

Business Plan
CEN/TC 442 Building Information Modelling (BIM)
2020 update

SCOPE CEN/TC 442
Building Information Modelling

Standardization in the field of structured semantic life-cycle information for the built environment. The committee will develop a structured set of standards, specifications and reports which specify methodologies to define, describe, exchange, monitor, record and securely handle asset data, semantics and processes with links to geospatial and other external data.

EXECUTIVE SUMMARY

Business Environment

The construction industry is one of the largest European industries (9% of the GDP of the EU and 18 million jobs and 3.1 million enterprises). It uses about 50% of the raw materials taken from the earth and generates about 40% of all greenhouse gas emissions in Europe.

The industry is seen as being relatively inefficient in both process and service delivery. Current practices lead to duplication of activities as well as increases in costs and timescales for the delivery of construction projects and operation of assets.

In order to face the challenges cited above, the clients of the construction sector need an improvement of the quality and the access to operating information a handover of assets and as such management of the asset.

The introduction of Building Information Modelling (BIM) is seen as being as a part of the solution to the management of the information during the design, construction and operational phases of the asset lifecycle. The development of BIM is advancing rapidly and requires the application of common standards to ensure future compatibility of information exchange and use.

Benefits

The introduction of common standards and operating methods using BIM will:

- Harmonize a European wide common strategic approach for the introduction of BIM in a highly fragmented construction sector while actively including small and medium sized enterprises.
- Enable the wide-spread and secure adoption of digitalized processes on mainstream construction projects with a skilled workforce equipped with the digital competences and capacity to operate across the value chain and across projects of differing size, complexity and type.
- Help and facilitate the adaptation to a sustainable built environment – one that supports the challenges of climate change and the need for a circular economy by improving resource efficiency of construction products and materials
- Greater productivity of the sector – delivering more facilities for the same or less expenditure
- Improve output quality of public assets and improve the value for money of public sector investment and service delivery in operation.
- Support improvements in team working and collaboration; leading to a stronger and digitally-skilled sector attracting talent and investment

Priorities

- Ensure that the pace of transformation allows the sector and all members of the value chain to adapt to the changes and to grow capacity without radical interventions to the market
- Facilitate the adoption of a security-minded approach that supports use of digital technologies and greater collaboration while continuing to protect and manage sensitive information
- Understand existing activities and standards in use within the European market
- Adopt suitable standards and technical specifications from ISO and then extend to cover new areas including infrastructure as well as records management
- Develop new standards to support process management and associated guidance, such as standards that enable the use of European sustainability standards in BIM.
- Develop relationships with key stakeholders including the European Commission

More information regarding BIM definitions is found in Annex A1.

1 BUSINESS ENVIRONMENT OF THE CEN/TC

1.1 Market needs

The European construction sector is at the centre of a tough but also promising set of economic, environmental and societal challenges. The sector represents 9% of EU GDP and employs 18 million people. It is a driver for economic growth and home to 3 million enterprises, most of which are SMEs.

SMEs constitute over 99% of enterprises in Europe. 92% of enterprises have less than 10 employees and limited resources. Through addressing their needs, the use of standards may be significantly increased. Furthermore, if standards take more account of the SME perspective, considerable benefits would accrue to all stakeholders in standardization

Climate change, resource efficiency, greater demands on social care, urbanisation and immigration, an ageing infrastructure, the need to stimulate economic growth, as well as constrained budgets: these are challenges faced by governments, public infrastructure owners and society as a whole. An innovative, competitive and growing construction sector is a crucial component for tackling these challenges.

Digitalization is the adoption or increase in the use of digital or computer technology by an entity such as an organisation, industry sector or country. The introduction of Building Information Modelling (BIM) represents the construction sector's moment of digitalization, It is undisputed that the wider use of technology, digital processes, automation and higher-skilled workers contribute greatly to our economic, social and environmental future. Current practices and studies show how traditional processes repeatedly experience dramatic information loss, especially in the steps between design, construction and operational stages. Processes that are merely digitized are often supported by additional manual processes to build and rebuild information. Therefore:

- Construction cost is increased by splitting up of processes and lack of communication;
- Without a common language, there are often significant communication errors and loss of information;
- The same information is re-entered several times in different systems before the building is handed over to owner organization;
- Same information is also re-created several times by different software packages and even then, it rarely reaches the end user of the asset or operator!

Building Information Modelling (BIM) is a way of structuring information about infrastructure and building information. BIM refers to the use of a shared digital representation of a built object to facilitate the construction process (including buildings, bridges, roads, process plants etc.) to facilitate design, construction and operation processes to form a reliable basis for decisions. (EN ISO 29481-1 2017 - Building Information Models - Information Delivery Manual- Part 1: Methodology and Format). The

resulting Building Information Model (BIM) can be visualized as a virtual representation of the real asset and can report object properties and relations. BIM gives a better understanding of complex building information and support many digital tools for effective information handling. BIM improves handling of information and is a condition for instance to tackle Lean Design and Construction, digital access to maintenance of project as well as product information during Facility Management or Operation. One-off pilot projects or successful infrastructure projects that adopt digitalized working practices are beneficial as exemplars, however, the possible benefits outlined above will only be achieved through the wide-spread adoption of digitalization on all construction projects. Therefore, adoption needs to be at scale; with a skilled workforce equipped with the digital competences and capacity to operate across the value chain and across projects of differing size, complexity and type. This capacity building is only possible through a consistent way of working that removes or reduces the transaction cost of re-learning from one project to the next.

With a digitalized BIM-based construction process, loss of information between processes and/or stages can be eliminated or at least strongly reduced. This requires the development and implementation of an open and interoperable BIM supported by standards used across the European construction industry.

Digitalization of the construction sector also requires the ability to exchange information about products that are incorporated into buildings and infrastructure assets, including the materials from which they are constructed as well as the more complex products and systems which are incorporated into buildings and assets to make them safe, comfortable, and fit for purpose.

