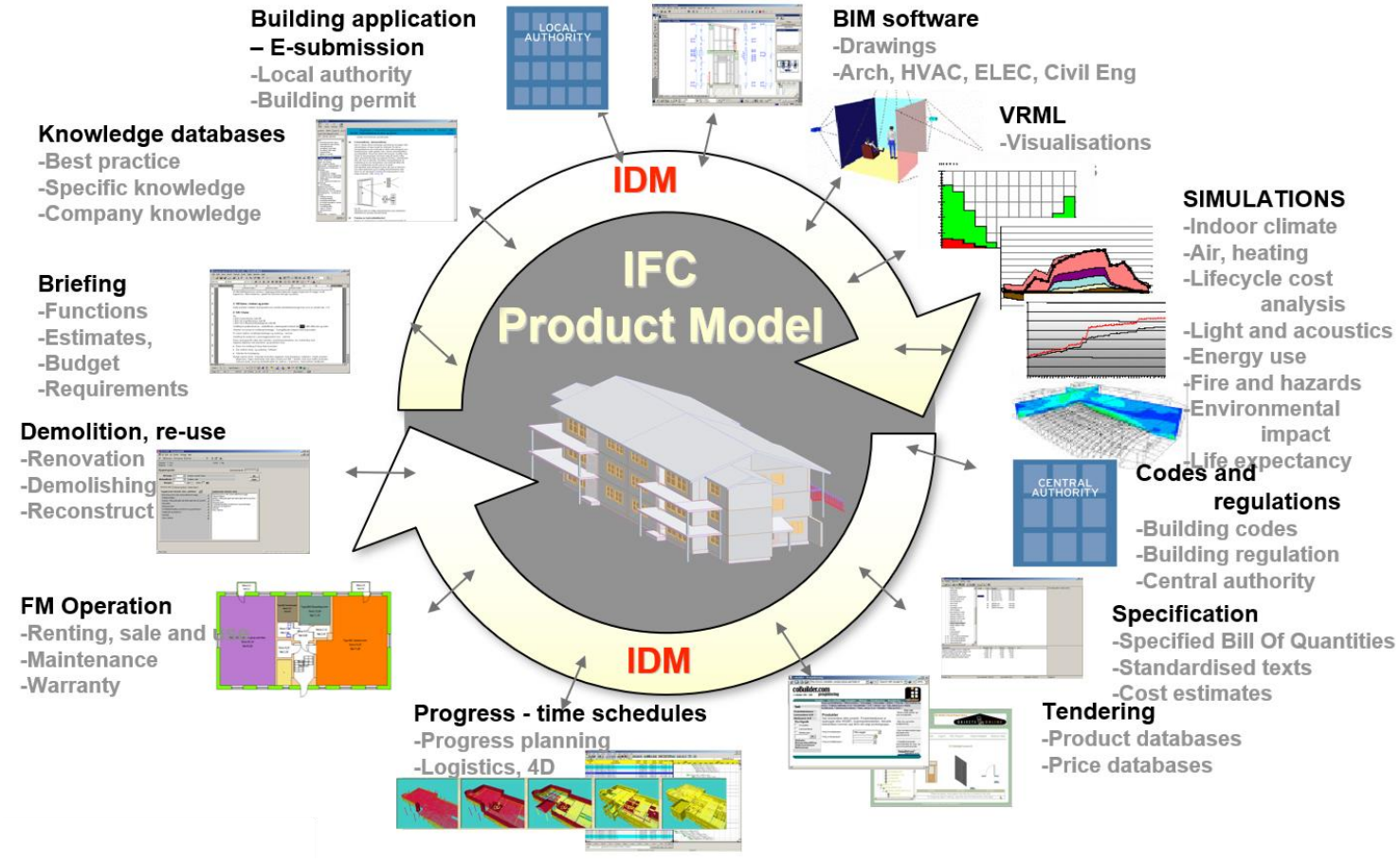
Presentation Outline

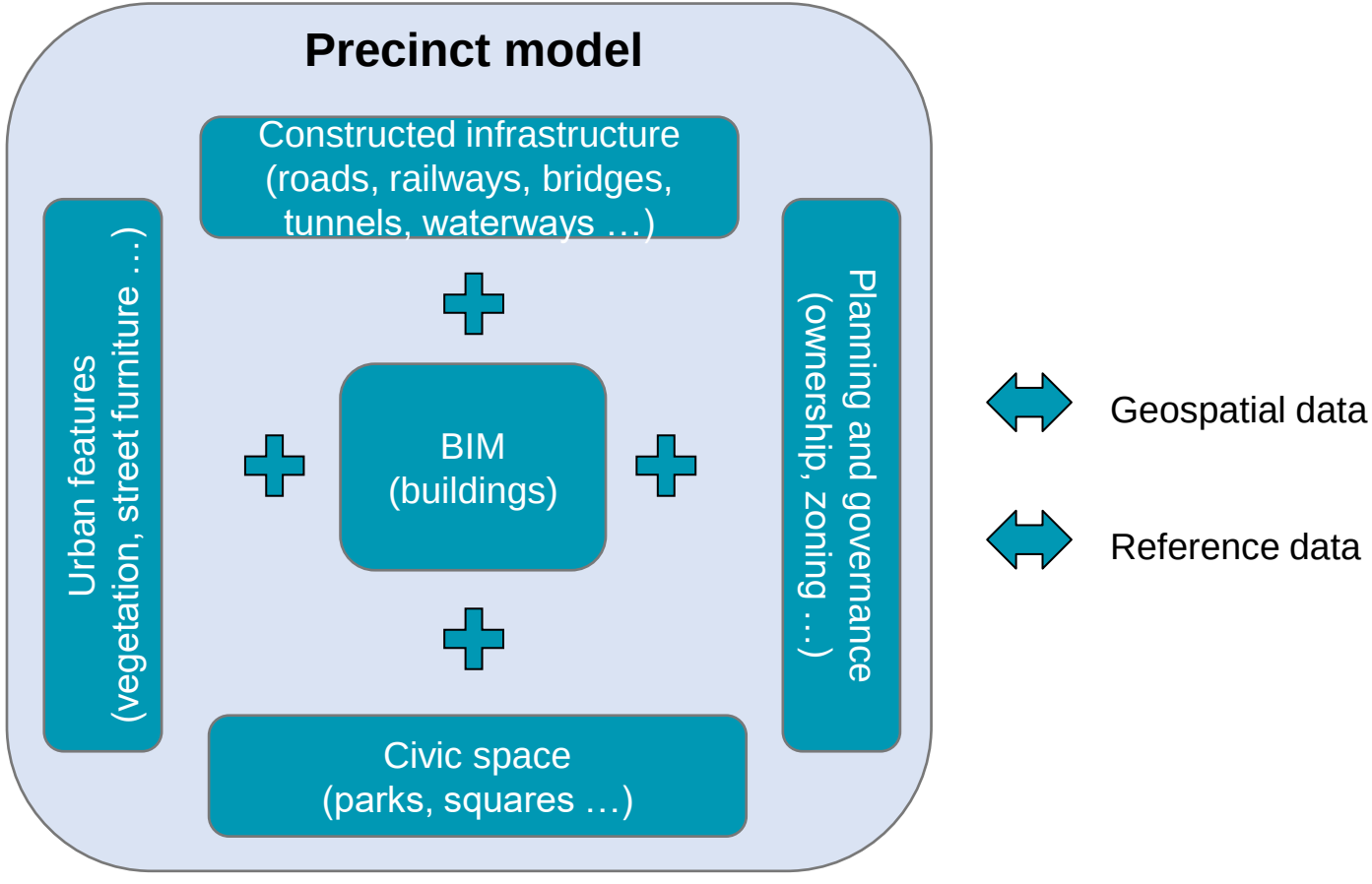
- InfraDomain Roadmap
- IFC 4.3 Update
- IFC Tunnel & Geotechnics
- Asset Operations Handover
- Open Geospatial Consortium Collaboration

