IT in Construction

Lecture 7
Building Information Modeling
An Overview of the Building Information Modeling (BIM)

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Construction Engineering and Management
Outline

- Diversity of construction industry
- Conventional computer aided tools
- BIM, new approach to address construction issues
- BIM capabilities
- BIM implementation examples
- BIM implementation challenges
- BIM software packages
- Open BIM/ Closed BIM
Diversity of Construction Industry
Construction projects should simultaneously address the **geography**, **site conditions**, **communities**, **physical environments**, **existing infrastructure**, as well as a wide range of **stakeholder requirements**. Adding to the complexity is the mix of team specialists and contractors (PMI, 2016).
Construction projects often result in a **one-of-a-kind product** rather than mass-produced products. While there is generally no opportunity to produce a prototype, a construction project may sometimes be performed in **phases** in order to provide an opportunity to review and refine the project design and implementation strategy, as well as validate the investment intention (PMI, 2016).
Construction projects specification

Construction projects are not always constructed in the performing organization’s principal place of business, but may be constructed in remote, sometimes hostile environments on the open seas, beneath the surface of the earth, and towering high into the sky (PMI, 2016).
Inherently, construction projects occur in an ever-changing, complex environment, and often with a high degree of risk.

Buildings, highways, residential units, healthcare facilities, utility infrastructures, oil and gas, and other industrial facilities may appear typical, but each project presents its own challenges and risks (PMI, 2016).
Construction projects sectors

- Construction Sectors:
  - Residential construction
  - Commercial construction
  - Industrial construction
  - Infrastructure and heavy construction
Construction industry is a combination of diverse fields of expertise and participants that have been *loosely* lumped together as a sector of the economy. **Name some of them!**
Various skills in construction industry

Construction projects often require the integration of engineering disciplines (civil, structural, electrical, mechanical, geotechnical, etc.) as well as interaction with technology and sophisticated equipment that demand unique construction techniques and methods (PMI, 2016).
Various skills in construction industry

- Major expertise involved:
  - Architecture (A)
  - Engineering (E)
  - Construction (C) (operation and management)

This is reason the construction industry is also called **AEC Industry**

- There are also affiliated expertise:
  - Professional services (legal, accounting, etc.)
  - Suppliers/ manufacturers
  - Financial Services
  - etc.
Conventional Computer Aided Tools
Pre-construction tools

Planning Tools:

- Scope, Schedule and Budget Planning Tools
  - **Microsoft Project**
    - For enterprises of all sizes
    - Project scheduling: define project tasks, assign them to the team, track in-progress assignments
    - Project budgeting: estimate the costs for the entire span of a project.
    - Perform “Earned Value Analytics”
    - interactive dashboards and reporting functionalities
    - Prepare insightful reports and make decisions about project execution and staffing levels
    - Can be deployed both on-premise and in the cloud
Pre-construction tools

- Planning Tools:
  - Scope, Schedule and Budget Planning Tools
    - Primavera P6
      - Plan, schedule, and control large-scale programs and individual projects
      - Select the right strategic mix of projects
      - Balance resource capacity
      - Allocate best resources and track progress
      - Monitor and visualize project performance versus plan
      - Integrate with financial management and human capital management systems
      - Cloud-based solution
Pre-construction tools

- Design Tools:
  - Stakeholders Requirement Management
    - Pure expert judgment – general computer aided tools (e.g., MS Office)
Pre-construction tools

- Design Tools:
  - Architectural Design Tools
    - Autodesk AutoCAD
Pre-construction tools

- Design Tools:
  - Architectural Design Tools
    - Autodesk 3ds Max

Formerly known as a 3D studio and 3D studio Max, 3ds Max is a 3D professional modeling, animation and rendering application build for making 3D animations, models, interactive games, visual effects for the entertainment industry.
Pre-construction tools

- Design Tools:
  - Structural Design Tools
    - ETABS

ETABS is an engineering software product that caters to multi-story building analysis and design. Modeling tools and templates, code-based load prescriptions, analysis methods and solution techniques, all coordinate with the grid-like geometry unique to this class of structure.
Pre-construction tools

- Design Tools:
  - Structural Design Tools
    - SAP2000

SAP2000 is general-purpose civil engineering software ideal for the analysis and design of any type of structural system. Created by engineers for effective engineering, SAP2000 is the ideal software tool for users of any experience level, designing any structural system.
Pre-construction tools