In Europe, construction products declare the performance according to harmonized specification mandated by the Commission, according to the Construction Products Regulation. Manufacturers, when covered by a harmonized standards, must declare the performance according to the rules included in the standard. TC 442 will use the performance indicators included in these standards to promote the single market and to ensure a common declaration of the information of construction products.

1.2 Quantitative Indicators of the Business Environment

Measuring the results and effects of change in the construction sector is not a trivial task. There is no 'off the shelf' methodology to undertake benefit measurement and evaluation. Some organizations perceive BIM as a net cost, given that the costs of implementing BIM can be easily quantified, while the less tangible and more complex benefits of BIM are more difficult to quantify¹.

As a consequence of the increasing use of, and dependence on, information and communications technologies there is a need to address the inherent vulnerability issues, and therefore the security implications that arise.

The following studies try to overcome the lack of information. They indicate substantial positive effects of BIM. They do not deal with the effects of BIM standardization on regional or international level. It is implicit that standardization improving the uptake of BIM simultaneously causes the mentioned positive effects in an increasing number of projects.

- CEDR - Conference of European Directors of Roads - published in April 2017 a Technical Report; "Utilizing BIM for National Road Authorities (NRAs)". This report describes that there is a very high Return of Investment (ROI) for investing in BIM. Based on the amount of portfolio 2014, the estimated combined structural cost savings for design and construction via BIM for The Netherlands, Sweden, Finland and Norway is on average about €378 million per year as of

¹ PWC (2017): BIM Level 2 Benefits Measurement. Introductory note: Approach and benefits framework.- (unpublished draft)

2020 onwards (ca. 8.2%) [1]. This percentage can grow even further, for example the estimation of the UK government is 30% in 2025 [2].

- A US study discloses that lack of access to information in Facility Management and Operation of buildings cost in general \$0.23 per Sq. ft. each year. A 20000 m² building generates an extra cost over 30 years of almost €2 million. Easy access to correct and update project and to product information with BIM will have a major positive effect on company and society level [3].
- A British BIM report discloses that BIM increases competitiveness and the ability to export service in the Building Industry. As an example, the report shows that "There has been an 24.6% improvement in productivity on UK Government projects using BIM". [4]
- The European construction sector output of €1.3trillion is approximately 9% of the region's GDP and it employs over 18 million people. Reports estimate the financial opportunity for digitalizing engineering, construction and operations processes to be in the range of 10%–20% of capital project expenditure across vertical construction (buildings) and infrastructure projects. Even using the lower threshold, a 10% productivity improvement of the European construction sector would generate savings of €130 billion [5]
- According to a recent study, full-scale digital transformation of non-residential construction would, within 10 years, be capable of producing annual global cost savings of \$0.7-1.2 trillion (13-21%) on Engineering and Construction and \$0.3-0.5 trillion (10-17%) in the Operation phase [6].

[1] CEDR - Conference of European Directors of Roads- Technical Report 2017-05 Utilizing BIM for NRAs, 2017

[2] HM Government, Industrial Strategy – Construction 2025, 2013

[3] Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry - NIST GCR 04-867, 2004

[4] NBS International BIM Report 2013.

[5] EU BIM Task Group, Handbook for the introduction of Building Information Modelling by the European Public Sector, 2017

[6] World Economic Forum, Shaping the Future of Construction – A Breakthrough in Mindset and Technology, 2017

2 BENEFITS EXPECTED FROM THE WORK OF THE CEN/TC

The overall benefits of the work from CEN/TC 442 are through BIM to support the visions for sustainable growth based on better resource efficiency through data sharing in the construction industry in Europe.

CEN/TC442 will specify methodologies to digitally define, describe, exchange, monitor, record and securely handle asset data, semantics and processes with links to geospatial and other external data which other TCs will then adopt. However, the other TCs will define their own properties, processes and elements.

The benefits and opportunities of adopting BIM are summarized as follows:

- Delivering the digitization of construction in Europe in a security minded way;
- Increase the competitiveness and efficiency of operation of buildings and infrastructure assets throughout their working life;
- Increase the competitiveness of the European Construction sector (e.g. engineering firms, contractors, designers and product manufacturers) in their world-wide activities;
- Deliver efficiencies for client organizations regarding requirements of legacy systems;
- Facilitate security-minded information exchange between client's asset management systems and contractors/designers systems thanks to interoperability;
- Deliver efficiencies for contractors and manufacturers through standardized product selection and ordering processes;
- European ICT support of increased sustainability and greenhouse-gas emission goals for the Construction Industry;

- Increased certainty for construction clients to achieve their asset objectives and improvements in briefing as a result of improvements in post occupation evaluations;
- Provide a common understanding regarding the design of built environment between owners, operators and users, designers, contractors and manufacturers of construction products;
- Facilitate secure exchange of information about construction services between stakeholders;
- Facilitate the marketing and use of construction products and offsite assemblies;
- Provide a common basis for research and development in the construction sector;
- Allow the preparation of common design aids and software packages;
- Support the objectives of European Governments in achieving their targets for BIM adoption.

Information sharing is a complex process where effective rules and controls need to be defined to ensure secure and reliable transactions. This process is generically termed interoperability.

“Interoperability” is an international programme in which Europe can take two roles:

- Better “resource efficiency” (including cost and carbon) is a key area of European contribution and expertise;
- European contribution should focus on language and translation issues towards an open market, for construction products and services. Align with Roadmap (1.4)
- The creation of CEN/TC 442 has created a focus for national and international coordination and implementation of BIM.

The geometry part of BIM has reached a high maturity level, and its potential is understood. However, the full potential of BIM is far from being utilized since the information (data) part, interoperability and implementation (e.g. work flow) remain immature.

3 PARTICIPATIONS IN THE CEN/TC

All the CEN National Standards Bodies are entitled to nominate delegates to CEN Technical Committees (TC) and experts to Working Groups, ensuring a balance of all interested parties. Participation as observers of recognized European or international organizations is also possible under certain conditions (see CEN/CENELEC Internal regulation part 2 chapter 4). To participate in the activities of this CEN/TC, please contact the National Standards Body in your country.

