Module 6

Introduction to BIM

Digitalisation in Construction

24 partners

12 countries

Date of Event

*Author/ **Institute***

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Introduction to BIM | Summary

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To equip the learner with the basic knowledge and skills required to understand the role of Building Information Modelling, (BIM) as part of the digitalisation of the construction industry.

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Introduction to BIM | Objectives

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1. Outline the **background** to Building Information Modelling, BIM
2. Define the methodology and **principles of BIM**
3. Outline **why BIM** is important for the construction industry
4. List and outline the **BIM Dimensions** (2D-7D).
5. List and outline the **BIM Maturity Stages** and their significance in the move towards a digital construction sector.
6. List and outline the **software and tools** that can be used in the BIM process
7. Identify and outline **BIM-viewers** to be used for collaboration in the construction industry

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Introduction to BIM | Content

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Topic 1 – BIM fundamentals

Topic 2 – BIM principles

Topic 3 – BIM uses and software

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1. BIM Fundamentals

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BIM Fundamentals

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BACKGROUND

Many technologies have been created in the past 50 years

- First PC - 1981
- First mobile phone - 1984
- Internet and Email - 1990s

These have contributed to be more efficient in some tasks. We don't need to create plans from paper, we have computers to make as many changes as required. Also we can save a huge amount of documentation through digital storage devices and not with paper (that takes a lot of physical resources and space).

Now we can contact someone in every moment: in our studio, while we are going somewhere on public transport or even when we are on site.

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Definition of BIM

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BIM is..

Process for creating and managing information on a construction project across the project lifecycle

This exchange of information can be done though the use of collaboration tools and modelling software such as

Building Information Modelling/Management

AUTODESK REVIT

GRAPHISOFT ARCHICAD

ALLPLAN

SketchUp

Source: Si!BIM Project

Online Collaboration

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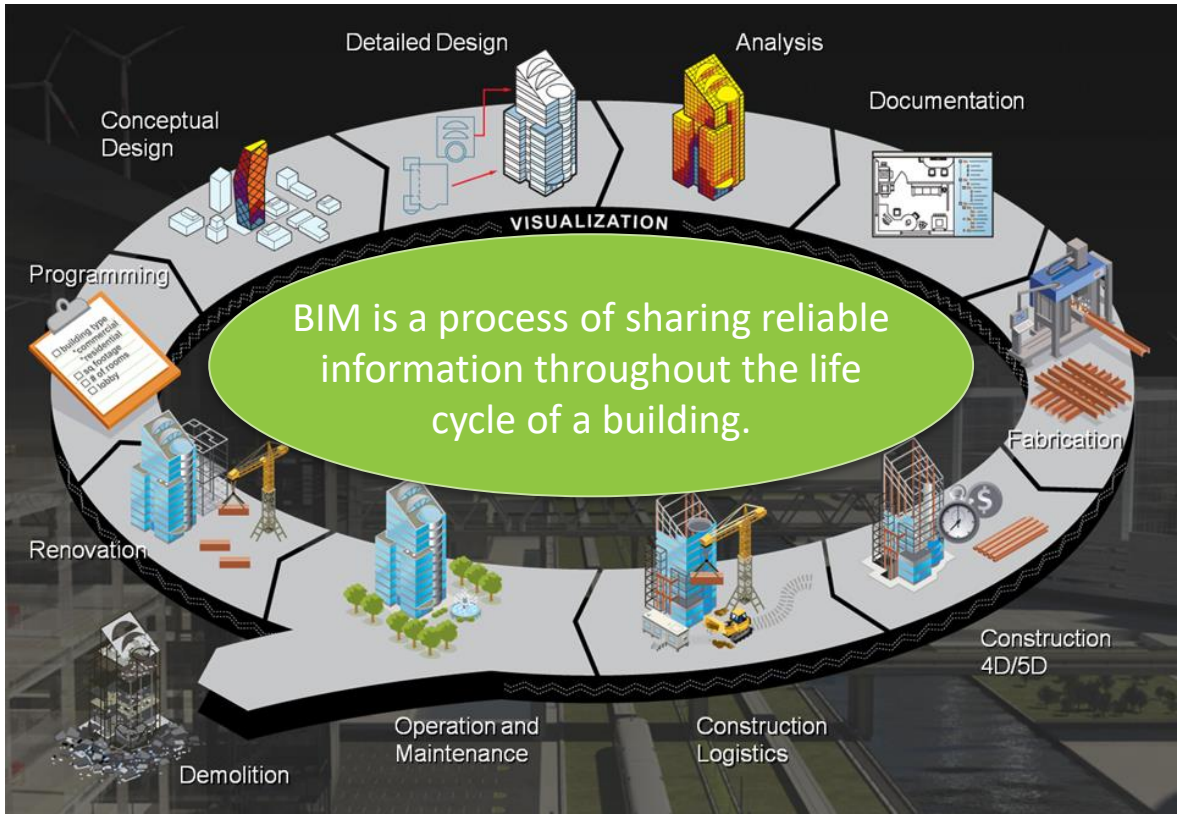
BIM is...

