BIM for Architects

BIM = Building Information Modeling

- What is BIM?
- Historic overview
- What is BIM good for?
- BIM for architects
- Case Studies
What is BIM?
Definition of BIM, Historic overview

BUILDING INFORMATION MODELING

Definition of BIM

Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.

**BIM Historic Overview**

- **1974:** BDS - Building Description System
- **1982:** 3D Collision Detection
- **1984:** VB Virtual Building
- **1992:** BIM Building Information Modeling
- **1998:** NURBS Surface Modeling
- **2000:** Paramatric Modeling
- **2005:** OPEN BIM – Open collaboration

**1974: BDS**

Building Description System

The goal is the "paperless" design documentation that provides additional benefits:

- **Simple design input** of complex building components,
- **Re-use** of exiting elements,
- **Generated building views**, renders,
- **Automated** building element schedules, surveys

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The four hierarchy level of the Building Description System database

1982: 3D Collision Detection

The very first 3D collision detection program was created in 1982 to check service systems of an atomic reactor

- it was running on a personal computer (HP 9000 technical computer)
- it could generate 3D models of pipe (with circular cross section) elements and systems
- it could perform collision detection between pipe systems

1984: VB

Virtual Building

Graphisoft Archicad 1.0 was released in 1984 for the Apple Lisa personal computer

- 3D building modeling with automatically generated views
- Parametric shapes with unique 3D geometry could also be created using the GDL scripting language.
1992: Building Information Modeling

The first paper on BIM was published in 1992 at the Technical University of Delft, this underlined:

- there’s no tight and organized link between the architectural and engineering “information” systems,
- The paper emphasizes the importance and advantages of the reference-model based workflow.

1998: NURBS Surface Modeling


- NURBS (non-uniform rational basis spline) analytical and geometry modeling application
- Provides easy and fast 3D “free-form” surface modeling for the general public
Revit Technologies announced Revit 1.0 in 2000 for Microsoft Windows operating system.

- The application uses a "parametric" engine used by mechanical engineering application.
- It enables to establish 2-way connection between building model elements.

BuildingSMART initiated OPEN BIM in 2005:

- BIM based design development and documentation workflows
- OPEN standards
- Applicable for the entire life-cycle of the building and accessible for all participants regardless the software application they use.
What is BIM?

CAD = Computer Aided Design Drawing

Paper → CAD

CAD = Computer Aided Design Drawing
What is BIM?

BIM = Building Information Modeling = ?

BIM = Computer program?
BIM = 3D building model?

BIM = Collection of Building Data?

Building Analysis
Documentation
Construction
Fabrication
Logistics
Operation & Maintenance
Design
Conceptual Design
Renovation
Whole Life-cycle

Bond Bryan Architects, UK
**BIM = Collection of Building Data?**

**DESIGN**
- Schematic design
- Construction docs.
- Building Analysis
- Design documents

**BUILD**
- Fabrication
- Construction 4D, 5D

**OPERATE**
- Renovation
- Maintenance

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**What is BIM?**

- Computer program
- 3D building model
- Building Data collection

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Levente FILETOTH, filetoth@egt.bme.hu
What is BIM?

BIM = Building Information Modeling

= Information + 3D

Structural information
Building Energetics
Standards, Rules, Codes
Fire Regs., Bldg. Physics
Manufacturer data
Construction, Logistics
Maintenance, Operation
Budget, Costs, Fees
What is BIM?

BIM requires a 3D building model,

yet BIM is much more than
• 3D geometry and
• Texture

What is BIM?

BIM contains the virtual representation of real life

• building elements,
• systems,
• components.
What is BIM?

BIM contains the virtual representation of real life

- building elements,
- systems,
- components.

What is BIM?

BIM enables the complete virtual simulation of the entire, real building, before starting the construction processes.
Virtual Simulation

Simulation Postprocessor

In 6 months of working with SIMULIA we realized a dream of going from this ...

Honda R&D Americas, Inc. May 2014
Virtual Building and Simulation

What is BIM?

BIM enables the complete virtual simulation of the entire, real building, before starting the construction processes.
What is BIM good for?
Faster design development, open project coordination

BIM based design development
20% - 50% savings on total time duration

2D CAD design development
Total (100%) time duration
What is BIM good for?
Faster design development, open project coordination

- Duration
- Coordination

What is BIM good for?
Faster design development, open project coordination

Conventional design, document and build workflow

BIM based workflow
Why OPEN BIM™ is even better?
Faster design development, open project coordination

OPEN BIM design coordination and collaboration, www.buildingsmart.org
Why OPEN BIM™ is even better?

OPEN BIM is a universal approach to the collaborative design, realization and operation of buildings based on open standards and workflows, accessible to all participants.

