

**BIRGIT** BIM for infrastructures and facility management  
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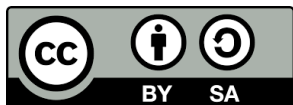


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# BIM for infrastructures and facility management

[r.molina@gisig.it](mailto:r.molina@gisig.it)

GISIG



## Learning outcomes

**At the end of this lecture, the learner is expected to be able to:**

- Understand the fundamental principles and benefits of BIM in the context of infrastructures and facility management.
- Understand the benefits of using GIS data in BIM infrastructure projects
- Describe the application of BIM in various infrastructure and civil engineering projects.
- Identify and assess different technical solutions to be used in BIM infrastructure projects
- Identify and assess the effectiveness of BIM implementation in different facility management tasks and practices.

## BIM for infrastructures

- What is BIM for infrastructures?
- Why use BIM for infrastructures?
- The primary components of BIM for infrastructures
- Planning and delivering a BIM infrastructure project
- The role of BIM in infrastructure projects
- Areas of application
- Examples of use
- Data and standards: ISO 19650
- Data and standards: OpenBIM and the IFC format
- Policies and mandates
- Use of GIS in BIM infrastructure projects
- Tools and technology

## BIM for facility management

- What is BIM for facilities management?
- BIM uses for facilities management
- BIM for space management and optimization
- BIM for asset management and inventory
- BIM for maintenance planning and scheduling
- BIM and construction sustainability
- BIM for efficient use of energy
- BIM for safety and security
- BIM for cost estimation and budgeting
- COBie: BIM interoperability for facility management

## What is BIM for infrastructures?

BIM for infrastructures involves the development of 3D digital models that contain all the essential information required to make infrastructure projects more efficient.

BIM is now recognized as an indispensable tool for undertaking complex infrastructure projects, including those relating to the so-called "horizontal resources" (such as **bridges**, **motorways**, **tunnels**, **railway lines**, **service networks**, etc.).





## Why use BIM for infrastructures?

*You still think that BIM is a methodology intended exclusively for building design?*

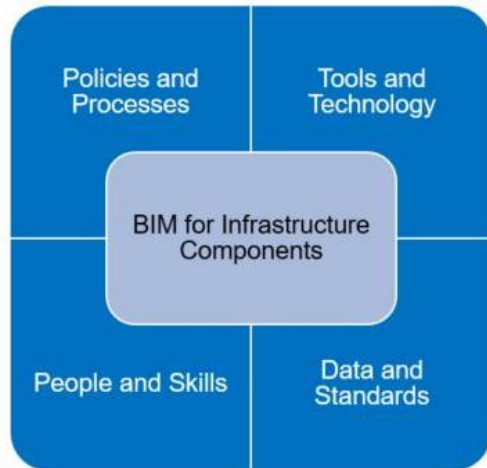
Building Information Modeling also offers enormous potential in the infrastructure and civil engineering sectors.

BIM for infrastructure is an intelligent approach to infrastructure design that is revolutionizing the construction industry.



It helps in better coordination, visualization, and simulation of the infrastructure, leading to improved decision-making, reduced errors, and enhanced collaboration among stakeholders throughout the lifecycle of the infrastructure.

## The primary components of BIM for infrastructures



To successfully implement BIM for infrastructures, these elements need to be functional within the organization developing the project:

**Policies and processes:** Launching BIM for infrastructure requires awareness of legislation, a high level of collaboration, and well-planned processes.

**People and skills:** The project requires a team of professionals with the right skills and experience. It is also important to have the right people in leadership roles.

**Data and standards:** Greater importance should be placed on standardized data formats and exchange protocols to enhance collaboration, design quality, and project efficiency

**Tools and technology:** Using the right tools and technology systems for each specific project is essential.

## Planning and delivering a BIM infrastructure project

Planning and delivering a BIM infrastructure project involves a comprehensive approach that encompasses various stages, from initial planning and preparation to execution and final handover.