4 OBJECTIVES OF THE CEN/TC AND STRATEGIES FOR THEIR ACHIEVEMENT

4.1 Defined objectives of the CEN/TC

The aim is to help the construction sector to be more efficient and sustainable by enabling a smooth information exchange and sharing between partners in the value chain.

The objectives of CEN/TC 442 are:

- To deliver a structured set of standards, specifications and reports which specify methodologies to define, describe, exchange, monitor, record and securely handle asset information, semantics and processes with links to geospatial and other related built environment data;
- Advise EU Commission and industry on policy for implementing BIM in Europe;
- To be the home for European BIM standardization. CEN/TC 442 shall support BIM coordination across relevant CEN/TC's. CEN/TC 442 shall consider New Work Item proposals to be developed in accordance with the Vienna agreement.

These objectives should support the work carried out by either other TCs or organizations dealing with standardization of products and systems or TC's dealing with specific construction topics (e.g. acoustics, environment, Eurocodes...). These objectives aim at providing methods and tools for taking into account and integrating the BIM needs related to their own domain. Therefore, CEN/TC 442 has to set up the conditions and methods for collaborating with the ad-hoc TC's and technical organizations. Reversely each TC in charge of either standardization of product and system or dealing with specific construction topics would take over and integrate these tools and methods to identify and provide directly the needed BIM elements related to its activity domain.

Such a TC will be called "liaison TC".

The benefits of a harmonized European approach can be summarized as follows:

Benefit of a harmonized European approach supported by standards and specifications	Description of the benefit
Accelerate national efforts	Through collaborative working and sharing of best practice, nations can accelerate their own BIM initiatives by learning from others.
Minimize costs	Wasted effort and investment can be minimized through the reuse of existing developments and knowledge.
Impactful and robust programmes	By drawing upon existing knowledge and practical experience of what makes programmes successful, individual nations can be informed to create and implement effective initiatives.
International critical mass	Taking a similar approach to neighbouring countries for the encouragement of BIM will increase the strength and effectiveness of each individual national programme.
Reducing trade barriers to growth	Alignment of a European approach will encourage trade and opportunity for growth across borders. Creating national specific approaches will likely confuse the construction sector, discourage cross border working and add a cost burden to the industry when complying with national different approaches.
Encourage international standards developments	Europe has the opportunity to collectively encourage the development of standards for use in international markets. This ensures open competition in the supply chain and the open sharing of information across software platforms.

Consequently CEN/TC 442 should:

- Set up a strong collaboration with other TC's and technical organizations, which implies:
 - to organize exchanges and liaisons;
 - to define an exchange convention (when, what, how...)
 - to complete the list of Liaisons,
 - to capitalize on expertise and centralize the results
 - to provide deliverables (e.g. guidelines, good practices...)
- Define a methodology for identifying the characteristics that will lead to the definition of properties for use within BIM
- Define a methodology for including the BIM aspects into the European standards developed by the liaison TC's
- Propose the nomination in each Liaison TC of a BIM-referent who will ensure the take-up of the proposed methodologies.
- Collect the need of actors.

4.2 Identified strategies to achieve the CEN/TC's defined objectives.

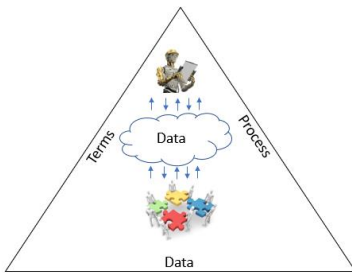
4.2.1 Introduction

Interoperability can be achieved without standardization but it conditions the project to agree on its own rules and deliveries. A high level of expertise and resources is required, and utilization of information in the construction life-cycle is not ensured.

Efficient interoperability requires a set of standards and implementation. The three pillars of interoperability are:

- a standardized way to store and exchange data models and implement them in software packages securely where necessary;
- a common understanding of terminology and data-semantic structure;
- an agreed set of information delivery specifications for the information sender to support the processes of the information recipient.

An efficient object-based interoperability is conditioned by three sets of standards:



- Data Model standards to specify data structure for entities, geometry and related properties as well as classification for exchanging data models. The data model ensures exchange of object based information;
- Data Dictionary standards to specify data structure for defining data-semantic concepts (entity, property, classification...) and relations between them;
- Process standards to specify how to describe the required information supporting a given process.

4.2.2 Understanding the current position

BIM maturity is associated to the fact that it not possible to move brutally from a traditional modelling approach towards an open BIM approach. The change has to be managed progressively as climbing up a stair step by step.

To evaluate which level is reached, indicators have been introduced. These indicators measure four aspects: the content, the digitalization, the interoperability and the collaboration.

BIM Maturity Map can be used to set the context for an aligned European approach as well as to monitor where a marked, project or organization is regarding BIM maturity.