- Design Tools:
  - Structural Design Tools
    - Autodesk AutoCAD
Pre-construction tools

- Design Tools:
  - Utility Design Tools
    - Ecodial Schneider Electric (Electrical Engineering)
Pre-construction tools

- Design Tools:
  - Utility Design Tools
    - Carrier HAP (Mechanical Engineering)
Pre-construction tools

- Design Tools:
  - Utility Design Tools
    - AutoCAD
Pre-construction tools

- Design Tools:
  - Design Integration and Clash Detection Tools
    - Pure expert judgement - No computer aided tools
Pre-construction tools

- **Estimation Tools**
  - **Quantity Estimation Tools**
    - Mainly expert judgement using on CAD drawings
  - **Cost Estimation Tools**
    - Cost index
    - Computer programs
    - Excel sheets
Progress Control Tools:

- Scope, Schedule and Budget control Tools
  - MS Project
  - Primavera P6
Various Construction Activities:

- Using custom-built computer based management information systems in conjunction with paper forms,
Post-construction tools

- Various Operation and Maintenance Activities:
  - Using custom-built management information system (MIS) computer systems in conjunction with the paper forms
Traditionally, the construction processes have been fragmented and disconnected using conventional computer aided tools.

Reduced productivity in the construction industry is the result in USA.

Source: Teicholz, Ph.D. Paul, Professor (Research) Emeritus, Dept. of Civil and Environmental Engineering, Stanford University
Issues in Conventional Computer Aided Tools

- As well as Germany:

Source: Federal Statistics Office, Germany
Can you name some examples of the current issues resulting in the decreased productivity?
Some factors created the current condition (Baldwin, 2019):

1. Industry diversity and complexity

The construction industry is continually becoming more complex and fragmented. Each decade brings new specialist disciplines and trades. With each specialization, project requirements become more complicated and communication and decision making is more laborious. Managing communication on large projects is an overwhelming task for the majority of contracting firms – most of these being small companies of less than ten employees.
Some factors created the current condition (Baldwin, 2019):

2. Manual, inefficient, and outdated processes

Many of our design and construction practices are antiquated. Trades like masonry and carpentry have changed little in the past centuries and will be progressively sidelined by prefabrication and robotic-assisted assembly. Similarly, our drawing conventions are a hangover from the Renaissance period and are no longer a viable means to deliver project information on large developments.

Plans must be accompanied by a mass of additional documentation (building specifications, equipment lists, schedules, operational and maintenance manuals, contracts, variation orders) that supplement, and too often duplicate or contradict what is represented in the drawings. There must be a better way of working!
Some factors created the current condition (Baldwin, 2019):

3. Technology resistance

The construction industry is, by and large, conservative and has made only tentative steps in adopting new technologies. There are notable exceptions, such as the development of digital fabrication processes (CAD, CAM) in the steel, timber, and other sectors. These developments are, however, typically isolated and have not inspired change across the supply chain.
Some factors created the current condition (Baldwin, 2019):

4. Conventionally applicable computer aided tools cannot talk to each other

- E.g., Structural design on ETABs are separately drafted by drafters in AutoCAD
Some factors created the current condition (Baldwin, 2019):

5. Efforts put on developing computer programs for performing former tasks in the early stages are barely developed and move the next stage for the latter tasks

- New drawings are required for the detail design after conceptual design
- Construction drawings need to be put in order manually according to the project plan based on the expert judgement
- Quantities should be manually extracted based on the drawings using the expert judgement
Some factors created the current condition (Baldwin, 2019):

7. Project documentation is decentralized and mainly based on the paper forms

8. Limited gathered knowledge during preconstruction and construction phases is transferred to the post-construction, i.e., operation and maintenance phase

*Additional time and cost is the result*
BIM, New Approach to Address Construction Issues
Digital technologies are transforming our lives. The Internet is now irreplaceable to most of our business processes.

With the proliferation of smartphones and other mobile devices, digital connectedness has altered almost every aspect of our professional and private interactions. It has changed the way we communicate, bank, shop, plan holidays, learn, share opinions and engage with our peers (Baldwin, 2019).
Improvement methods

So, how can we address these issues, and which role does Building Information Modelling play?