Key steps to take include:

- Develop a training and competency plan and provide BIM training to all project stakeholders,
- Select the appropriate BIM methodology that aligns with the project's goals and objectives (infrastructure projects typically use BIM Level 3 or 4)
- Develop and implement standardized BIM processes and standards to ensure consistency and efficiency across the project team.
- Identify and procure BIM software and hardware based on the project's requirements and the team's expertise. Consider factors such as compatibility, scalability, and training needs.
- Establish a secure and scalable data management infrastructure to store, access, and share BIM models and data.
- Document and Maintain BIM Data throughout the project lifecycle.



## The role of BIM in infrastructure projects



The digital modeling of infrastructures is **very intricate and detailed**.

BIM is used to create an integrated digital model of the infrastructure, containing the geometric information and relevant data necessary to support the design activities.

It also allows to visualize what needs to be built within a simulated virtual environment and the creation of a “**digital twin**” for real-time monitoring and analysis.

All this helps industry professionals to obtain a complete and shared understanding of the project.

## Areas of application



BIM is used in infrastructure for planning, design, construction, operation, maintenance, sustainability, and cost management.

BIM is used to enhance communication and collaboration among stakeholders

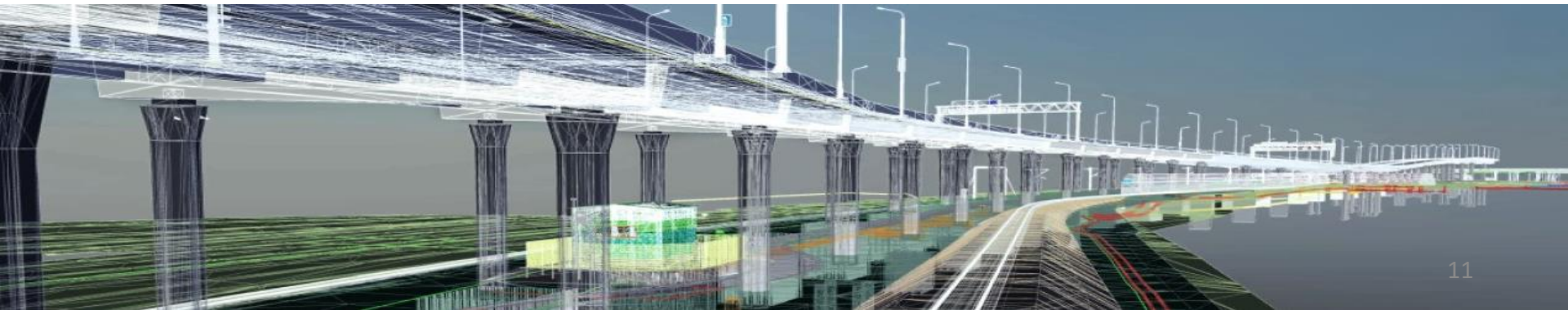
It creates detailed models, plans construction, and generates cost estimates.

Also creates digital twins for asset management and assesses sustainability aspects.

For existing infrastructures where the documented building information is either outdated or is not available, is the ideal way to develop accurate documentation of the existing project.

## Examples of use

- Transportation projects such as roads, railways, highways, metro stations, sidewalks, broadways, waterways, etc.
- Horizontal structures, such as bridges, tunnels and dams.
- Support in land development and Landscape Information Modeling (LIM).
- Civic structures such as malls, stadiums, parks, pools, commercial centers, etc.
- Complex projects such as offshore structures, purification plants, service networks, airports, hospitals, power plants and renewable energy facilities.



## Data and standards: ISO 19650

**ISO 19650** is an international standard that provides a framework for the management of information in the built environment, including BIM.

It defines the roles and responsibilities of different stakeholders in the construction process, and it provides guidelines for the creation, exchange, and sharing of BIM data.