Introduction – Building Information Modelling

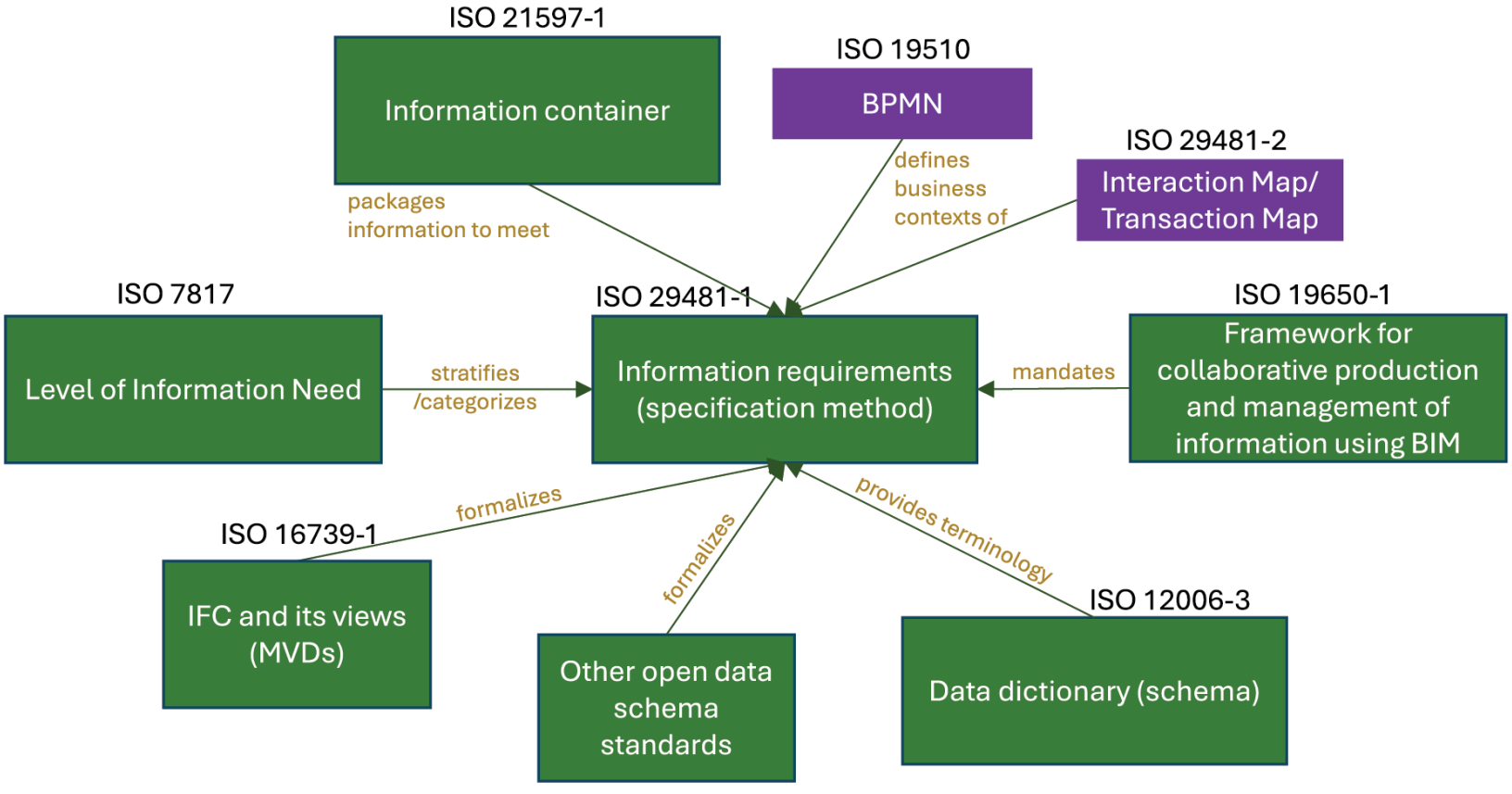


buildingSMART Australasia

Introduction – Building Information Modelling

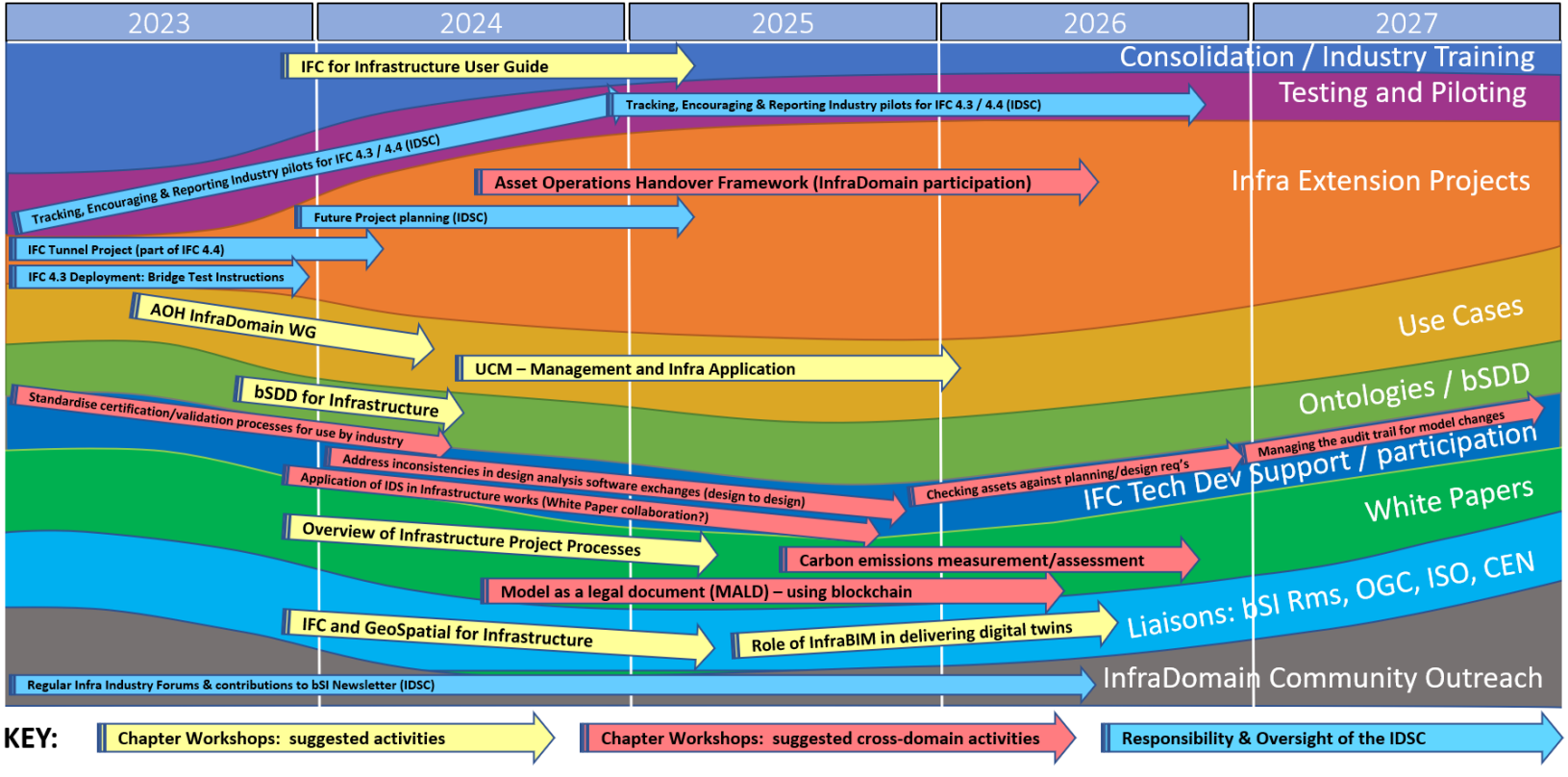


Introduction – Building Information Modelling



InfraDomain Roadmap

Infrastructure Domain Roadmap



IFC 4.3 Update

IFC 4.3 Beginnings

InfraBIM – Christophe Castaing

" The prospective IFC for infrastructure project – openINFRA – was discussed at the Singapore meetings in September 2011. The draft proposal – now being amended by Christophe Castaing, Egis International, from the French chapter, which is leading the project – will demonstrate that this is a practical project which meets real needs and will offer tangible rewards for the efforts that will be put into it. The openINFRA steering committee is setting up workshops in order to explore work already done around the world and identify how consistent process maps are.