A collaborative working method that makes use of **3D digital models** that contain **technical and structured data**, which improves the traditional approach



Source : http://buildipedia.com/aec-pros/design-news/the-daily-life-of-building-information-modeling-bim

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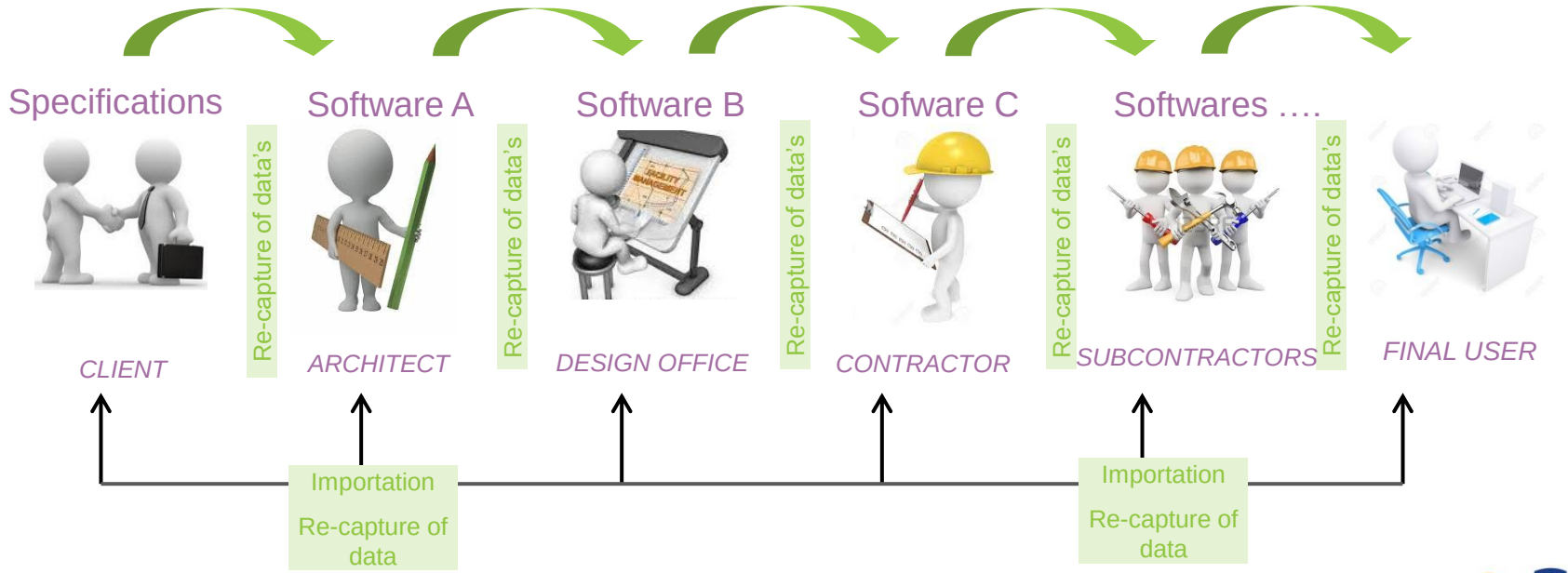
Traditional Process