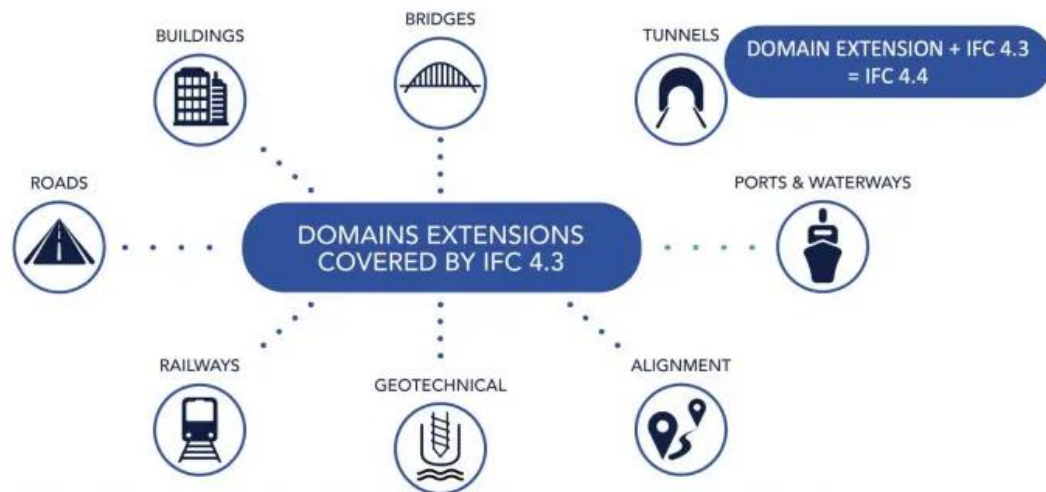
When applied to **infrastructure projects**, ISO 19650 ensures that BIM is used effectively to manage and maintain infrastructure assets, improving efficiency and reducing costs over the asset's life cycle.



## Data and standards: OpenBIM and the IFC format

**OpenBIM** is a collaborative approach and associated standards that facilitate the creation, exchange, and sharing of data related to BIM.

**IFC** is the most common openBIM standard and is a data model for the built environment managed and maintained by **buildingSMART**.



The IFC format provides a common language for BIM software applications to share data, ensuring interoperability across different platforms and vendors.

## Policies and mandates

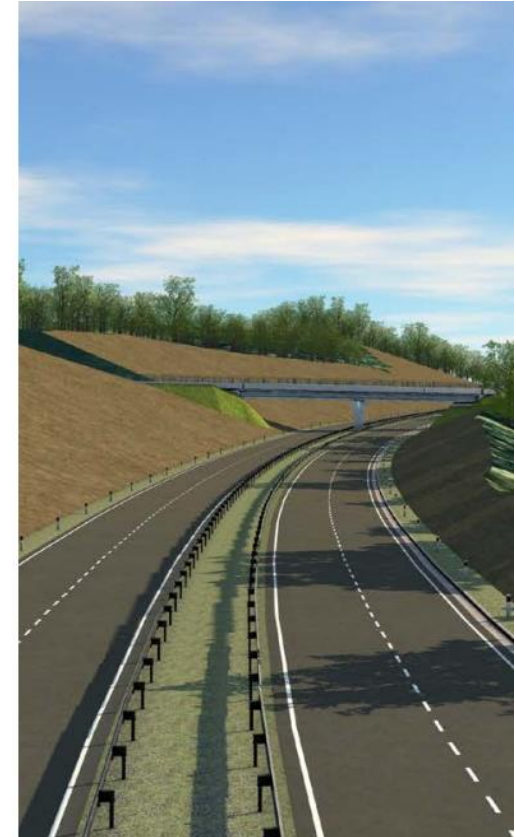
The EU has issued several policies and guidelines to promote the use of BIM in infrastructure projects.

The most relevant is **Directive 2014/24/EU** on public procurement:

This directive encourages member states to consider BIM when evaluating bids for public contracts for the design, construction, or refurbishment of infrastructure projects, such as roads, railways, and bridges.