" The revised proposal, drawing on work by the steering committee, will be discussed at the IUG and ITM meetings in March and be presented to the International Council in May 2012. 'We have to get the details of the proposal robust and workable,' says Christophe. 'At the same time, we are asking other chapters to determine the local level of support for the project.'

bSI Newsletter, 2011

Infra Room resolutions München October 2013 - Draft

INFRAROOM Organisation

- Chair:
  - Christophe Castaing
  - Vice chair: Henk Schaap
- Coordinator:
  - Henk Schaap
- InfraCom

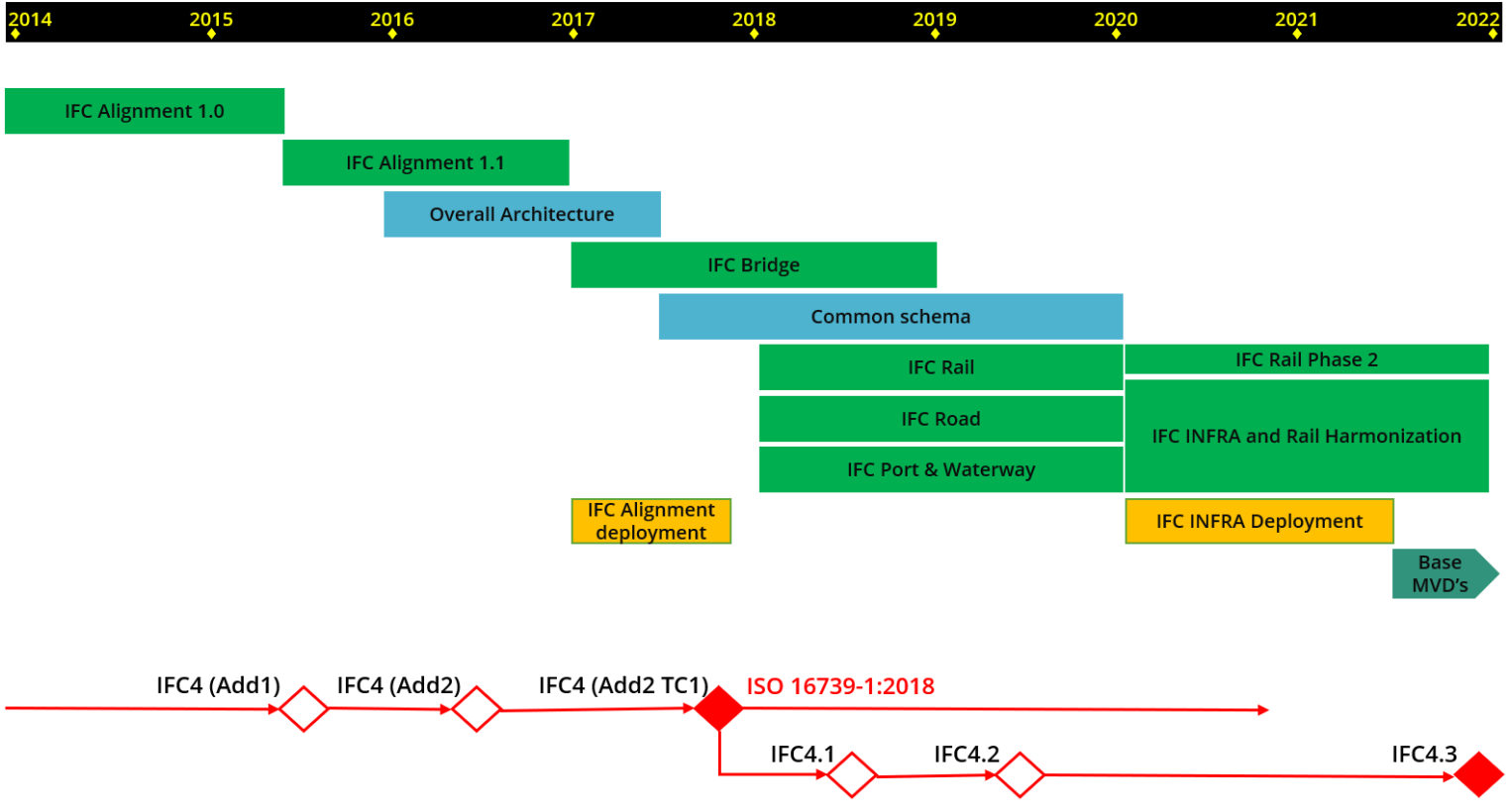
Pierre Benning	Henk Schaap
Christophe Castaing	Jim Plume
Hyunjoo Kim (secretary)	

- Steering Committee:

Pierre Benning	Vaino Tarandi
Stuart Chen	Hugh Woods
Wonsik Choi	Nobuyoshi YABUKI
Hyunjoo Kim	Jim Plume
Paul Scarponcini	Benno Koehorst
Mikael Malmkvist	Johnny Jensen
Andre Borrmann	

IFC 4.3 Development Timeline

The IFC 4.3 Standard – Timeline



IFC 4.3 Deployment Testing Example

2014 2015 2016 2017 2018 2019 2020 2021 2022

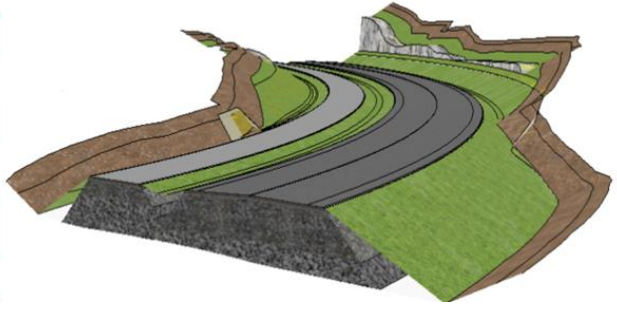
Domain Expert	Storyline Titles	Data available
FTIA, TRV, Banedanmark, Bane NOR	SLLC_DD & SLLC_MO *"Level crossing – detailed design"* *"Level crossing – Maintenance & operation"*	LandXML, Ifc
BuildingSMART FI, Infra std group MINnD	IR_SLRD-PD *"Road drainage – Preliminary design"* IR_SLBH_XX *"Road drainage – Design to design"*	LandXML
ISO/TC 127/SC03/WG05 - Worksite data exchange	IR_SLRH-C *"Road handover – Final design to construction"*	Imports from other SL

Validation

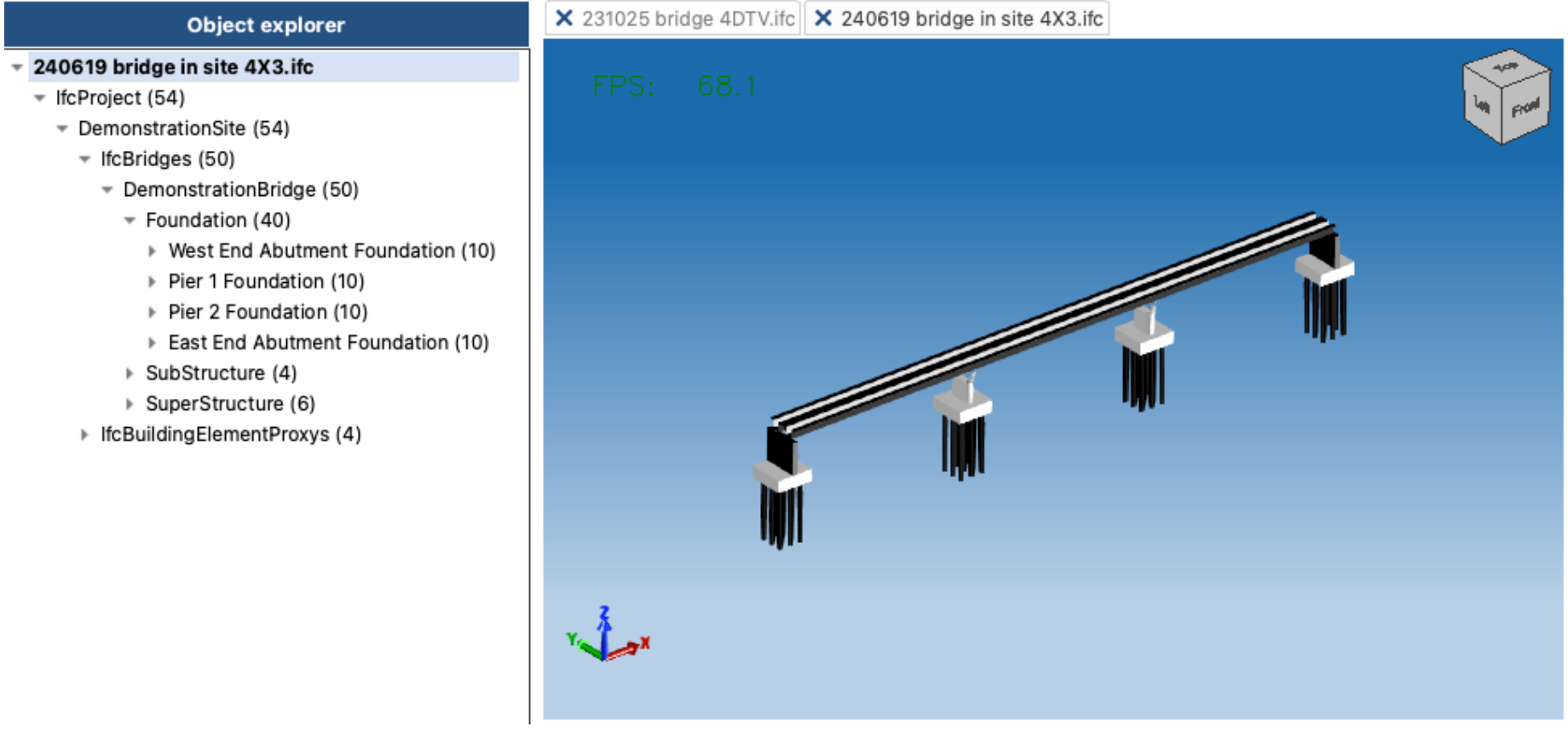
Use cases
3DV - Visualization
QTO – Quantity take-off
HAM - Handover to asset management
INSM - Initial state modelling
CCD – Coordination & Collision detection
DTDR – Design to design (reference model)
MCON – Machine control & Guidance

Unit tests derived
Alignments
Georeferencing
Spatial structure, Road & Railway facilities
Drainage systems
Furniture (Signage, Signals, Boom barrier, Signal assembly)
Cross disciplinary (Road/Railway)