There is a **LACK OF COMPATIBILITY**

- of software used by designers
- of data imports and duplication of operations



Source: Si!BIM Project

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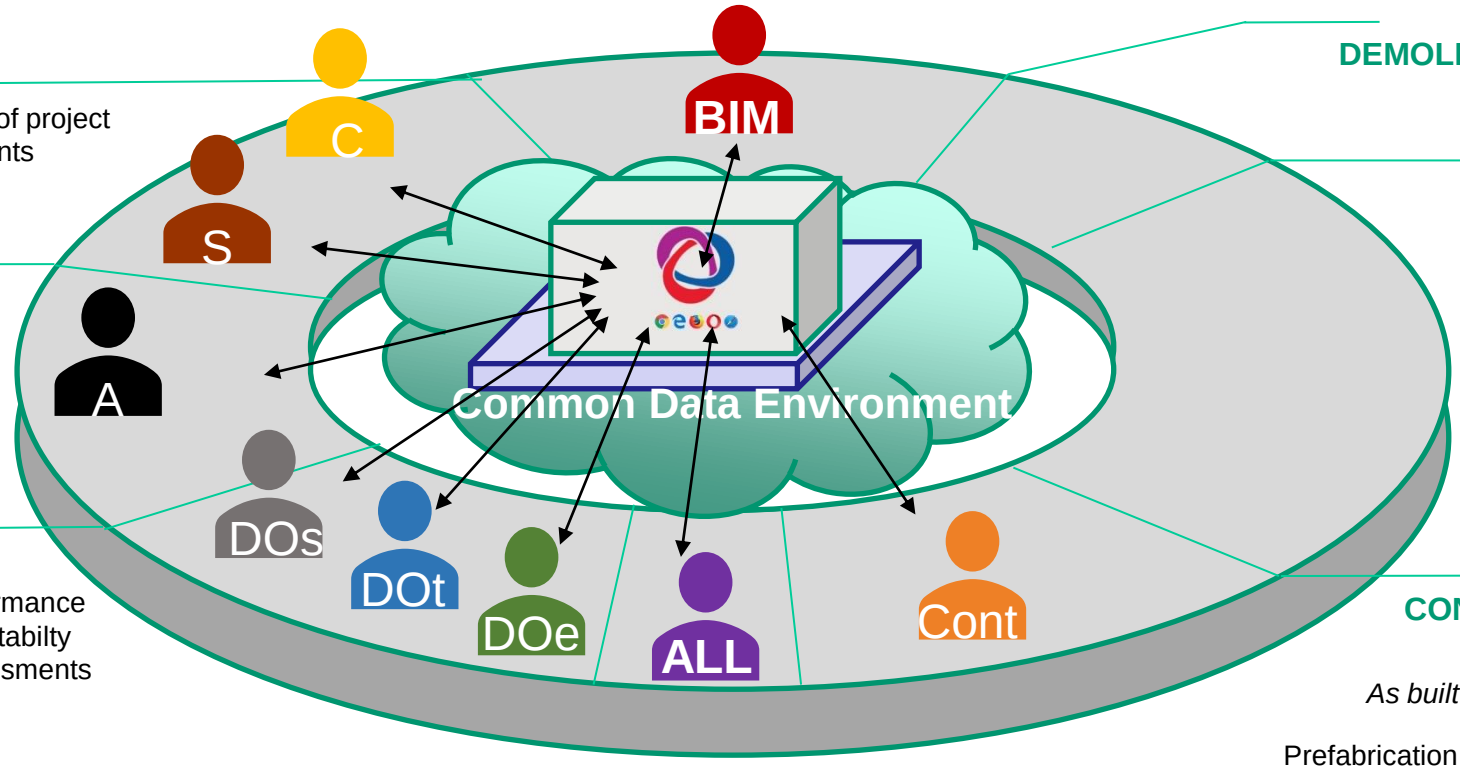
BIM Process



PREPARATION & PROJECT BRIEF

Definition of project requirements

Analysis and Modelling of Existing Conditions

ARCHITECTURAL DESIGN

Architectural model

Project presentation and dissemination

TECHNICAL DESIGN

Structure model

Performance and Stabilty Assessments

Specialist technical model

Environmental Impact

Simulations to assess future performances (Thermal, Luminosity, Acoustic, etc.)

Analysis of the Building's Actual Performance

Production of deliverables

Standards and Compliance

Cost estimation

Planning

Site management

Prefabrication

As built model

CONSTRUCTION

USE & MAINTENANCE

DEMOLITION

Source: Si!BIM Project

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Information Management

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The digital model, BUILDING BEFORE IT IS BUILT.

It is a **database** that contains **information:** the geometry of the building, the position of the elements, performance, properties, materials, behaviours and quantities

- Managing the Common Data Environment
- Project information management
-Collaborative working, information exchange and project team management