### National BIM Policies and Mandates

In addition to the EU directive, many EU member states have implemented their own BIM policies and mandates. These mandates vary in scope and stringency, but they all reflect the growing recognition of the benefits of BIM.





## Use of GIS in BIM infrastructure projects

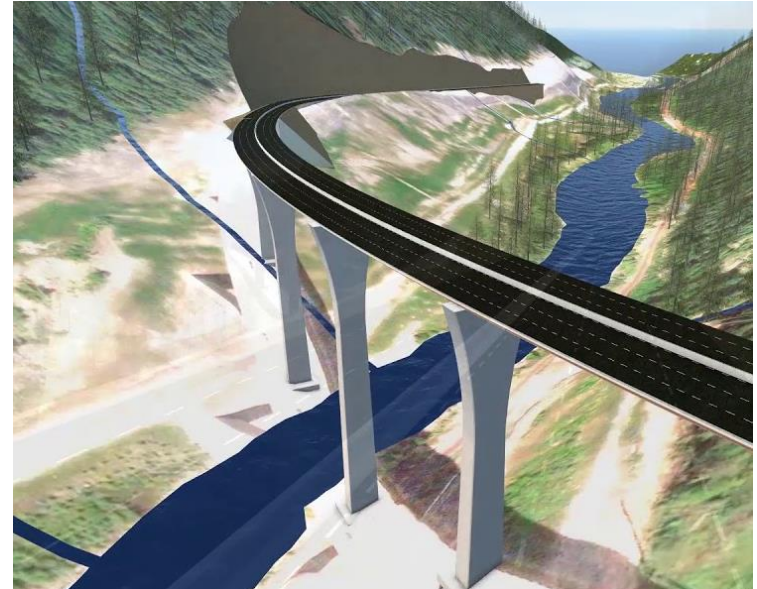
GIS can play a crucial role in BIM infrastructure projects, providing a comprehensive understanding of the physical environment.

### **GIS integration provides a number of benefits:**

- ✓ Enhanced visualization of the project site
- ✓ Improved site planning and design based on land use and environmental aspects.
- ✓ Prevent conflicts between infrastructure elements and other structures.
- ✓ Cost optimization and project efficiency

### **Examples of GIS data usage**

- ✓ Road and bridge design
- ✓ Railway design
- ✓ Underground network design



## Tools and technology

### Types of BIM software in infrastructure projects

- ***BIM modelling software:*** Creates detailed 3D models of infrastructure projects such as roads, railways, bridges, tunnels, buildings, and utilities.
- ***BIM visualization software:*** To generate realistic 3D representations of infrastructure projects, allowing stakeholders to visualize the project in its context.
- ***BIM collaboration software:*** Enables project stakeholders to share and collaborate on models, drawings, documents, and other data. A common data environment (CDE) is a crucial tool for BIM implementation in infrastructure projects