Verification



Simple Bridge Model - Open IFC Viewer 25.5



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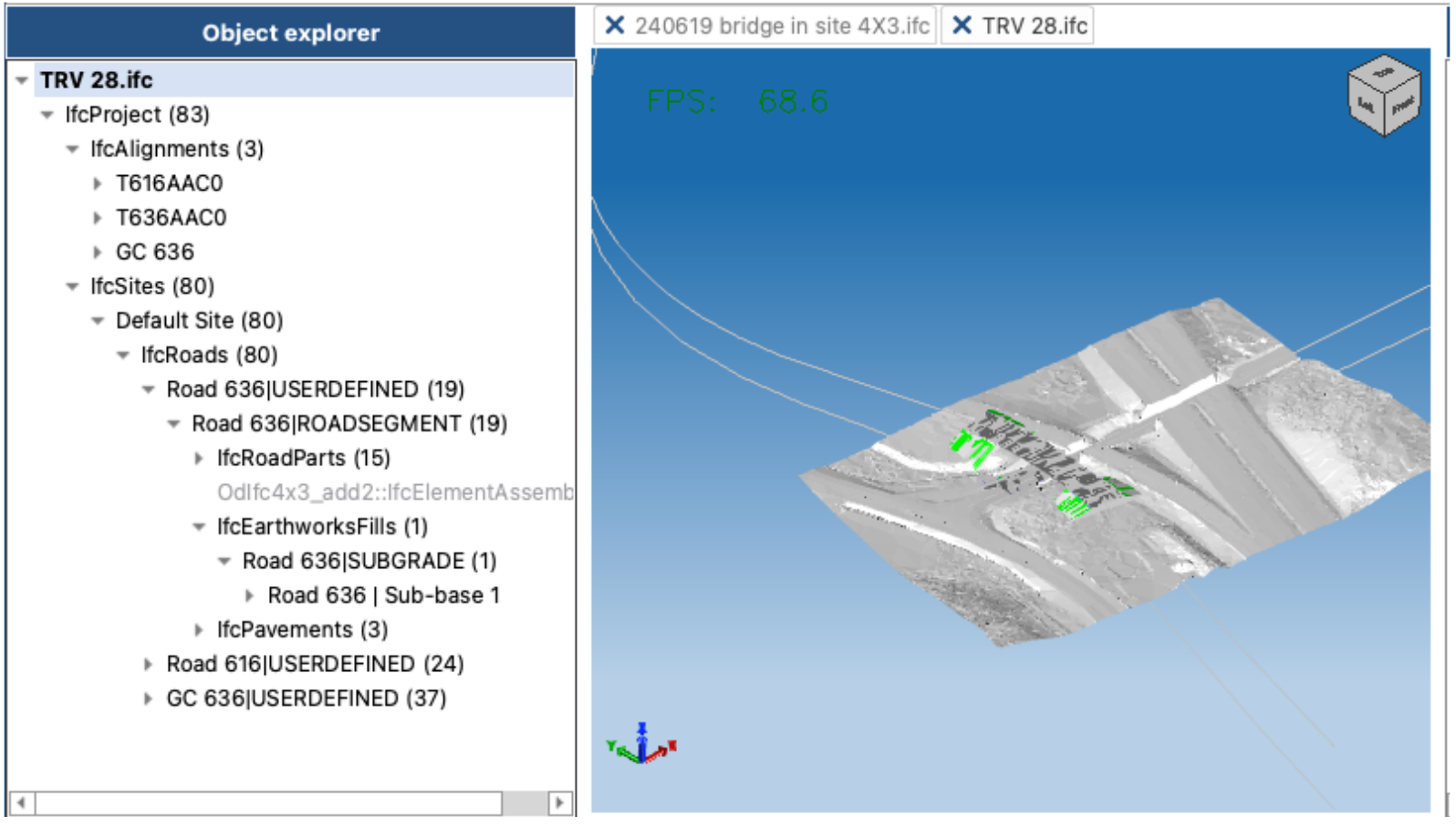
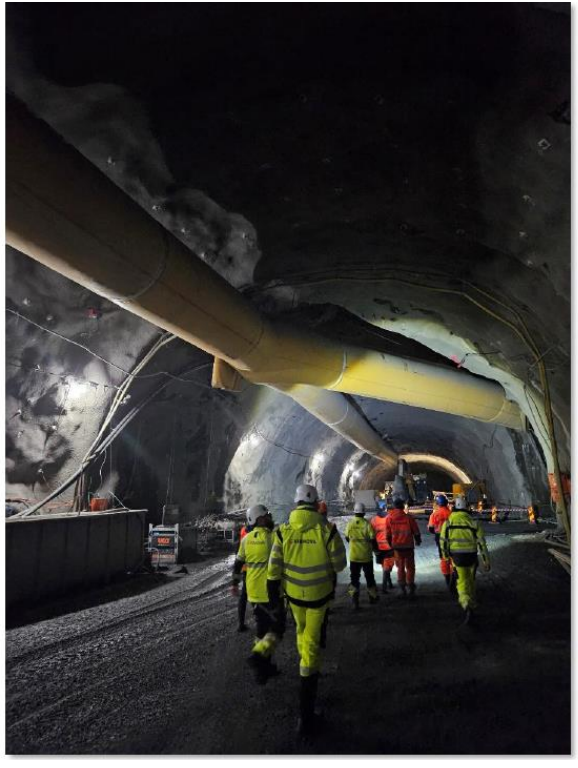
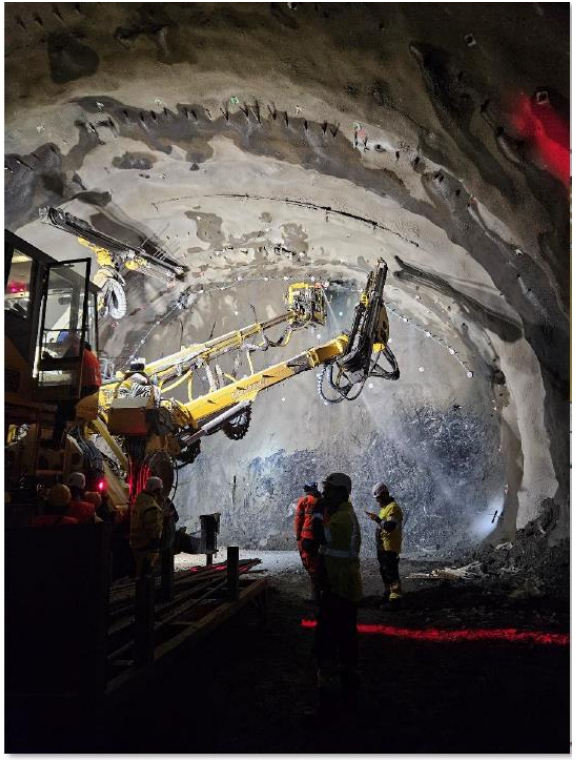