Information Manager

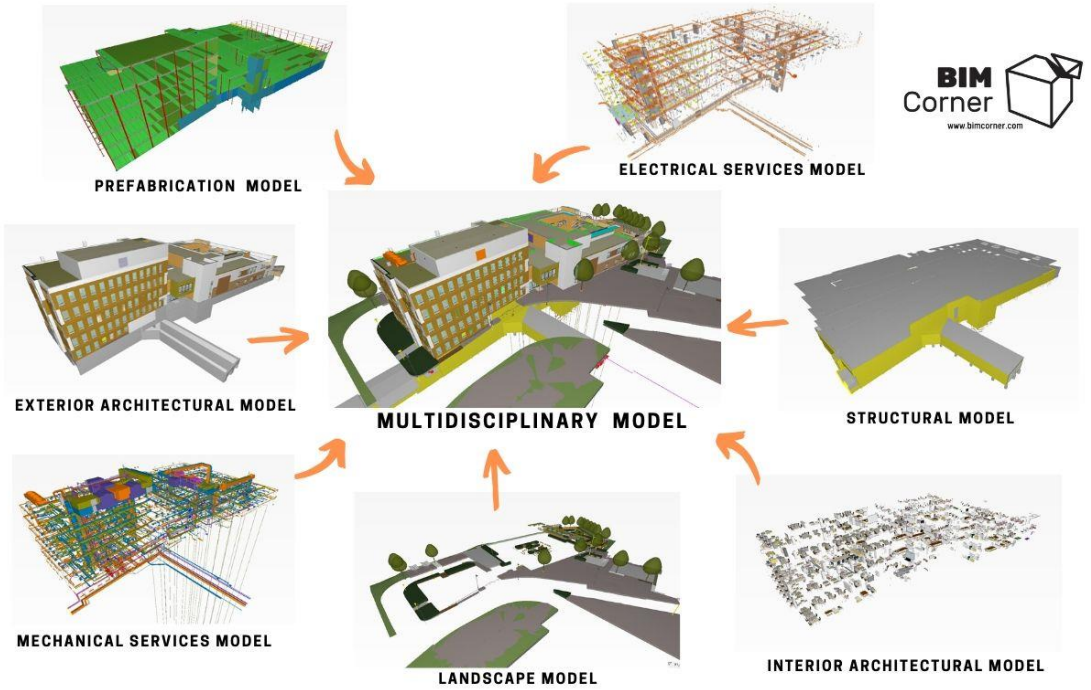

Image source BIM Corner

Source: Si!BIM Project

BIM for information management

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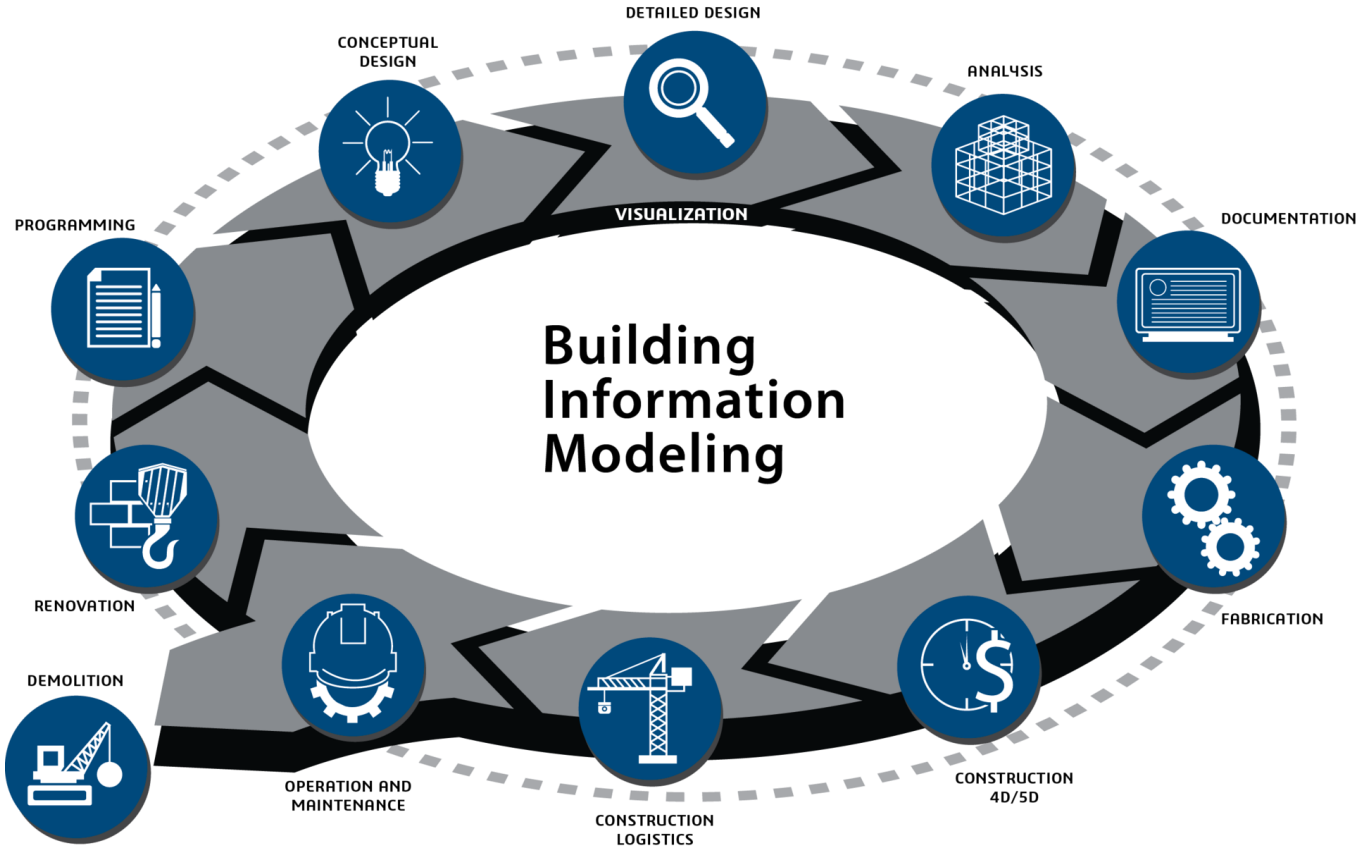
The management of all information for the different phases of the life cycle of a building, from architectural design to post-occupancy maintenance, can be supported on a single common technological environment.