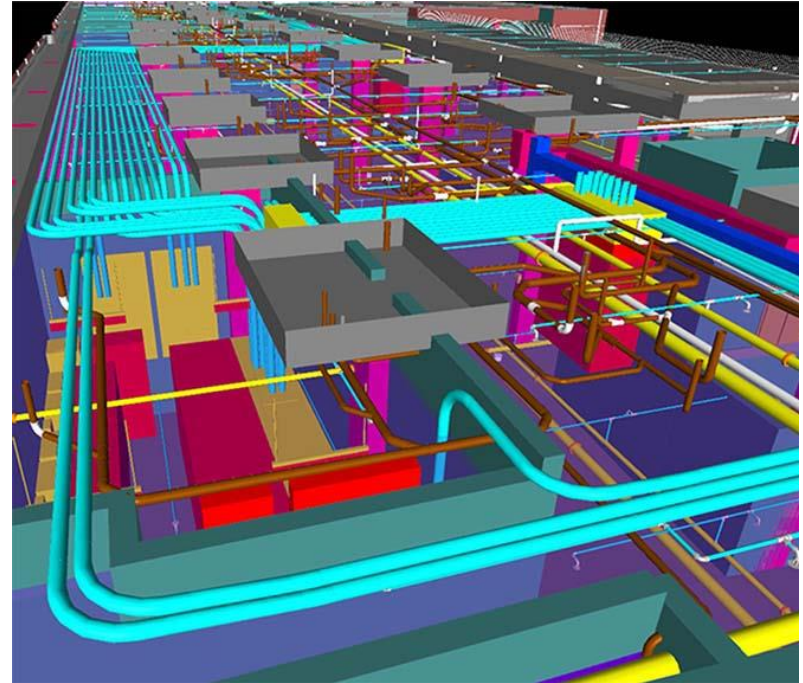
### Most popular solutions

- ***Autodesk Civil 3D*** is one of the most popular BIM software supporting infrastructure designers
- ***Autodesk InfraWorks*** can be used to visualize and analyze infrastructure projects in the context of their surrounding environment. It can seamlessly integrate geospatial data.
- ***Autodesk Revit*** is the most popular construction BIM modeling software in the world.

## What is BIM for facilities management?

BIM for facilities management (or FM) is a process that uses a digital representation of a building and its systems to **improve the efficiency and effectiveness of facilities management operations.**

In the context of facilities management, BIM can be used to manage and maintain the facility throughout its lifecycle, including tasks such as **space planning, asset management, maintenance scheduling, and energy analysis.** It helps improve efficiency, collaboration, and decision-making in facility management processes.



## BIM uses for facilities management

Facility managers are finding value in a number of areas of **building operations** that benefit from enhanced BIM data.

BIM applications in facilities management include:

- Space management
- Asset management
- Maintenance planning
- Energy management
- Safety and security
- Cost estimation and budgeting
- Construction sustainability

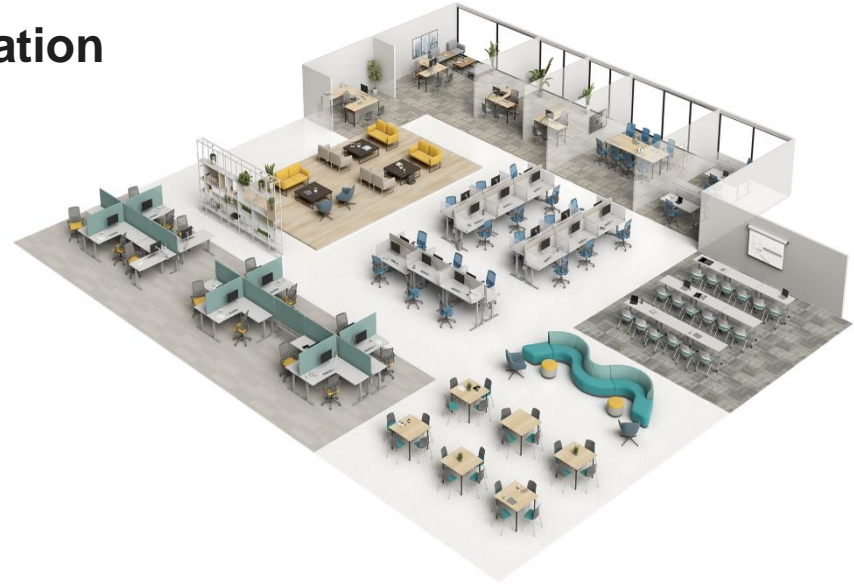


## BIM for space management and optimization

BIM models provide 3D visualizations of spaces, enabling facilities managers to optimize space utilization, identify underutilized areas, and plan for future expansion.

This approach ensures that space allocation aligns with organizational needs and maximizes utilization efficiency.

By understanding the details of how space is used, facility professionals can reduce vacancy and ultimately achieve major reductions in real estate expenses. The room and area information in BIM models are the foundation for good space management.