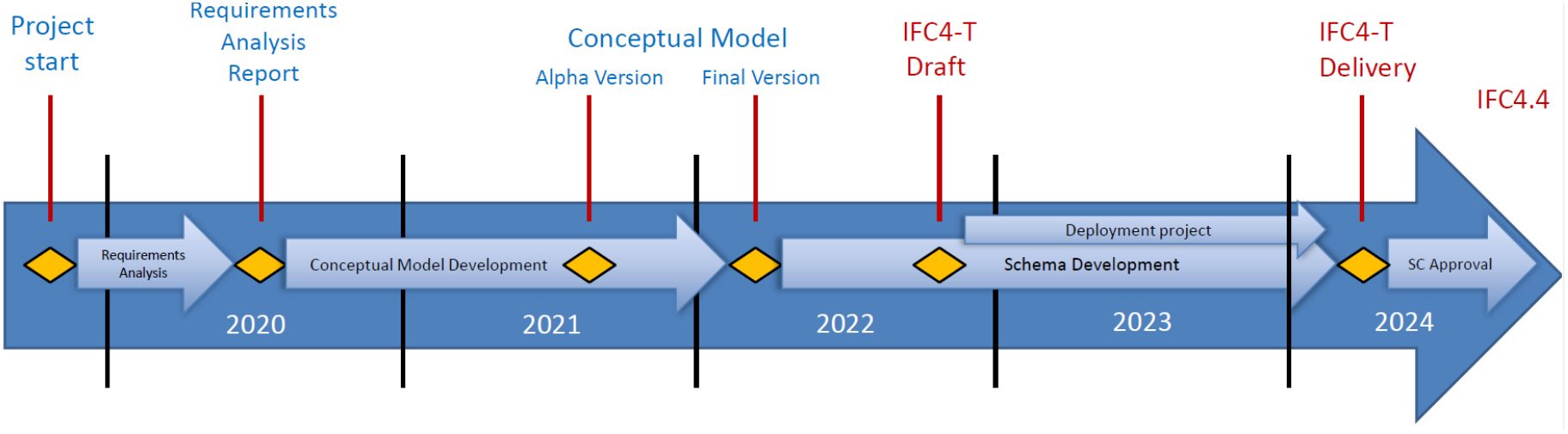
IFC Tunnel Extension Project

IFC Tunnel Extensions





IFC Tunnel – Schema Development & Testing



IFC Tunnel – Geotechnics

Geotechnics not sufficiently covered in IFC nor OGC

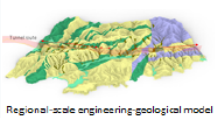
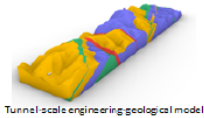
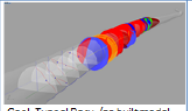
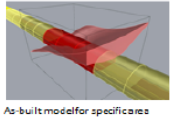
Challenge: **uncertainty** generating **risks**

Clear separation of

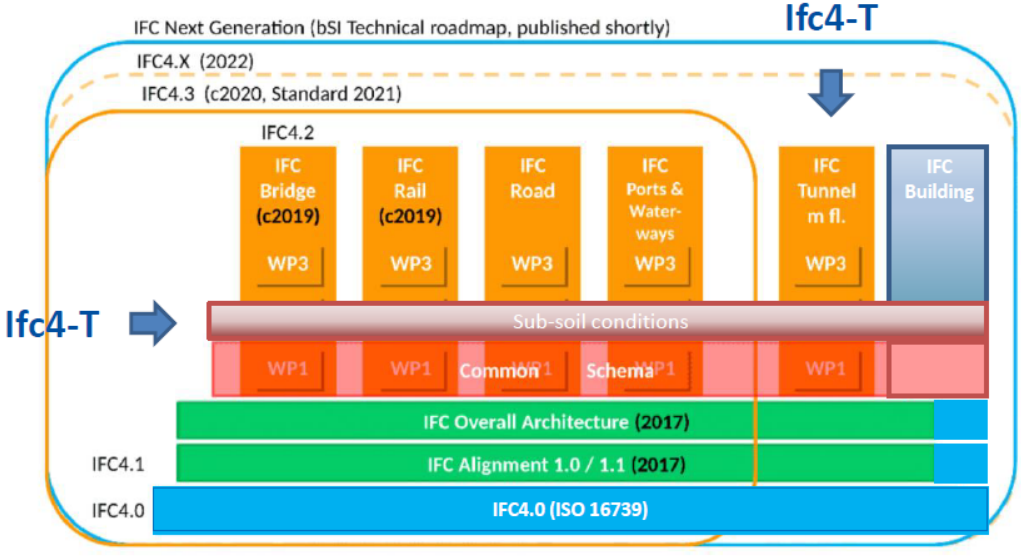
- factual data
- interpreted models
- Implications (design)

Consideration & linking w. existing standards

- OGC GeoSciML, DIGGS, AGS

Lifecycle stage	Plan & Investigation	Investigation & Design	Construction	Maintenance
Primary objective of modeling	Tunnel routes / alignment studies (UC 2a)	Tunnel Design (UC 2b, 12b)	Construction management (UC 15b, 2c, 12b)	Measures to deformation and damage (2C)
Model example	 Regional-scale engineering-geological model	 Tunnel-scale engineering geological model	 Geol. Tunnel Docu. / as-built model	 As-built model for specific area
Modeling area	Relatively wide area including potential tunnel routes	Around the tunnel corridor	Around the tunnel excavation	Selection of previous models around zones of interest
Approx. resolution required to the model	>10m mesh	<10m mesh	Down to 0.1m mesh	Down to 0.1m mesh
Input data for modeling Book A: Factual Data	• Previously existing data and first project-specific site investigation results	• Pre-existing data • Mainly project-specific site investigation results (including field mapping)	• Pre-existing data • Site investigation results • Geol. tunnel (and other) documentation, additional investigation	• Pre-existing data • Site investigation results • Data obtained during construction • maintenance data
Model content Book B: Interpreted models	• Regional topography, geology, hydro-geology, etc. • Engineering-geological aspects to be considered for tunnel route selection (potential hazards)	• Geological conditions and geotechnical design parameters (like rock mass strength, permeability, discontinuity pattern etc.) • Engineering-geological aspects to be considered for tunnel design and construction (potential hazards)	• Encountered geological and geotechnical conditions • Potential hazards during construction	• Relationship among damage area, geotechnical condition and tunnel
Implications Book C: Design solutions and applications based on the interpreted models	• Decisions on alignment, land acquisition, etc.	• Ground behaviour, construction method, support measures, ground improvement, system behaviour, excavation classes etc.	• Observation and interpretation of displacements • Adjusted prediction of expected geotechnical conditions • Safety management • Comparison to predicted conditions	• Safety monitoring, routine maintenance works, counter measures for damages etc.
Remarks	• The model (B) should be accompanied by the base data (A) to enable an update with new data and to evaluate the model's uncertainty • The implications (C) depend on the model and should be linked to it • Consequently, ABC should be linked as one package and be delivered next phase.			