This concept is the basis of Building Information Modeling (BIM) technology.

ALCI´NIA Z. SAMPAIO. The Introduction of the BIM Concept in Civil Engineering Curriculum. International Journal of Engineering Education Vol. 31, No. 1(B), pp. 302–315, 2015



Source: CONDAP Project

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Benefits of BIM

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- Provide support for the project's decision making process
- Parties have a clear understanding of the project objectives and interfaces with other related trades
- Visualize design solutions
- Assist in design and the coordination of designs
- Increase and secure the quality of the building process and the final product
- Make the process during construction more effective and efficient
- Improve safety during construction and throughout the building's lifecycle
- Support the cost and lifecycle analysis of the project
- Support the transfer of project data into data management software during operation

Source: CONDAP Project

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Integrated Project Delivery

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Integrated Project Delivery is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize:

1. project results,
2. increase value to the owner,
3. reduce waste,
4. maximize efficiency through all phases of design, fabrication, and construction

Source: Si!BIM Project

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Integrated project delivery

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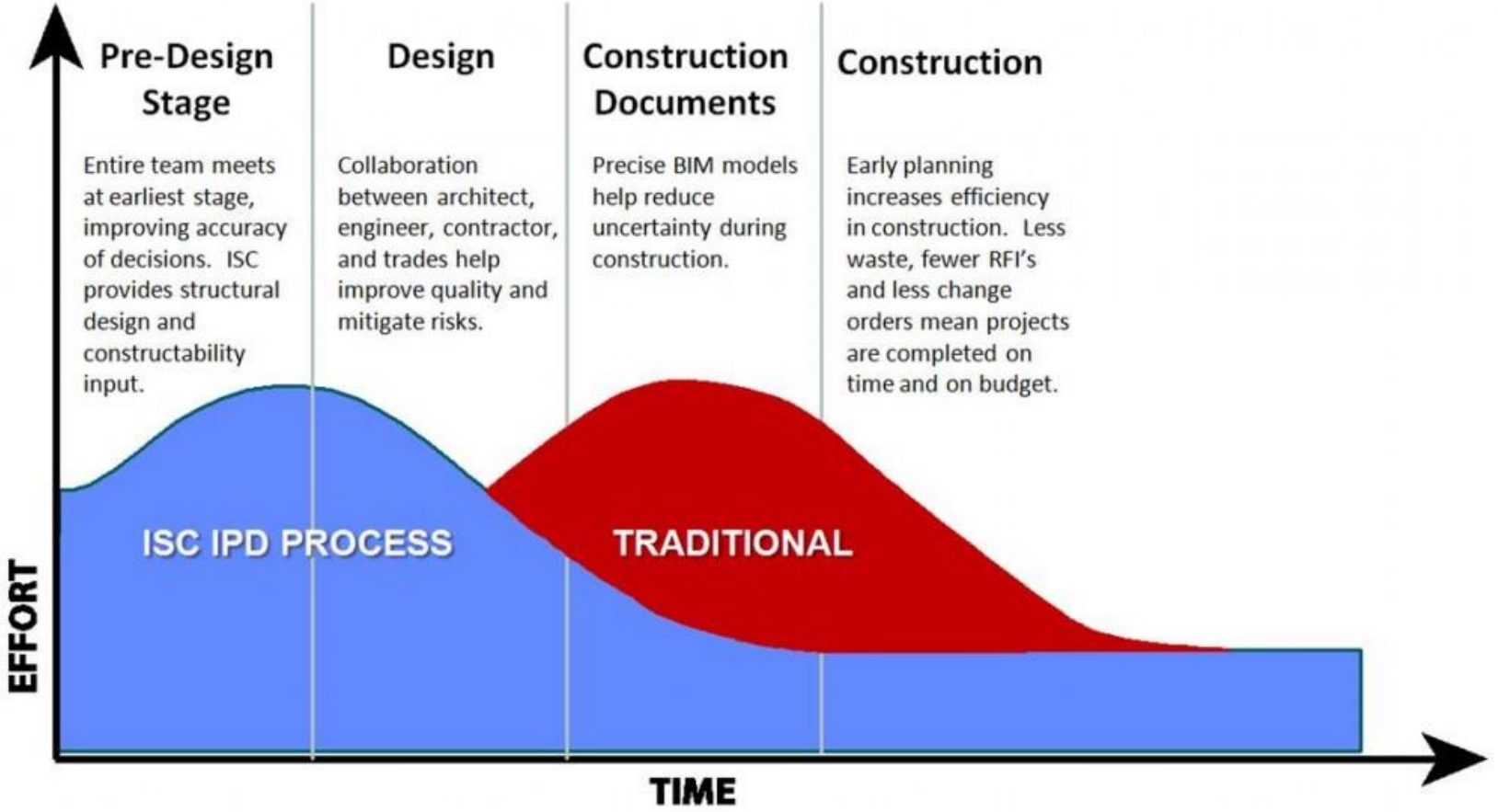