## BIM for asset management and inventory

BIM asset management is the strategic management of an asset through BIM.

BIM can be used to create a comprehensive digital asset inventory for a facility. This inventory can include information about the **location, condition, specifications, and maintenance history** of each asset.

This information can be used to track the lifecycle of assets, identify areas for maintenance, and plan for asset replacement.





## BIM for maintenance planning and scheduling

BIM can be used to automate the creation of preventive maintenance schedules based on the condition and usage of assets.

This can help to prevent breakdowns, extend the lifespan of assets, and reduce maintenance costs.



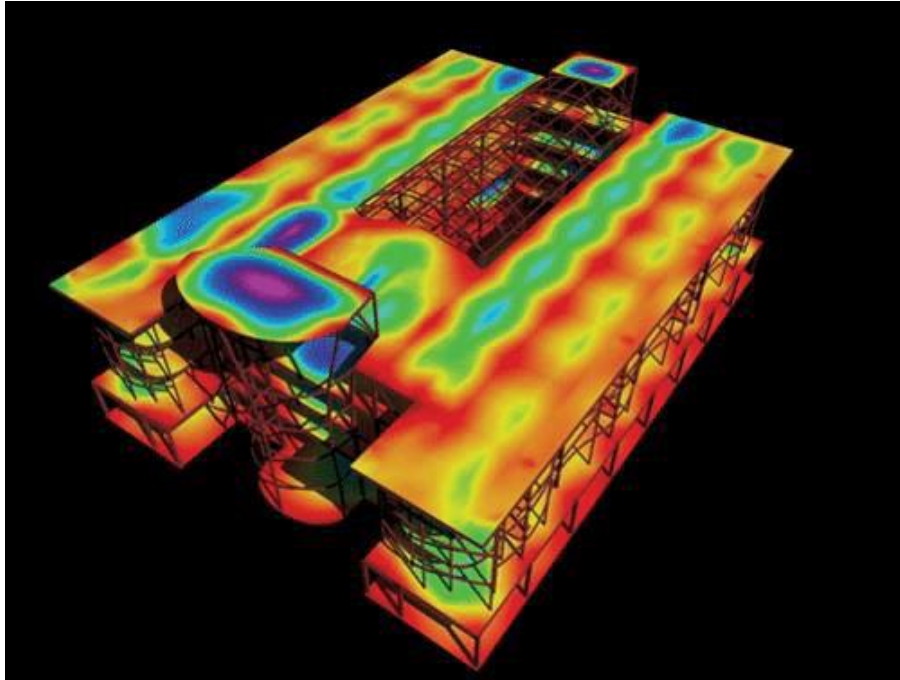
## BIM and construction sustainability

6D BIM integrates environmental data into the model. Builds on all the other dimensions to help optimize the building's environmental performance. It considers the building's entire lifecycle and includes data like energy consumption and environmental impact.

It is essential during the design and planning stage, as it helps teams evaluate different design options and identify the most sustainable approach.

It also comes into play during operations and maintenance aiding teams with managing energy systems.