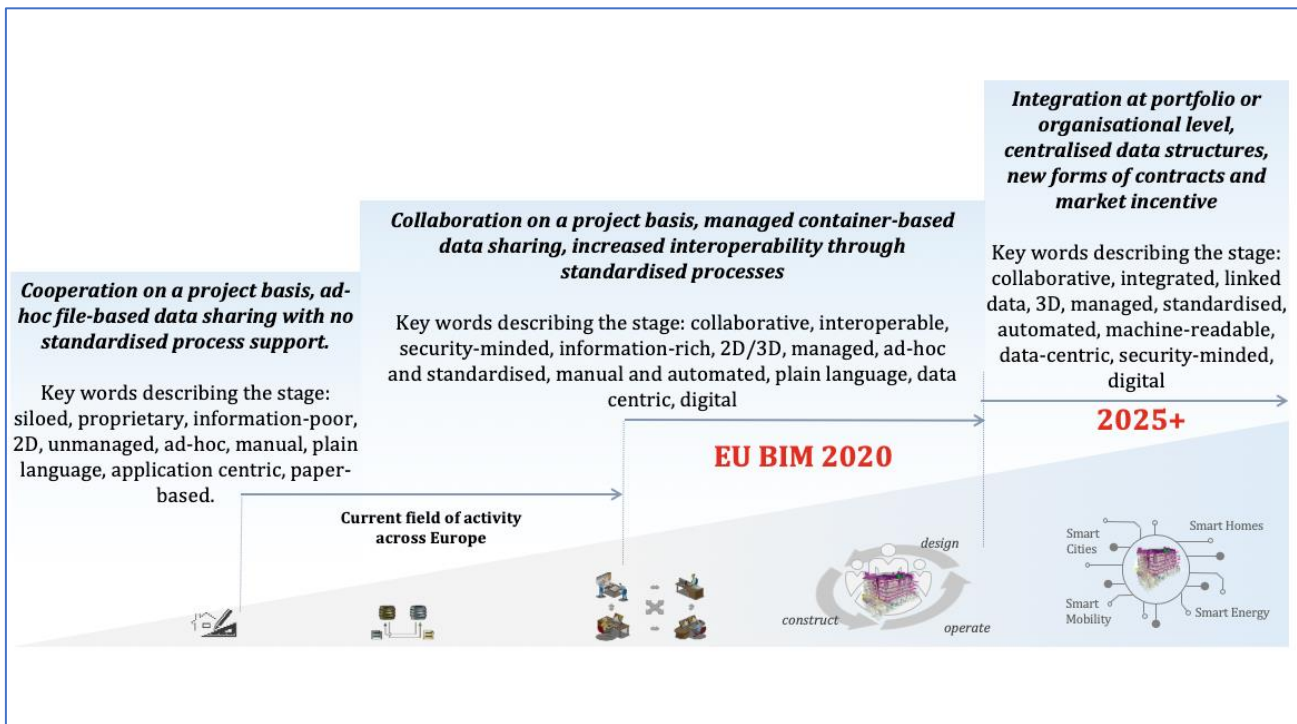


Figure 1 The European BIM Framework in the transformation journey

There are several current national BIM standardization projects and more will probably be seen as implementation increases. Therefore, it is necessary to understand what are the available standards including the implementation of existing ISO standards, from ISO/TC 59/SC 13 and ISO/TC 184/SC 4.

The nature of BIM is evolving rapidly and the above diagram will be revised on a regular basis.

4.2.3 Adopt ISO standards as EN-ISO standards or technical specifications

The work programme include, according to the Vienna agreement and where appropriate, to make current ISO standards for BIM valid as EN standards or technical specifications. EN standards will be implemented as national standards within EU Member States and thereby have a greater impact on national level than ISO standards not implemented as national standards.

CEN/TC 442 operates in close collaboration with other CEN and ISO committees and with other industry standardization organizations. Formal liaison agreements have been established with the geospatial community and STEP community. There will be more liaisons in the future e.g. Energy, Environmental, Fire safety, ITS, Rail and Roads etc.

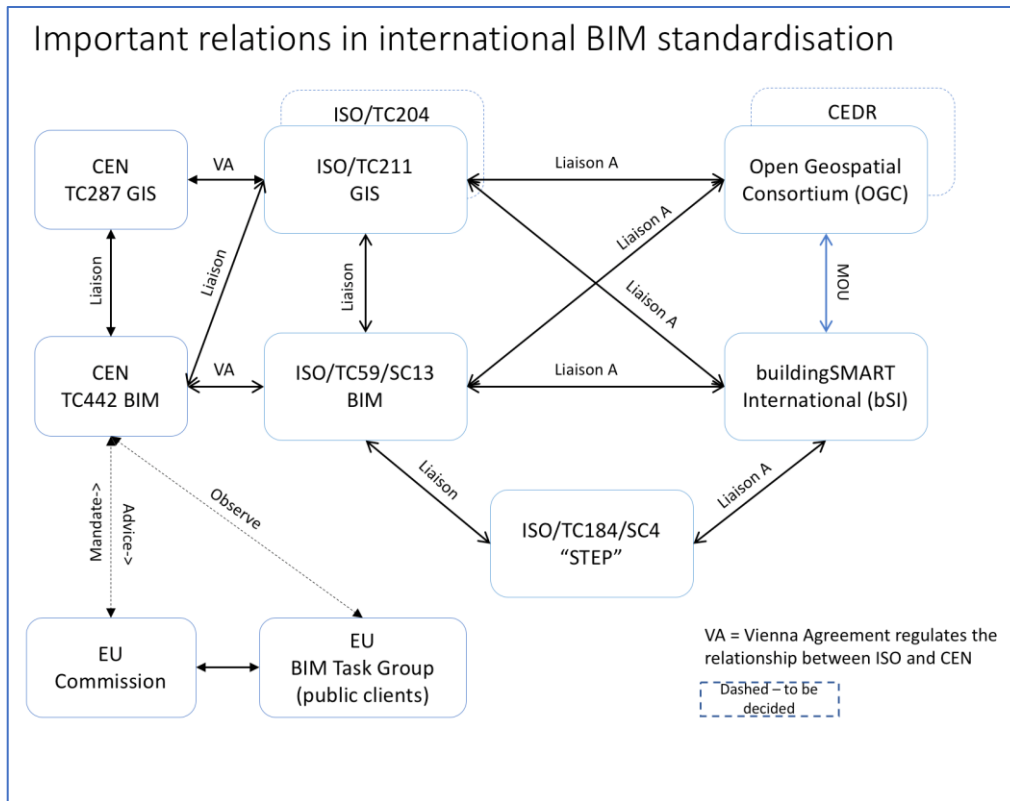


Figure 2 Important relations in international BIM standardization

4.2.4 Exchange Information - Enhance IFC standards

IFC (Industry Foundation Classes) is an international standard, EN ISO16739 - Industry Foundation Classes (IFC) - for data sharing in the construction and asset management industries. It specifies a conceptual data schema and an exchange file format for Building Information Model data. It represents an international standard for BIM data that is exchanged and shared among software applications used by the various participants in a built environment construction or asset management project. buildingSMART International has the ownership for the IFC standard. ISO and buildingSMART International has signed a copyright agreement securing both organizations right to publish the standard. The coordination between the organizations is shown in figure 3.