Source: Si!BIM Project

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Definition of BIM

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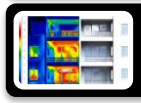
The construction sector faces the following current and future challenges

Innovation and sustainability


Digitalisation


Smart buildings


Energy efficiency


Rising material costs


Waste management

human resources and living space


Labour shortage


Changing of working patterns


Communication


Urbanisation

Health & safety

Source: Si!BIM Project

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2. BIM Principles

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BIM Principles

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BACKGROUND

It’s impossible to build in a perfect way, so it’s impossible to resolve all the specific solutions that a project requires during the project stage or the construction one. There are a lot of issues to take into account and technology can help us to detect some issues that can compromise the quality of the project.

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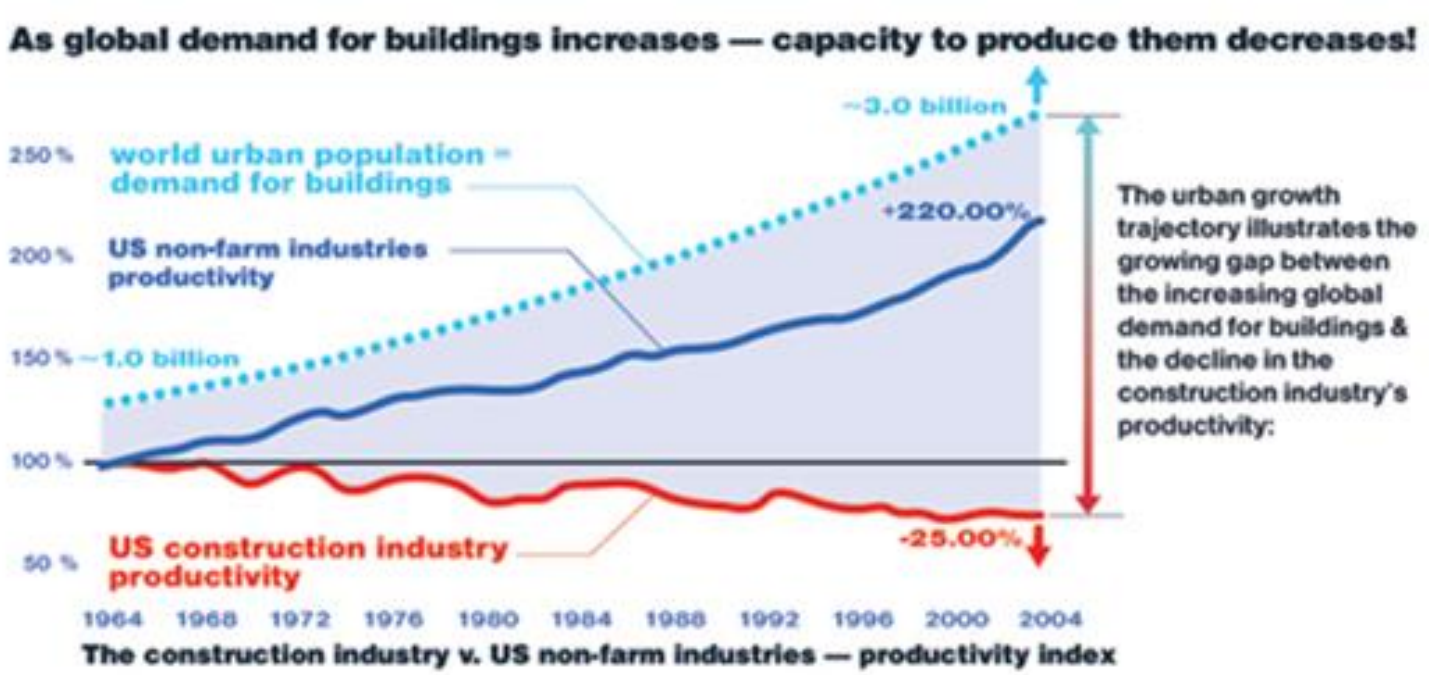
BACKGROUND