There is no reversing industry fragmentation. Rather, we should embrace specialization by enabling **communication and information sharing in a networked, flexible, and agile manner.** New processes need to be adopted that remove antiquated workflows and support integrated, digital ways of working. And a **cultural change** needs to take place in order to shift our perception and use of technology (Baldwin, 2019).
Many of the technologies we need for this digital transformation already exist: cloud computing, mobile devices, digital fabrication technologies, and GPS-controlled site equipment, to name a few. We simply need to make the use of them more commonplace (Baldwin, 2019).

Cloud computing refers to data processing that takes place remotely (in data centres), not in our PCs. Personal Computers and mobile devices access the applications over the internet, while the actual computing takes place in the ‘cloud’.
BIM is the Answer!

The new construction world’s response to overcome the current issues is:

Building Information Modeling (BIM)
What is BIM?

- Building Information Modeling (BIM) is an object oriented three dimensional (3D) simulation of the project components which is shared among different stakeholders in the design, construction and maintenance phases.
Object oriented feature of BIM

Ground Floor Plan

South Elevation  East Elevation
2D CAD transition to 3D BIM

Lego analogy (Baldwin, 2019)
2D CAD transition to 3D BIM
One feature of object properties is the filtering mechanism which helps quick identification of various object instances based on their characteristics. Necessary studies can then be performed based on different characteristics (Baldwin, 2019).
Searching and sorting feature in BIM

(Lego analogy)
Object properties enable powerful search and sorting functions (Baldwin, 2019).
Searching and sorting feature in BIM
Necessity of BIM

- A powerful tool for improving project management and implementation
- Avoided duplication and waste of resources
- Increased pace of the project construction
- Reduced construction and maintenance cost in large and complex construction projects compared to the traditional implementation methods
- The rapid improvement of information technology requires construction project clients to bring along with the pace of advances
BIM applications growth

BIM application growth in UK

- **Knowing BIM**
- **Using BIM**

<table>
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<th>Year</th>
<th>Knowing BIM</th>
<th>Using BIM</th>
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<tbody>
<tr>
<td>2011</td>
<td>32%</td>
<td>13%</td>
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<tr>
<td>2016</td>
<td>54%</td>
<td>42%</td>
</tr>
<tr>
<td>2017</td>
<td>62%</td>
<td>35%</td>
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</table>
BIM applications growth

It is expected in 2019 around 95% use BIM in UK.
BIM in different countries

- **UK**
  - The British government in 2007 stipulated that all public-funded public projects should "use" BIM by 2016. UK has become an example for other countries.

- **USA**
  - The use of BIM in construction projects began in the country since about 2000.

- **Australia**
  - Air Conditioning and Mechanical Contractors' Association (AMCA) in 2016 proposed mandating of using BIM in construction projects in Australia. The association estimates 10% to 30% reduction in costs during construction and maintenance.

- **Scandinavian**
  - For the BIM, regulations have been developed in Scandinavian countries.
BIM Capabilities in Different Project Phases
BIM capabilities in different project phases
Design phase

- Integrated design
Design phase

- Stakeholders participation in the design reviews
Design phase

- Constructability reviews

- 3D Structural Analysis Model
- 3D Rebar Installation TEKLA Shop Drawing Model
- 3D Architectural Revit Model
- 3D Clash Detection Navisworks Model (All Disciplines)
- 3D Structural Revit Model
- 3D Steel Fabrication TEKLA Shop Drawing Model
- 3D MEP Revit Model
Design phase

- Clash detection and clash removal
Design phase

- Controlling design codes
Design phase

- Quantity take off and cost estimation
Construction phase

- Mobilization planning
Construction phase

- Analyzing construction site layout
Construction phase

- 4D modeling
Construction phase

- Prefabrication
Construction phase

- Safety management
Construction phase

- On-site data access
Construction phase

- Virtual reality and augmented reality in marketing
Construction phase

- Project progress control
Operation and Maintenance phase

- Facility management
Operation and Maintenance phase

- Emergency planning
- Layout planning
Examples
Example 1: Structural Lab at University of Canterbury

- Construction of the Canterbury University Construction Facility in New Zealand is an example of the implementation of the BIM at the construction stage.
Example 1: Structural Lab at University of Canterbury

- Use of BIM made the project run without any rework and with minimal waste of resources.
- The project has been completed according to the schedule.
- Use of BIM saved at least twice the BIM implementation cost.
Example 2: Northumbria University, UK

- 120,000 square meters of university buildings was transferred to the BIM to more efficiently maintain, operate and develop the buildings in the future.
Example 3: National Taiwan University