- Design
- Procure
- Assemble
- Operate

OPEN BIM design coordination and collaboration, www.buildingsmart.org

OPEN BIM™ = OPEN project coordination

Over 200 software applications support the OPEN BIM workflows and standards

- Allplan
- ArchiCAD
- Revit
- Spirit
- EliteCAD
- Vectorworks
- Solibri
- DDS-CAD MEP
- Dialux
- Revit MEP
- Energy Plus
- Vico Office

OPEN BIM design coordination and collaboration, www.buildingsmart-tech.org/implementation/implementations
OPEN BIM™ = 5D Construction

Design + Costs + Time = 5D

OPEN BIM for the entire building life-cycle, www.vicosoftware.com

OPEN BIM™ = Teljes életcikus támogatás

Design + Construct + Maintain = Whole Life-cycle

OPEN BIM for the entire building life-cycle, www.baboonlab.com
Why OPEN BIM™ is even better?

- Platform independent support
- Standard, open data exchange
- Safe & secure information flow
- Optimizes production, less waste
- 4D & 5D construction management
- Whole building lifecycle support

Nyílt alapú, struktúrált tervkoordináció, www.buildingsmart.org
What is BIM good for?

BIM = Faster **design development**

OPEN BIM™ = Open, standard **project coordination**

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BIM for Architects

**BIM in the architectural design practice**

- BIM Based Design
- Documentation
- Renderings, Animations
- Algorithmic Design
- Energy Evaluation
- Teamwork
- Interactive presentation
- Coordination
- Construction
- Smart City

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Frank Lloyd Wright: Solomon Guggenheim Museum (ARCHICAD)
BIM based design development

“One change, one place at one time” while all
- project views,
- documentation layouts,
- detail drawings,
- schedules, etc.
are automatically and instantly updated
Design Documentation

BIM based design development provides various advantages during documentation:

- document versioning,
- revision management,
- layout update,
- support of bid packages,
- auto-update of detail drawings,
- one-click publishing of document sets in various formats.
**Renderings, animations**

The 3D BIM model enables the quick and easy creation of
- presentation renderings,
- photo-realistic views,
- animations
at any stage of the design development and documentation processes.
Algorithmic architecture

“Free-form” building models created through mathematical expressions, in the BIM environment provides advantages during
• design development,
• documentation,
• construction.
Michael Hansmeyer
Computational Architecture
www.michael-hansmeyer.com
TED Talk
BIM and Building Energetics

BIM with energy information enables architects to

• validate design alternatives based on energy consumption,
• quick and accurate analyses,
• perform annual, dynamic energy simulation,
• at any stage of the design development processes.
Energy Conscious Design

Energy Conscious Design + Solar Technologies + Renewable Energy

BIM based building energy evaluation

1. **Building geometry** review
2. Review of **details, materials**
3. **Manual** data input
4. **Dinamic** energy calculation
5. Results displayed as **graphic charts**
Déli felvésű laboratóriumok vizsgálata lombhullató és örökszöld növényekkel (mint természetes árnyékolóval)

Növény nélkül | Örökszöld növény | Lombhullató növény

Szoláris nyereség

Növény nélkül: 38 609 kWh | Örökszöld növény: 31 476 kWh | Lombhullató növény: 33 369 kWh
BIM based building energy evaluation

Energy consumption based refurbishment of an office building
- Evaluation of design alternatives based on energy consumption
- Adding external shading systems on large curtain walls
- Evaluation of renewable energies, passive and active solar systems
Teamwork

BIM work environment enables teamwork in the office and across continent (cloud-based)

- reserve your work area
- real-time messages
- send & receive changes
- offline work
- safe & secure environment

Teamwork with the office
Teamwork across continents
Interactive presentation

BIM enables interactive design presentation

- 2D + 3D content
- interactive walk through
- collaboration is enabled,
- works on mobile devices,
- easy to use,
- manufacturer specific element information can be displayed

Interactive project presentation
Interactive project presentation
BIM based workflows are at the center of open interdisciplinary project collaboration:

- **System independent**, open date exchange,
- **Reference model** based coordination
- Considering local and global standards
- Using **standardized model classes** throughout all processes
Reference Model

Architectural model ≠ Structural or MEP model

Reference Model

Architectural model ≠ Structural or MEP model
OPEN BIM™ Collaboration

1. Design alternative

2. Design alternative

New
Deleted
Modified

Levente FILETOTH,
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Construction

BIM based Tender, Pre-Construction, Construction workflows enables the delivery of more accurate quantity estimations, tight integration of construction management processes while minimizing errors on the site. Faster construction, reduced costs are the ultimate benefits.
Smart City & BIM

BIM provides the primary data core of a Smart City, to be extended with CIM and GIS data to create the so-called “BIG Data”.

Smart City
- infrastructure, transportation, optimized primary energy consumption,
- better urban comfort,
- sustainable future is the ultimate goal.
BIM, CIM, GIS and the Smart City

BIM, CIM, GIS and the Smart City
BIM for Architects

- Computer program
- 3D building model
- Collection of Building Data
- Faster design development
- Open, standardized coordination
- Whole life-cycle support
  - Design
  - Procure
  - Assemble
  - Operate