## BIM for efficient use of energy

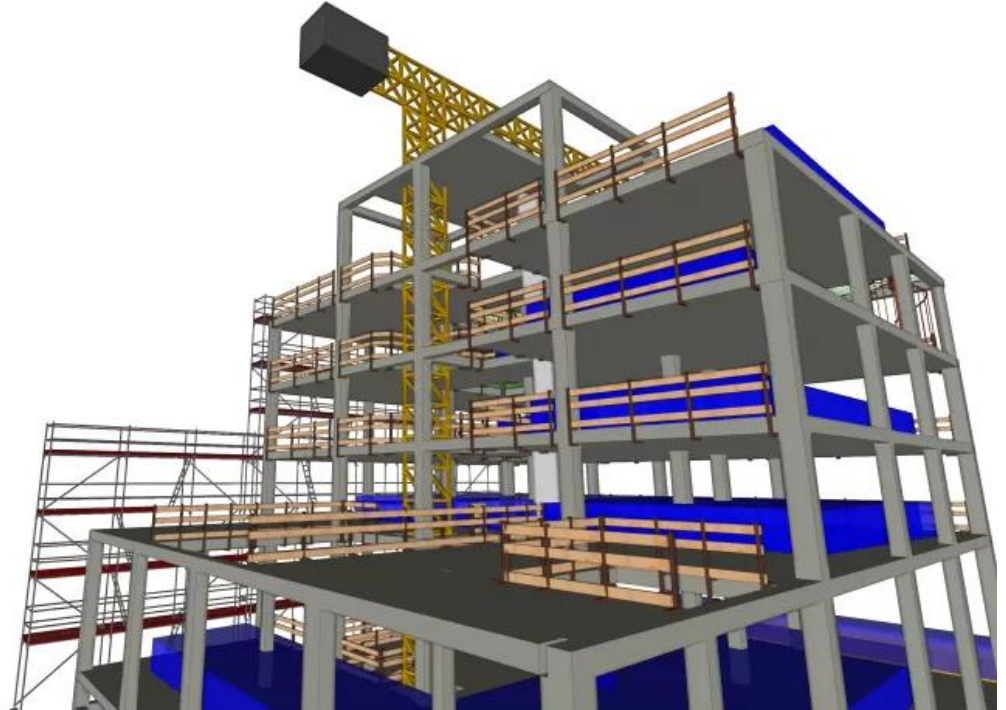
BIM can be used to simulate the energy performance of a facility, identifying areas for improvement and potential energy savings.

This analysis can guide the optimization of HVAC systems, lighting controls, and other energy-consuming equipment, leading to significant cost reductions and environmental benefits.

## BIM for safety and security

BIM can be used to identify potential safety hazards, such as obstructed walkways, malfunctioning equipment, or poorly maintained fire safety systems.

This proactive approach helps to enhance safety for building occupants and comply with safety regulations.



## BIM for cost estimation and budgeting

BIM can be used to generate **accurate** cost estimates and budgeting for maintenance, repairs, and upgrades, providing a reliable basis for financial planning.

This transparency ensures that costs are managed effectively and aligned with organizational goals.

Here are some of the ways that BIM can be used for cost estimation and budgeting:

- ✓ Generate accurate quantity **take-offs** for all materials and components of a building. This can help to ensure that estimates are based on real data, rather than guesswork.
- ✓ Identify conflicts between different trades or over-specifying materials.
- ✓ Identifying opportunities to reduce material usage or simplify construction methods.
- ✓ Develop life-cycle cost estimates for a building, which consider the costs of operation, maintenance, and disposal.

## **COBie: BIM interoperability for facility management**

COBie allows the information necessary for the management and maintenance phase of a building or infrastructure to be integrated into the BIM process.

### **Key Features of COBie:**

- Standardized format for capturing and managing operational and maintenance information
- Compatible with IFC, the industry-standard building information model data format
- Readily editable in Microsoft Excel
- Facilitates data sharing between construction and management teams

COBie is developed and maintained by the Building Smart Alliance and is becoming increasingly popular due to its benefits and its alignment with industry standards.



### **What is openBIM?**

<https://www.buildingsmart.org/about/openbim/openbim-definition/>

### **IFC standard**

- <https://technical.buildingsmart.org/standards/ifc/>
- <https://www.iso.org/standard/70303.html>

### **ISO 19650**

<https://www.iso.org/standard/68078.html>

### **COBie standard**

[https://nationalbimstandard.org/files/COBie-v3-Standard\\_Executive-Summary\\_DRAFT061322.pdf](https://nationalbimstandard.org/files/COBie-v3-Standard_Executive-Summary_DRAFT061322.pdf)

### **EU BIM Task Group Handbook 2017**

<https://eubim.eu/handbook/>



<https://birgitproject.eu/>

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