- In the construction project of the Faculty of Civil Engineering at Taiwan National University, BIM was used to improve the productivity and selection of suitable materials.
Example 4: Maine General Medical Center

- Maine General Medical Center has 60,000 square meters and 192 inpatient beds in Georgia, USA.
Example 4: Maine General Medical Center

- Considering the high cost of the hospital maintenance and the expected cost saving by using, an integrated BIM-based maintenance system was implemented.
An Internet-based BIM system was implemented where different stakeholders in the hospital could easily access facility information.
Example 4: Maine General Medical Center

- This project led to an annual facility management cost reduction of $185,000 to $225,000.
Example 5: Stanford University Neuroscience Health Center

- This center is located in California, USA, with an area of 8500 square meters.
Some benefits of the BIM implementation in this hospital can be listed as:

- Reduced facility maintenance and management cost by 5%
- 60-70% reduction in repair time due to the facilitated locating of the facilities and equipment
BIM Implementation Challenge
Many BIM projects do not bring the promised benefits, leaving project teams frustrated and behind schedule.

It is seen especially the case with many BIM implementations in Iran!

So, What does differentiate successful projects from unsuccessful ones?

The short answer is strategic planning!!!
Successful/ Unsuccessful BIM Implementation

(Baldwin, 2019)

- Many factors have a bearing on the success of a BIM project:
  - Project Complexity
  - Scope defined for the project
  - Design changes over the course of the project
  - Project cost
  - Project schedule
  - Technological constraints
  - Team competency and experience.

- 1) Setting realistic goals, 2) managing expectations across the team, and 3) planning and executing projects in a structured manner, are the components of successful BIM project implementation.
BIM Implementation Complexity

- **BIM** is a main tool for improving *management* of the construction projects!
- Successful implementation of **BIM** projects requires a proper knowledge from various conceptual and technological aspects of **BIM**.
- Many of these conceptual and technological BIM aspects get quite complex, specially when they are dealt with in the context of specific types of construction projects with a set of unique project organizational and technical issues!

💡 How many knowledgeable individuals in both conceptual and technological aspects of BIM do you know in our BIM implementation projects?

(Baldwin, 2019)
Project Management bears a broad fields of knowledge and expertise. Successful BIM implementation requires a robust project management knowledge and experience.

How many proficient project managers do you know?

Therefore, BIM implementation is a complex endeavor to take! It requires deep knowledge of the implementation team in both BIM and Project management!
BIM Implementation Pyramid

- BIM implementation is not a definite notion!
- When we talk about BIM implementation, a wide range of implementation levels comes in mind!
- This implementation range can be represented as the BIM pyramid!
The first specification of a BIM model which comes to mind is the 3D geometric formation of the BIM models. Geometry is the first tier of BIM implementation!

Building geometry stays at the top of the BIM implementation Pyramid, Why?

A part of expected benefits of BIM implementation is achievable via the sole use of 3D geometric specifications of BIM models!

Even proper use of 3D geometric capability of BIM models alone can bring great benefits to the construction projects!

Some example benefits are: better space design, merging different design disciplines, communicating with non-professionals, and locating covered items.
Experimental Case:

- Hospitals buildings have a complicated set of utility systems
- Their maintenance requires high amount of money and effort
- We shadowed the maintenance and repair operations in one public hospital in Tehran.
- Major issues identified were:
  - Difficulty to read and merge 2D drawings
  - Problem to find location of components
  - Lengthy training period for new crews
We identified BIM as a proper tool to facilitate the hospital buildings’ maintenance management.

Simple use of 3D models could help the maintenance crew to merge models of different disciplines, to locate the covered components and train new maintenance crew.
In the broader context, however, 3D geometric specification of the BIM models is only a fraction of what BIM represents.

Although the benefits of a geometric model are great!!!, they are overshadowed by the value of the information content for improving performance of the construction projects.
- It is the *data* embedded in the model that represent its true worth.

- Object data, or properties, are the basis for *search criteria, simulation*, and *analysis*. Information content is the second tier of BIM implementation.
We used BIM as a powerful tool for improving lifecycle cost and energy performance of buildings.

The focus of this study was on finding the most appropriate building envelope structures considering specific regional condition.

Regional conditions: weather condition, availability of materials in the region, material purchase, transportation and installation cost!