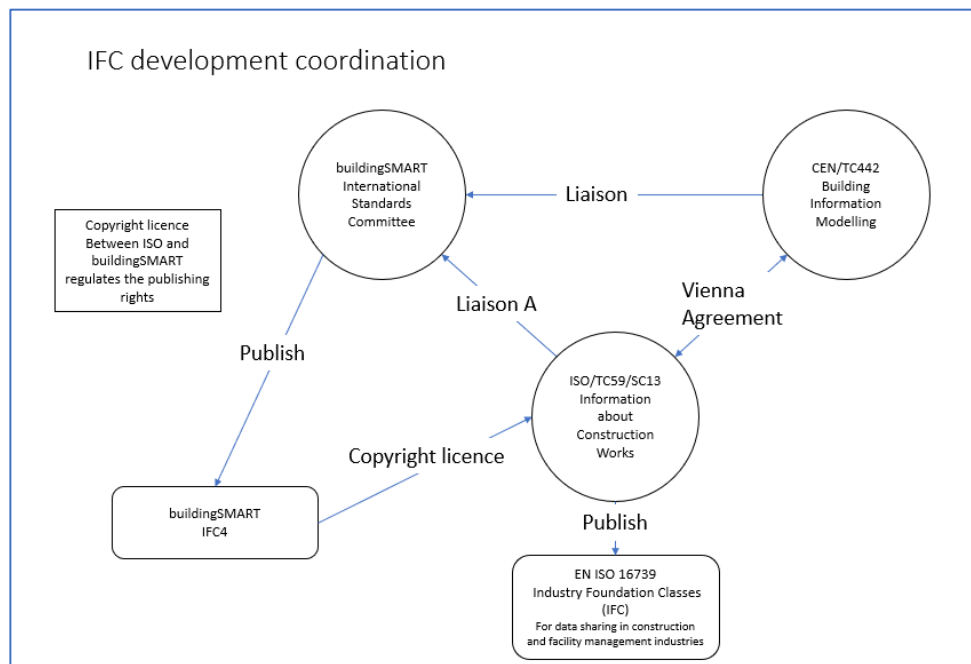


Figure 3 IFC development coordination

Actions:

- Extend and develop standards for industrial assets and infrastructure**
 BIM extensions are requested, in particular regarding industrial assets and infrastructure. The description of the industrial process being already defined by ISO 15926 Industrial automation systems and integration -Integration of life-cycle data for process plants including oil and gas production facilities - ISO/TC 184/SC 4, a link between the two standards is required.
- Extend and develop standards for geolocation of facilities**
 As facilities are always located in a geographical area, BIM should rely on the work already carried out and associated standards to tackle that purpose. This work will be carried out in close co-operation with ISO standards on BIM and CEN/TC 287 on geographic information.
- INSPIRE directive**
 To avoid duplication of work or to embrace already existing work, and according to the INSPIRE Directive [Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community].
- Support asset management**
 Collaborate with the organizations responsible for managing assets. Editing group to develop text
- Support Record management**
 Record management on BIM's data is necessary. In practice, to be efficient, the BIM's data produced for an asset shall be readable and useful during all the stages of the whole life cycle (from design, construction, operation, maintenance to deconstruction) and where appropriate, able to be managed in a security-minded way. This work is broader than BIM and relates to Long Term Record Management. It will be carried out in close co-operation with ISO standards in order to avoid duplication of work or to embrace already existing work.

4.2.5 Develop Information Delivery Specifications

ISO16739 is an international standard for BIM data exchanged and shared among software applications used by the various participants in a built environment construction or asset management project. The content of the data exchanged is highly driven by the lifecycle stage, the involved disciplines and the level of development, or more generally speaking by the process. Information Delivery Specifications should capture (and progressively integrate) construction processes practices and business context whilst at the same time providing detailed specifications regarding the information that a user fulfilling a particular role would need to provide at a particular point within an asset's lifecycle. Where information is sensitive, it should be possible to control access to that information to those with a genuine need-to-know.

From the end-user point of view, this leads to the so-called Information Delivery Manual (IDM- EN ISO 29481); from a BIM point of view, the associated description is called Model View Definition (MVD) defining a subset of the complete IFC model or equivalent, with strict specifications regarding the attribute description.

An Information Delivery Manual comprises the following:

- An interaction/transaction map and/or a process map
- Exchange requirement(s)

The interaction/transaction map defines the roles involved and the transactions between roles. The process map shows the activities for each role and interactions/transactions between activities for different roles. A swim lane diagram is commonly used as a process map.

To achieve the BIM information highway, there are many IDM's and MVD's to be developed. MVD are not only required for a specific data exchange schema and for quality checks, but also having a solution that can be used as a master file that could be adapted on project level.

Actions:

- Develop a framework for BIM Guidelines (see ISO 12911);
- Define current Use Cases;
- Support Energy Assessment for practical implementation of EN 15603;
- Support lifecycle cost estimation and assessment, in order to provide a practical implementation of CEN/TC 350 related standards
- Support asset Management and Operation, documentation of which is a common challenge in all projects;
- Support building Application, in which digital rules and processing can substantially improve both efficiency and quality of the industry interaction with Planning and Regulatory Authorities.

4.2.6 Support Data Dictionaries

EN ISO 12006-3 – Organization of information about construction work – Part 3 Framework for object-oriented information is a standard for Data Dictionaries. A Data Dictionary connects the entire world's domain terminology with internationally standardized and machine-readable concepts. Data Dictionaries can link together all existing and new databases and registries in the world. It provides the ability to search information from around the world with a standardized interface. Data dictionaries can be used both to secure unambiguous information flow with IFC files and in direct communication with databases without the use of the IFC model.