This graphic shows us the evolution of productivity in different industries in United States since 1964. It can be interpreted as the productivity evolution in industries in a developed country.

All industries but farm rose their productivity index from 1960s to 2000s.

In only 40 years world urban population increased 2 billion people.

US construction industry productivity falls a 25%.



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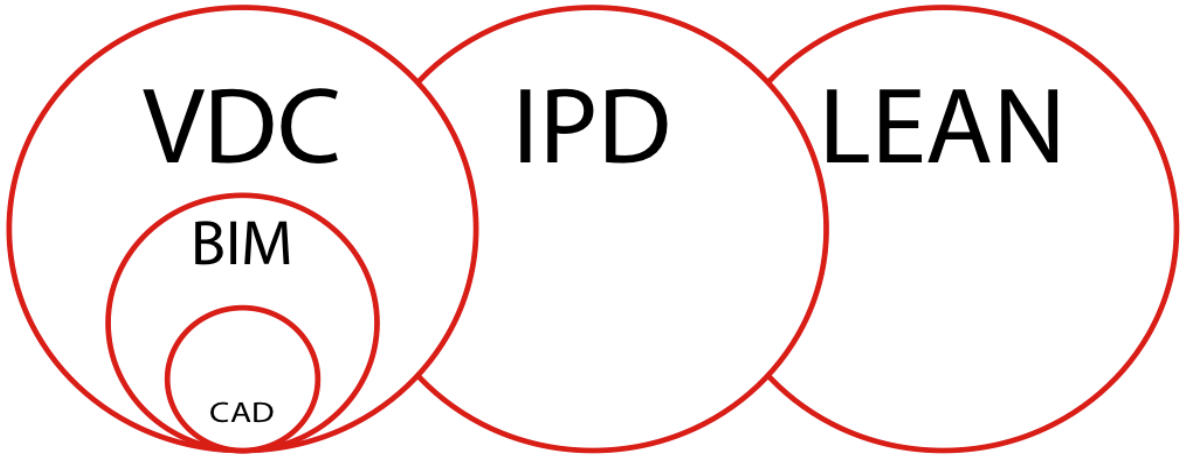
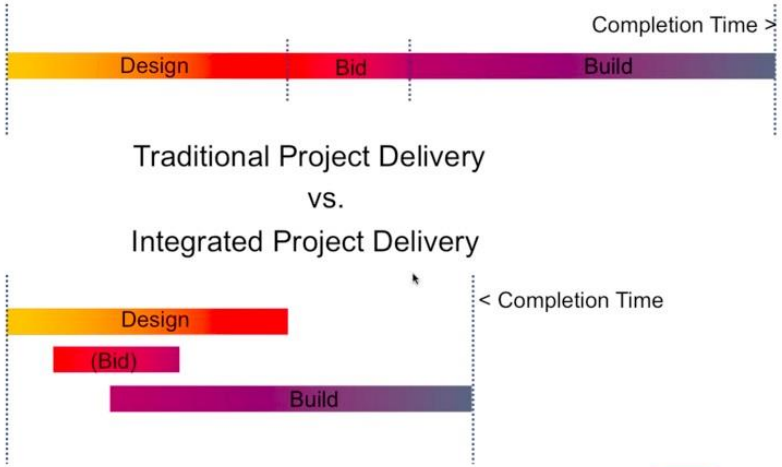
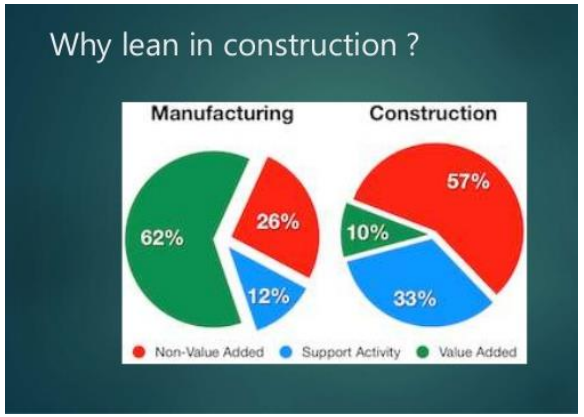
SOLUTION

To increase collaboration, the usage of new technologies in the construction industry and the implementing of new approaches will construction industry productivity.