IFC Tunnel – Standard Development



ISO International Organization for Standardization

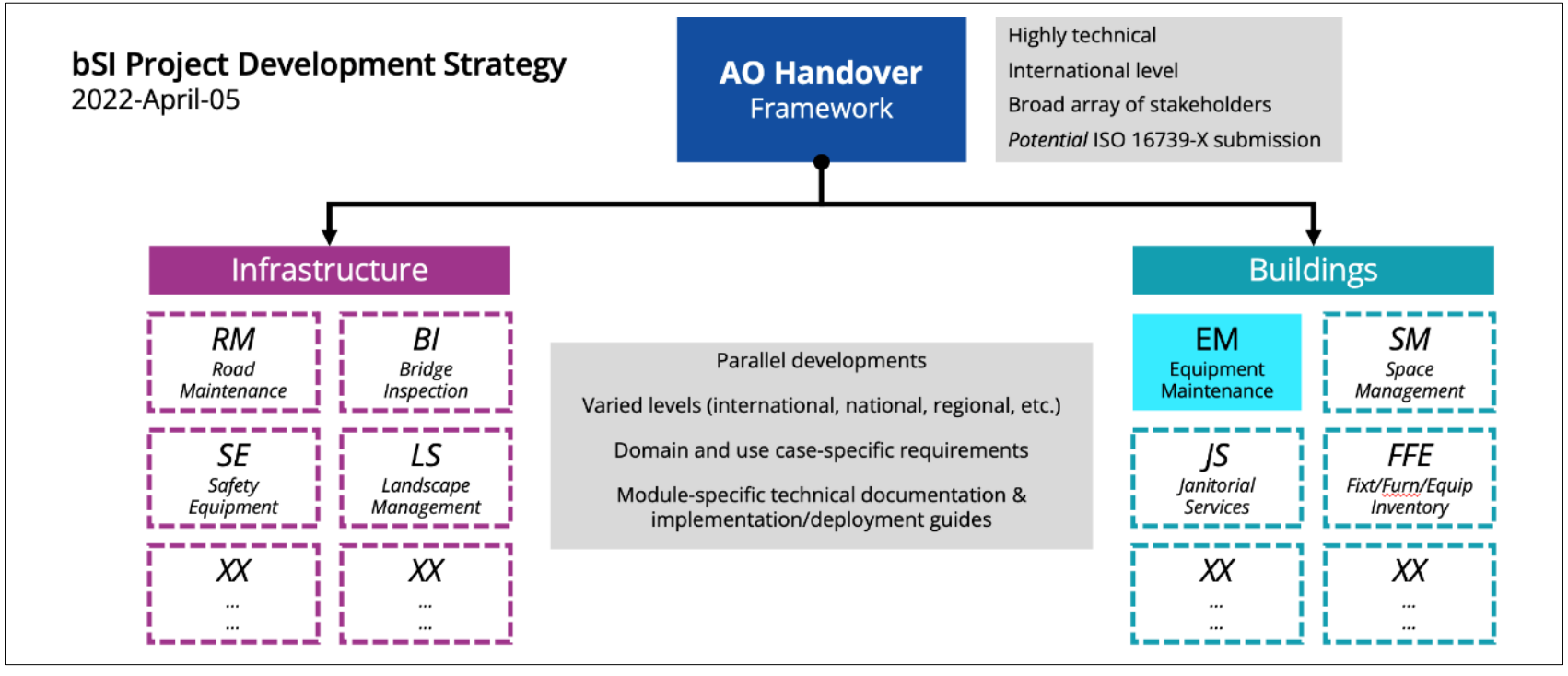
cen

One (1) unified schema
Extensions Ifc4.4 = geotechnics + excavation/structures + systems for operation

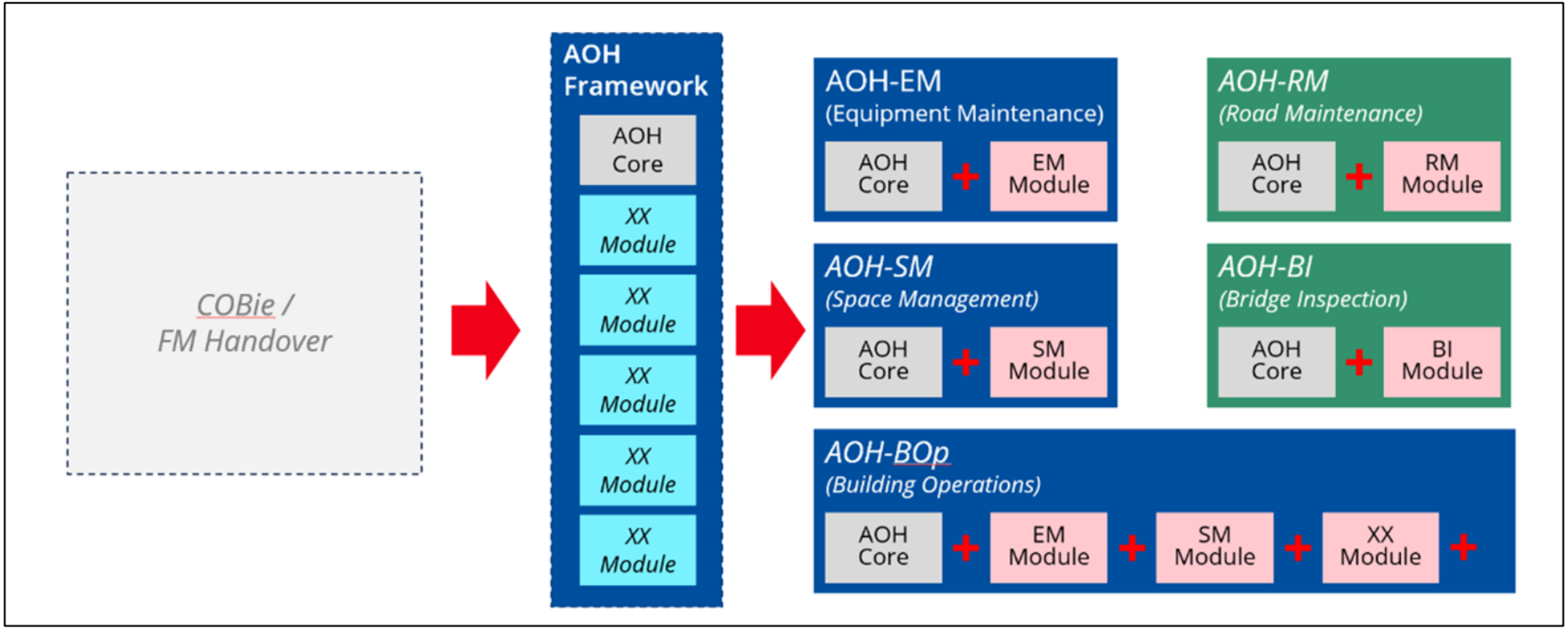
ISO 16739 IFC incl. 4.3
ISO 19650 BIM Management