There are several areas of standardization and implementation of a European Data Dictionary:

- Establish a European standard for the data structure of data dictionaries by adopting EN ISO 12006-3 as a European standard. Adoption of EN ISO 12006 does not include adoption any of the current implementations;

- produce standards for Product Data Templates based on CEN/CENELEC standards,
- produce an agreement for specific content of particular interest to the European market, expressed by the standard structure of EN ISO 12006-3 by developing high-value common European content and standard APIs;
- (potentially multiple) commercial implementations of a data dictionary server, using the standardized data structure of EN ISO 12006-3 and delivering the agreed content for the European market combined with services is out of scope of the CEN/TC 442.
- Guidelines ISO 16354 (Guidelines for knowledge libraries and object libraries)

Actions:

- **European Data Dictionary and Application Programming Interfaces**

The aim is to establish some common Data Dictionary content including definitions of entities and properties based on a common object classification in order to support the European market and sustainability.

Common Data Dictionary content will act as the shared placeholder for national and regional context projects and make them generally accessible.

An effective implementation of a link between a harmonized standard dictionary of concepts and IFC-based modelling will act as a unifying element for trade in national and regional projects.

Production of standardized Application Programming Interfaces (API) for Data Dictionaries ensures that different context projects are related and accessible.

- **Harmonization of construction product properties**

Regarding Product Dictionaries, the ISO standards define the framework. The current challenge is related to the number of product dictionaries and the need to avoid misunderstanding of property naming conventions: same name but different meaning or values or same concept but different names and values. A standard is necessary to address the topic, e.g. ISO 16757.

- **Harmonization of European classification tables**

Clarify the practice of classification (based on and according to ISO 12006-2) related to the existing standards like EN ISO 16739 and EN ISO 12006-3. The focus is on the mapping of national and international tables and not primary to establish a future European classification table.

- **Dictionaries and Object Libraries**

Access to generic and product specific object libraries is a key for effective design and access to properties on available products. An Object Library is a structured set of digital objects (e.g. a door or a lighting fixture) which can both specify geometry, properties, classification and links to other documentation. An object library is established in a given data model with appropriate security controls where required.

The Work Item includes:

- a standardized European Dictionary framework based on either common classification tables or national tables cross referenced according to the Data Dictionary framework standard;
- The standardization of rules for BIM object libraries makes it possible to use object libraries from all of the CEN countries regardless of local documentation requirements. Object Library rules will be standardized with the use of Data Dictionaries and common rules and guidelines for

modelling and documenting naming and properties including those relating to the protection of sensitive information

- The standardization of rules for linking object type libraries and data dictionaries.

Actions:

- Identify key stakeholders for future collaboration.
- Extend BIM towards infrastructure to involve infrastructure stakeholders, in particular CEDR as liaison organization. CEDR stands for Conference of European Directors of Roads. It is a platform for cooperation between National Roads Authorities.

4.2.7 Collaboration with relevant technical committees and organizations

CEN/TC 442 has established liaisons and cooperation with the following technical committees and organizations:

- ACE, Architects Council of Europe (Liaison Org.)
- CEIR, Comité Européen de l'Industrie de la Robinetterie (Liaison Org.)
- CERAME-UNIE, European Ceramic Industry Association (Liaison Org.)
- CPE, Construction Product Europe (Liaison Org.)
- EC, European Commission
- EFCA, European Federation of Engineering Consultancy Association (Liaison Org.)
- EHI, European Heating Industry (Liaison Org.)
- ERMCO, European Ready Mixed Concrete Organization (Liaison Org.)
- EURALARM (Liaison Org.)
- EURIMA, European Insulation Manufacturers Association (Liaison Org.)
- EUROGYPSUM (Liaison Org.)
- EUROVENT, Europe's Industry Association for Indoor Climate, Process Cooling, and Food Cold Chain (Liaison Org.)
- FIEC, European Construction Industry Federation (Partner Org.)
- SBS Small Business Standards (Partner Org.)
- buildingSMART Int. (Liaison Org.)
- CEN/TC 51 Cement and building limes
- CEN/TC 69 Industrial valves
- CEN/TC 126 Acoustic properties of building elements and of buildings
- CEN/TC 127 Fire safety in buildings
- CEN/TC 134 Resilient, textile and laminat floor coverings
- CEN/TC 169 Light and lighting
- CEN/TC 247 Building Automation, Controls and Building Management
- CEN/TC 250 Structural Eurocodes
- CEN/TC 254 Flexible sheets for waterproofing
- CEN/TC 287 Geographic information
- CEN/TC 310 Advanced automation technologies and their applications
- CEN/TC 348 Facility Management
- CEN/TC 350 Sustainability in Construction Works
- CEN/TC 371 Project Committee - Energy Performance of Building project group
- CEN/TC 440 Electronic Public Procurement
- CEN/TC 251 Health informatics
- ISO/TC 46 Information and documentation
- ISO/TC 59/SC 13 Organization of information about construction works
- ISO/TC 211 Geographic information/Geomatics

Relevant organizations, such as the followings, will be asked to establish liaisons with this CEN/TC:

- OGC - Open Geospatial Consortium;
- ECOS - European Environmental Citizens Organization for Standardization;
- EU BIM Task Group
- CEDR – Conference of European Directors of Roads / Conférence Européenne des Directeurs des Routes.

Recommendation:

TC 442 shall identify key stakeholders for future collaboration. Relevant TC's within CEN, CENELEC, ISO and ISO will be identified, and liaisons considered.

4.3 Environmental sustainability aspects

Construction Industry energy use represents about 40% of total energy consumption (Norwegian figures). A reduction of the Construction Industry's energy consumption and production waste is necessary to meet future emission goals. In addition, the UK "CarbonBuzz" project had identified a 30% performance gap between the design carbon performance of a project and its "in use" performance. Key to the reduction of carbon emissions is the ability to perform complex performance analysis creates a potential to focus on environmentally low-impact design, construction, operation and demolition [5]. Standardized handling of information can help predict environmental performance and thereby improve decision on impact from:

- construction (emissions, resource consumption and waste)
- operation (energy consumption, construction product life-cycle, maintenance)
- construction in local setting (transport, exchange of heat/cooling and electricity, shade, wind effect, water treatment)

Benefits:

- Better planning and design on energy and emissions;
- Coordination of domains during design and construction to reduce waste;
- Resource effective operation;
- Long-term BIM analysis of Cost and Resource;
- Documentation of Environmental Impact Values to elements of the Building Information Modelling;
- Performance measurement and feedback;
- Identification of reuse opportunities;
- Collaboration with environmental sector.