BIM models were utilized for the material quantity takeoff and energy simulation of the building.
BIM Implementation Pyramid-Information

Experimental Case:

Proposed BIM based framework for improving lifecycle cost of buildings

BIM Model

Regional Condition

Sample Building Specifications

Quantity Takeoff

Utilizing BIM Models of Building Envelope Scenarios

Construction Cost (CC)

Operation Cost (CO) + Maintenance Cost (CM)

Financial Assessment

Construction Costs

Maintenance Costs

Building Envelope's Lifecycle Cost Assessment

Unit Costs

Cost ($)

Time (Year)

Energy Costs

Energy Carriers' Costs

Best Envelope Choice for The Building

NPV = \sum_{t=1}^{m} \frac{CC_t}{(1+i)^t} + \sum_{t=m+1}^{m+n} \frac{CO_t + CM_t}{(1+i)^t}

Construction Period

Operation Period

0 1 m m+1 m+2 m+n
Experimental Case:

- The BIM based framework was implemented in a residential building in Tehran, Iran.

- Prevalent building envelope structures were identified and compared:
Experimental Case:

### Scenario 1:
- **PI:** 1(cm)2(cm)
- **EPI:** 2.5(cm) 2(cm)
- **CM:** Plaster
- **TS:** Earth Plaster

### Scenario 2:
- **PI:** 1(cm) 2(cm)
- **EPI:** 2.5(cm) 2(cm)
- **CM:** Expanded Clay concrete block 15(cm)

### Scenario 3:
- **PI:** 1(cm)
- **CM:** EPS Concrete Block 15(cm)
- **TS:** Travertine Stone

### Scenario 4:
- **PI:** 1(cm)
- **CM:** Lightweight Concrete Panel 12(cm)
- **TS:** Shotcrete

### Scenario 5:
- **PI:** 1(cm) 2(cm)
- **CM:** 3D Panel 15(cm)

### Scenario 6:
- **PI:** 1(cm) 2(cm)
- **CM:** Concrete panel 15(cm)

**Materials:**
- **PI:** Plaster
- **EPI:** Earth Plaster
- **CM:** Cement Mortar
- **TS:** Travertine Stone
- **Sh:** Shotcrete
- **EP:** Expanded Polystyrene
In addition to the geometry, BIM model of the building was used for extracting various other information items required for the assessment, including:

- Material type
- Material density
- Thermal conductivity of materials
- Structure of different envelope components including wall, window and roof
- Surface area to the outside condition
BIM Implementation Pyramid - Information

Experimental Case:
BIM implementation reaches its highest impact when it is incorporated into the project management processes.

Process Management refers to all the organizational issues around process definition, plan and control.

Especially, BIM can effectively facilitate the collaboration and coordination activities required in the project management processes.

Sample BIM applications in project process management are:

- Defining model content and delivery requirements;
- Establishing digital workflows;
- Managing design processes;
- Managing changes;
- Controlling quality
Experimental Case:

- BIM based design clash detection and removal in a hospital project
# Experimental Case:

## Clash Report

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BIM Implementation Pyramid - Management

Experimental Case:
BIM Elephant

- In recent years, BIM applications have rapidly penetrated in different aspects of construction projects.
- BIM is applied to all disciplines across the planning and organization, design, construction, and operation phases of a building.
- Depending on the project specification, each instance of BIM application can take on a new form.
- The rapid growth and broad applications of BIM have created confusion and ongoing debates about the terminology and principles that define BIM.
- Similar BIM terminology and principles mean different things to different people.
BIM Elephant

The BIM Elephant (Baldwin, 2019)
BIM Software Packages
## BIM Software Packages

<table>
<thead>
<tr>
<th>Manufacturer Company</th>
<th>3D Modeling</th>
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<tbody>
<tr>
<td>Autodesk</td>
<td>Revit</td>
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<td>Civil 3D</td>
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<tr>
<td>Bentley Systems</td>
<td>ProStructures</td>
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<td>AECOsim</td>
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<td>Bricsys</td>
<td>BricsCAD BIM</td>
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# BIM Software Packages

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<th>Manufacturer Company</th>
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<td>ACCA</td>
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<td>BuilderTREND</td>
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# BIM Software Packages

<table>
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<tr>
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<th>Energy and Sustainability</th>
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<td>PriMus IFC</td>
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<td>Synchro Ltd.</td>
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<td>Synchro Pro</td>
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Open BIM/ Closed BIM
Variety of BIM based application packages have been produced by different specialized Companies and are used by various parties in different phases and aspects of construction projects,

OpenBIM is about recognizing the need for vendor-neutral (non-proprietary) methods of exchanging information throughout a project (buildingSmart Australia).