Asset Operations Handover Framework Proposal

AOH Framework - Strategy

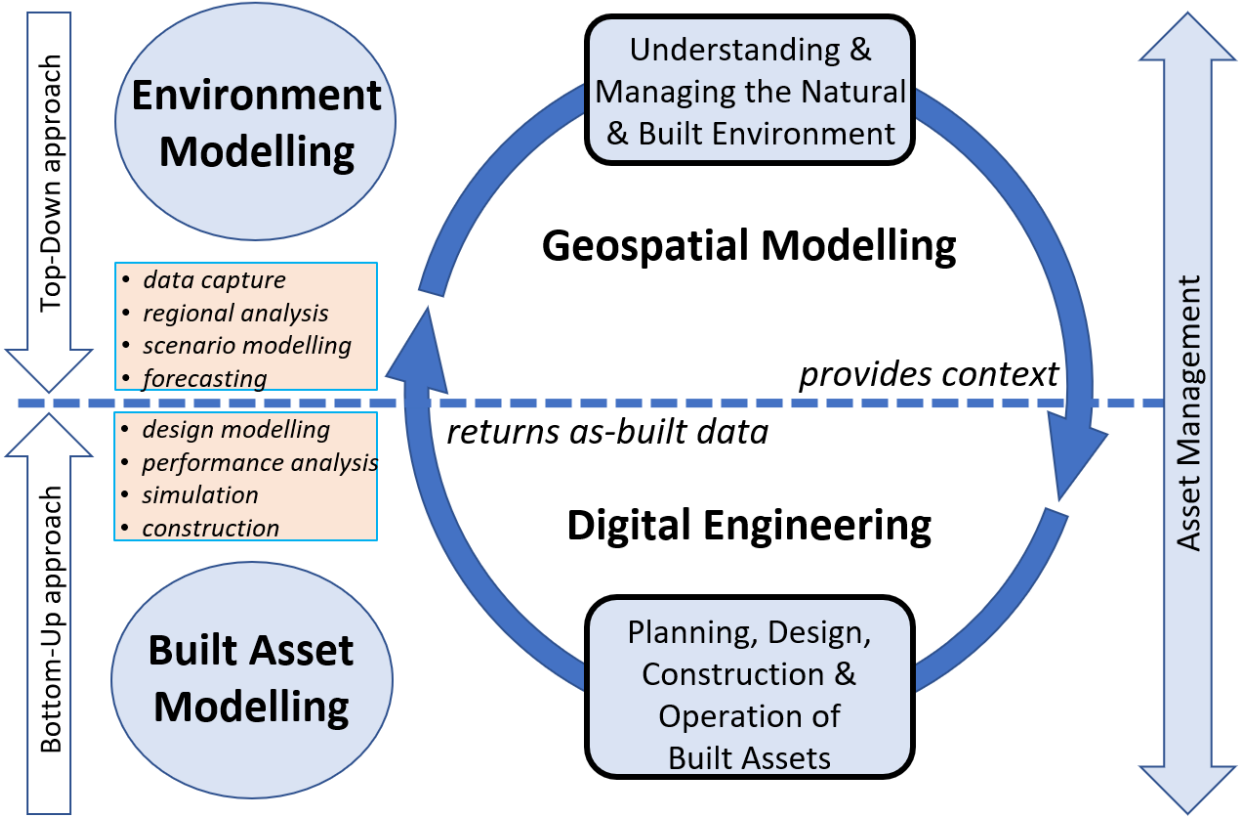


AOH Framework - Strategy



Geospatial Standards

The Integrated Digital Built Environment

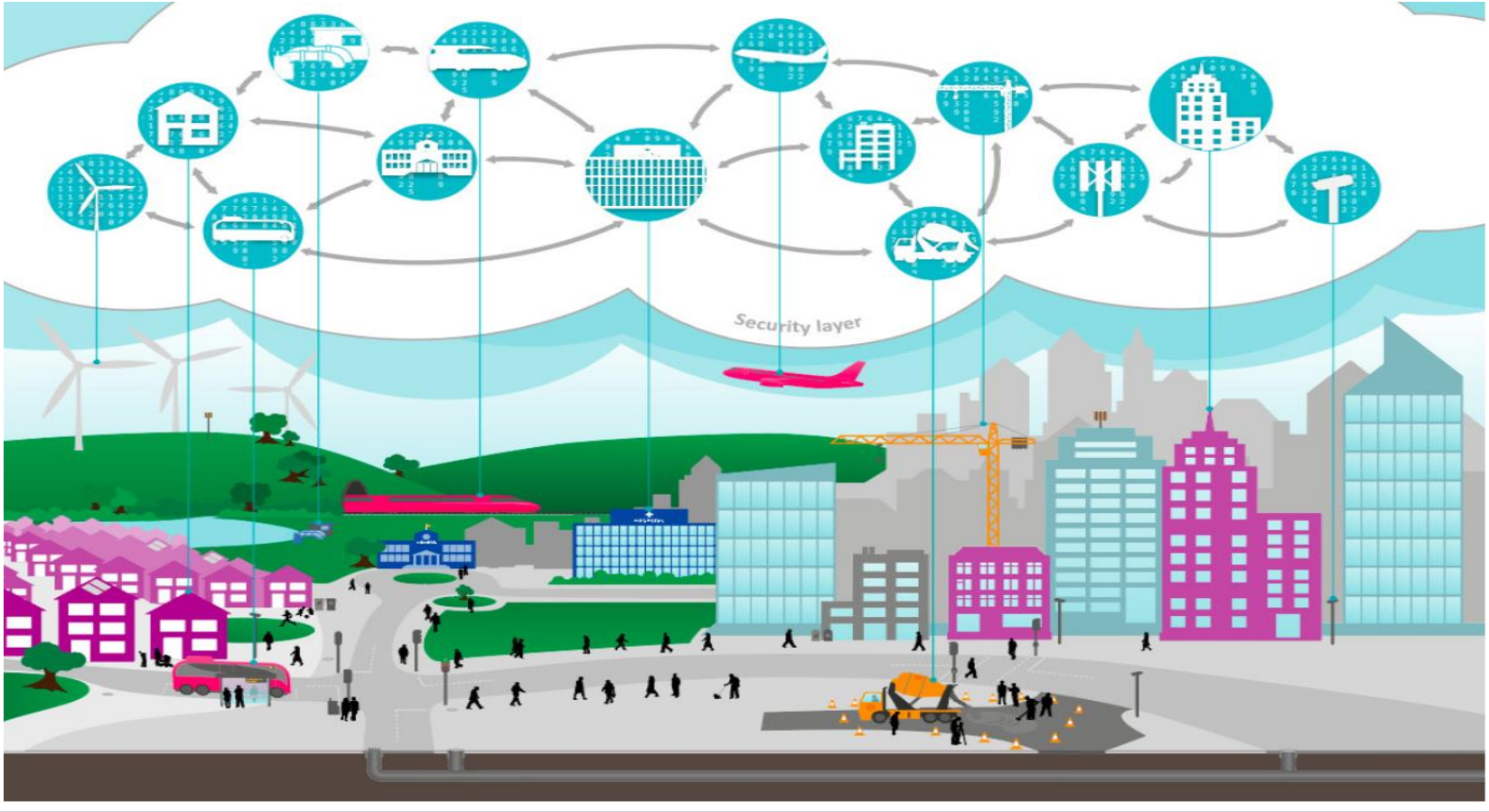


The Open Geospatial Consortium (OGC)

OGC standards are developed by members to make location information and services FAIR – Findable, Accessible, Interoperable and Reusable. They are used by software developers to build open interfaces and encodings into their products and services:

- **CityGML** - open data model and XML-based format for the storage and exchange of virtual 3D city models
  https://www.ogc.org/standards/citygml
- **LandInfra / InfraGML** - scope of the Land and Infrastructure Conceptual Model is land and civil engineering infrastructure facilities
  https://www.ogc.org/standards/infragml
- **GeoSciML** - Geoscience Markup Language is a model of geological features commonly described and portrayed in geological maps, cross sections, geological reports and databases
  https://www.ogc.org/standards/geosciml
- **GroundWaterML 2 (GWML2)** - a conceptual and logical model for the exchange of groundwater data
  https://www.ogc.org/standards/gwml2
- **OGC API family of standards** - are being developed to make it easy for anyone to provide geospatial data to the web … these are being constructed as "building blocks" that can be used to assemble novel APIs for web access to geospatial content
  https://ogcapi.ogc.org/ https://www.ogc.org/docs/is

Introduction – Internet of Things



Thanks!!

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