Action:

- Support the European sustainability standards by use of BIM.

5 FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE CEN/TC WORK PROGRAMME

In line with the objectives, the work of CEN/TC 442 will concentrate expertise from the Construction Sector. The exchange format (IFC) is derived from ISO standards. The key topic is to implement successfully this exchange process. Therefore, guidelines and specifications supporting the exchange format have to be prepared in order to ensure consistency between the deliverables produced by CEN/TC 442 and the end-users needs.

Deliverables prepared by CEN/TC 442 have to include the use of software solutions.

The work of CEN/TC 442 shall be oriented for infrastructure and Building Owners, including Public Owners, as well as for the Construction Sector, including Small and Medium-sized Enterprises (SME) which constitute the majority of companies in that sector.

A relationship between European Commission and CEN/TC 442 has to be created to ensure consistency of the deliverables produced by CEN/TC 442 with EC orientations.

Annex A Work programme

Project reference	Status	Initial Date	Current Stage	Next Stage	Forecasted voting date
prCEN/TR (WI=00442031) Framework and Implementation of Common Data Environment Solutions, in accordance with EN ISO 19650	Preliminary		2019-09-10		
prCEN/TR XXX (WI=00442024) Guideline for the implementation of BIM Execution Plans (BEP) and Exchange Information Requirements (EIR) on European level based on EN ISO 19650-1 and -2	Under Drafting	2019-06-04	2019-12-04	2021-03-04	
prCEN/TR XXX (WI=00442023) Guideline on how to understand and utilize EN/ISO 29481 Building information models - Information delivery manual - Part 1: Methodology and format and Part 2: Interaction framework	Under Drafting	2019-06-04	2019-12-05	2021-03-04	
prEN (WI=00442033) Building information modelling - Exchange structure for product data templates and product data sheets based on ISO 16739-1 - Part 2: Requirements and configurable products	Under Drafting	2019-10-22	2020-02-27	2020-06-22	2021-07-30
prEN 17473 (WI=00442008) Building information modelling (BIM) - Data templates for construction objects used in the life cycle of any built asset - Data templates based on harmonised technical specifications under the Construction Products Regulation (CPR)	Under Approval	2018-04-10	2020-04-16	2020-10-18	2020-10-18
prEN 17549-1 (WI=00442018) Building Information Modelling (BIM) - Information structure based on EN ISO 16739 1:2018 to exchange data templates and data sheets for construction objects - Part 1: Data templates and configured construction objects	Under Approval	2019-08-20	2020-07-23	2020-08-20	2021-05-28
prEN 17632 (WI=00442021) Building Information Modelling (BIM) - Semantic Modelling and Linking (SML)	Under Approval	2020-01-13	2020-11-23	2021-03-18	2021-10-21
prEN ISO 12006-3 rev (WI=00442019) Building construction -- Organization of information about construction works -- Part 3: Framework for object-oriented information	Under Drafting	2018-02-15	2018-02-15	2018-08-16	2020-03-30
prEN ISO 19650-4 (WI=00442028) ISO 19650-4 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling — Part 4 : Information exchange	Under Drafting	2019-07-05	2019-07-05	2020-01-06	2021-08-16
prEN ISO 29481-3 (WI=00442034) Building information models — Information delivery manual — Part 3: Data schema and classification	Under Drafting	2020-12-08	2020-12-08	2021-06-08	2023-01-18
(WI=00442027) BIM in infrastructure – standardization need and recommendations	Preliminary		2019-05-16		
(WI=00442030) Building Information Modelling – Level of information need – Part 2: Guidance for application	Preliminary		2019-09-11		
(WI=00442032) Common Data Environments (CDE) for BIM projects –Open data exchange between platforms of different vendors via an open CDE API	Preliminary		2019-09-13		
(WI=00442029) "Building Information Modelling – Level of information need – Part 3: Data Schema"	Preliminary		2019-09-11		

Table 1 Work Programme – last update 2020-12-15

Annex B Published Standards

Reference, Title	Publication date
CEN/TR 17439:2020 (WI=00442022) Guidance on how to implement EN ISO 19650-1 and -2 in Europe	2020-06-10
EN 17412-1:2020 (WI=00442009) Building Information Modelling - Level of Information Need - Part 1: Concepts and principles	2020-11-18
EN ISO 12006-2:2020 (WI=00442026) Building construction - Organization of information about construction works - Part 2: Framework for classification (ISO 12006-2:2015)	2020-02-05
EN ISO 12006-3:2016 (WI=00442003) Building construction - Organization of information about construction works - Part 3: Framework for object-oriented information (ISO 12006-3:2007)	2016-10-19
EN ISO 16739-1:2020 (WI=00442025) Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries - Part 1: Data schema (ISO 16739-1:2018)	2020-02-19
EN ISO 16757-1:2019 (WI=00442012) Data structures for electronic product catalogues for building services - Part 1: Concepts, architecture and model (ISO 16757-1:2015)	2019-05-29
EN ISO 16757-2:2019 (WI=00442013) Data structures for electronic product catalogues for building services - Part 2: Geometry (ISO 16757-2:2016)	2019-05-29
EN ISO 19650-1:2018 (WI=00442004) Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 1: Concepts and principles (ISO 19650-1:2018)	2018-12-19
EN ISO 19650-2:2018 (WI=00442005) Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 2: Delivery phase of the assets (ISO 19650-2:2018)	2018-12-19
EN ISO 19650-3:2020 (WI=00442020) Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 3: Operational phase of the assets (ISO 19650-3:2020)	2020-08-19
EN ISO 19650-5:2020 (WI=00442017) Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 5: Security-minded approach to information management (ISO 19650-5:2020)	2020-07-01
EN ISO 21597-1:2020 (WI=00442015) Information container for linked document delivery - Exchange specification - Part 1: Container (ISO 21597-1:2020)	2020-04-22
EN ISO 21597-2:2020 (WI=00442016) Information container for linked document delivery - Exchange specification - Part 2: Link types (ISO 21597-2:2020)	2020-11-18
EN ISO 23386:2020 (WI=00442007) Building information modelling and other digital processes used in construction - Methodology to describe, author and maintain properties in interconnected data dictionaries (ISO 23386:2020)	2020-03-25
EN ISO 23387:2020 (WI=00442010) Building information modelling (BIM) - Data templates for construction objects used in the life cycle of built assets - Concepts and principles (ISO 23387:2020)	2020-07-22
EN ISO 29481-1:2017 (WI=00442006) Building information models - Information delivery manual - Part 1: Methodology and format (ISO 29481-1:2016)	2017-10-11
EN ISO 29481-2:2016 (WI=00442001) Building information models - Information delivery manual - Part 2: Interaction framework (ISO 29481-2:2012)	2016-10-19