OpenBIM standards, recognizable to each BIM software producer, are required to support the exchange of information in a consistent and transparent way in the construction project,
Open Versus Closed File Format

Open (non-proprietary) pdf versus M.S. Word proprietary file format (Baldwin, 2019)
Open BIM Versus Closed BIM

- **openBIM** refers to collaborative processes (namely data exchanges) using neutral and openly available standards.

- **closedBIM (also nativeBIM)** refers to collaborative processes (namely data exchanges) that are based exclusively on proprietary systems and commercial file formats,
Open BIM Versus Closed BIM

OpenBIM (non-proprietary) versus Autodesk Revit proprietary format (Baldwin, 2019)
Open BIM Versus Closed BIM
Open BIM Standards-buildingSMART

What We Do

buildingSMART International is leading the digital transformation by enabling better collaboration and digital workflows through the solutions and standards it delivers.

Interoperable, open, international standards for BIM that transcend traditional design and construction phases to enable a comprehensive digital environment for the entire project and asset lifecycle offer substantial benefits.
## OpenBIM Standards - buildingSMART

(Baldwin, 2019)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description (function)</th>
<th>Standard</th>
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<tr>
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<td>Medium for Data Transfer</td>
<td>ISO 16739</td>
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<td>Industry Foundation Classes</td>
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<td><strong>MVD</strong></td>
<td>IFC View Filter</td>
<td>buildingSMART MVD</td>
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<td>Model View Definition</td>
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<td><strong>IDM</strong></td>
<td>Standardised Process Description</td>
<td>ISO 29481-1, ISO 29481-2</td>
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<td>Information Delivery Manual</td>
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<td>Mapping of Terms</td>
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<td>International Framework for Dictionaries</td>
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<td>(implemented in the bSDD)</td>
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<tr>
<td><strong>BCF</strong></td>
<td>Reporting and Tracking</td>
<td>buildingSMART BCF</td>
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<tr>
<td>BIM Collaboration Format</td>
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</tbody>
</table>

Source: buildingSMART

The buildingSMART openBIM standards
IFC file format

- The Industrial Foundation Classes (IFC) file format or schema is a standard format used by different BIM software packages for data exchanging.
- IFC is registered by international standard organization (ISO) as an official International Standard of: ISO 16739.
- IFC standard has been revised over time currently IFC ISO 16739:2018 is the latest revision.
- IFC has become official standard BIM format by the government of the countries such as UK, Norway, Denmark and Singapore.
ISO 16739-1:2018

Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries — Part 1: Data schema

Abstract

The Industry Foundation Classes, IFC, are an open international standard for Building Information Model (BIM) data that are exchanged and shared among software applications used by the various participants in the construction or facility management industry sector. The standard includes definitions that cover data required for buildings over their life cycle. This release, and upcoming releases, extend the scope to include data definitions for infrastructure assets over their life cycle as well.
IFC file format

- IFC is supported by almost all BIM based computer software packages for data import and export.
- Only limited number of BIM software packages have chosen IFC as the working file in their working environment.
- Most software packages have developed their own version or proprietary file format, such as .rvt for Revit, .pln for ArchiCAD and .edb for ETABS,.
BCF (BIM Collaboration Format) (Baldwin, 2019)

- Working with IFC has typically been a one-way street. It is great for exporting a model for coordination or collaboration.
- IFC does not really translate decisions made in the collaborative environment back into the native software.
- To close the communication loop, the BIM Collaboration Format, or BCF, was developed. BCF serves as a communication channel between the federated IFC models and the native models.
- In simple terms, BCF can be thought of as a messaging tool, a sort of WhatsApp or Telegram for BIM.
BCF (BIM Collaboration Format)

(Baldwin, 2019)

- BCF was primarily designed for defining views of a building model during clash detection and removal process.
- Currently, BCF application is not limited to clash detection application and it is used in a broader range of information management in BIM applications such as space design, delivering process and building maintenance processes!
- BCF is supported natively by modeling software such as ArchiCAD, Tekla Structures, Navisworks, BIMsight, simplebim, and Vectorworks.
- Standalone BCF plugins include BCF Manager, BCFier.
- Cloud services offering BCF based issue tracking include BIMcollab and bimsync.
References


References


- Project Management Institute, 2016, “Construction Extension to The PMBOK® Guide”.

Thank you!

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