Table 2 Published standards, last update 2020-12-15

Annex C Definitions

API

Stands for Application Programming Interface. It is a standardized access point to information and relations in a data model.

Asset management

The profession and processes that includes multiple disciplines to ensure functionality during operation of the built environment by integrating people, place, process and technology. In a wider definition, it covers operations of assets.

Building application

Covers both the process of and the actual application to local building authorities to get a permit to build and use a construction.

BIM - Building Information Modelling

use of a shared digital representation of an asset to facilitate design, construction and operation processes to form a reliable basis for decisions (EN ISO 29481-1:2016 Preferred term CEN/TC442/WG01, 2018)

BIM - Building Information Modelling

Is an industry term that covers the sharing of structured information for assets. "Sharing" requires consideration of processes and interoperability, "structured" requires the use of a common data schemas and "information" may depend on development of common terminology (CEN/BT/WG215, 2014 - not in accordance with CEN/TC442/WG1 preferred terms).

BIM - Building Information Model

Can be visualized as a virtual geometrical representation of the real asset and can report object properties and relations. BIM gives an intuitive understanding of complex building information and support many digital tools for effective information handling (CEN/BT/WG215, 2014 - not in accordance with CEN/TC442/WG1 preferred terms).

buildingSMART International

Is the International, open and non-for-profit organization that has developed and maintains the IFC standard. buildingSMART International develops actual implementation based on their standard and work together with the Industry to ensure implementation of Open BIM. buildingSMART International is formally recognized by ISO as organization in cooperation.

Data Dictionary based on EN ISO 12006-3.

ISO 12006-3:2016 specifies a language-independent information model which can be used for the development of dictionaries used to store or provide information about construction works. It enables classification systems, information models, object models and process models to be referenced from within a common framework.

Facility

physical structure, including the related site, serving one or more main purpose

Construction works

everything that is constructed or results from construction operations. This term covers both building and civil engineering works.

Data model

A specified set of entities and their related properties and attributes representing a virtual model of one or more domains structured by a modelling language. The buildingSMART Data Model is the same as the IFC data model.

Data dictionary

A data-semantic dictionary specifying concepts (entities, properties, classification and other concepts) and their relations. A data dictionary defines entities and properties uniquely, understandable and machine readable. It is possible to connect different data dictionaries and to harmonize the understanding of the content we want to share. Such a harmonized dictionary of properties could be used for an unambiguous information exchange either in direct communication with Data dictionaries or other exchange flows based on IFC.

Exchange requirement (ER)

Defined set of information units that needs to be exchanged to support a particular business requirement at a particular process phase (or phases)/stage (or stages). (EN ISO 29481-1:2016).

IFC

Stands for Industry Foundation Classes. It is a neutral data format to describe, exchange and share information typically used within the building and facility management industry sector. IFC is the international standard for openBIM and registered as EN ISO 16739:2016.

Information Delivery Manual (IDM)

Documentation which captures the business process and gives detailed specifications of the information that a user fulfilling a particular role would need to provide at a particular point within a project. (EN ISO 29481-1:2016).

Information Delivery Specification

The same as an IDM.

IDM components

Basic elements that form an IDM: Interaction maps/transaction maps, process maps and exchange requirements. (EN ISO 29481-1:2016).

Information unit

Individual information item, such as a window identifier or a room depth. (EN ISO 29481-1:2016).

Interaction map

Representation of the roles and transactions relevant for a defined purpose. (EN ISO 29481-1:2016).

Interaction framework

Formal description of the elements of interaction, including definitions of roles, transaction, messages in transaction, and data elements in messages. (EN ISO 29481-1:2016).

Life-cycle

Covers both the process perspective and the actual life span of a given physical structure. The life-cycle perspective focuses to improve the sum of performances of a physical structure in its various relation to e.g. function, people, environment and economy.

Model

Representation of a system that allows for investigation of the properties of the system. (EN ISO 29481-1:2016).

Model View Definition (MVD)

Computer-interpretable definition of an exchange requirement, specifically bound to one or more particular standard information schemas. (EN ISO 29481-1:2016).

Note 1 to entry: A model view definition (MVD) is also referred to as a view definition, a subset (of a schema) and a conformance class (CC) especially in ISO 10303. (EN ISO 29481-1:2016).

Object

Part of the perceivable or conceivable world. (EN ISO 29481-1:2016).

Note 1 to entry: An object is something mental or physical toward which thought, feeling, or action is directed

Object library

A set of virtual objects representing a physical construction object.

An Object Library can be generic and product specific.

openBIM

means the deployment of BIM based on open standards, not dependent on proprietary formats, allowing the separation of the information from the applications that manage it. In this document, BIM means always openBIM.

Property

A single characteristic of an object or system. (not in accordance with CEN/TC442/WG1 preferred terms)

These definitions are provided as elements of understanding of the Business Plan. They could be modified following the work of CEN/TC 442/WG1.

Security-minded

the understanding and routine application of appropriate and proportionate security measures in any business situation so as to deter and/or disrupt hostile, malicious, fraudulent and criminal behaviors or activities (EN ISO 19650-5)