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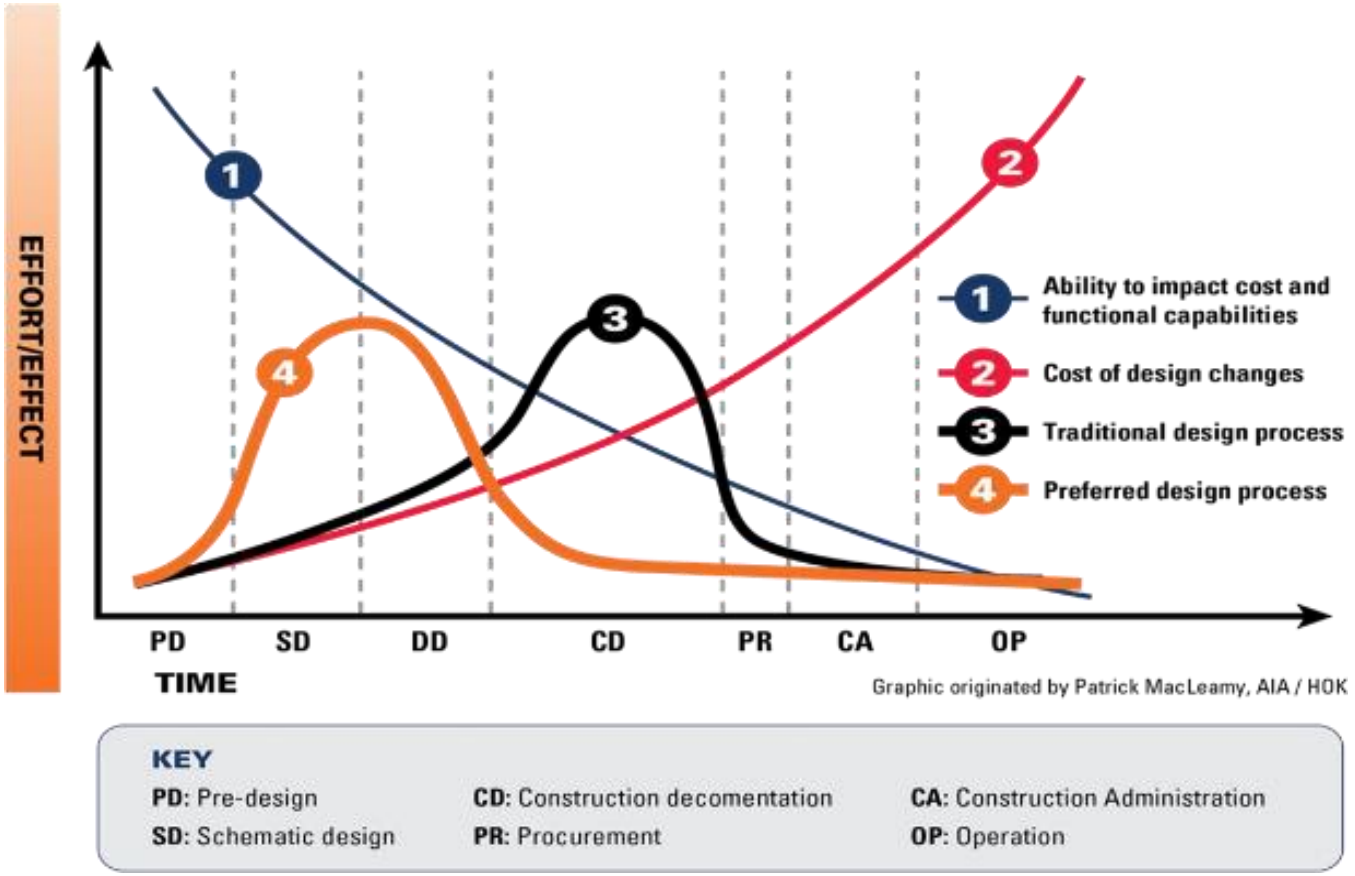
BIM APPROACH

The use of the BIM methodology requires that we anticipate certain decisions at an early stage.

We need to further define the documentation that will be used to build as we are building it digitally at 1:1 scale. That is, at real size.

This allows us to analyse the build, without leaving room for error of interpretation in the documentation. Because we have a 3D model, we are able to analyse it from different aspects.



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BIM APPROACH

BIM is a methodology that allows us to implement a process of creating and managing the information (graphic and non-graphic) of a project throughout all the phases of the life cycle of an asset.

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CAD vs BIM

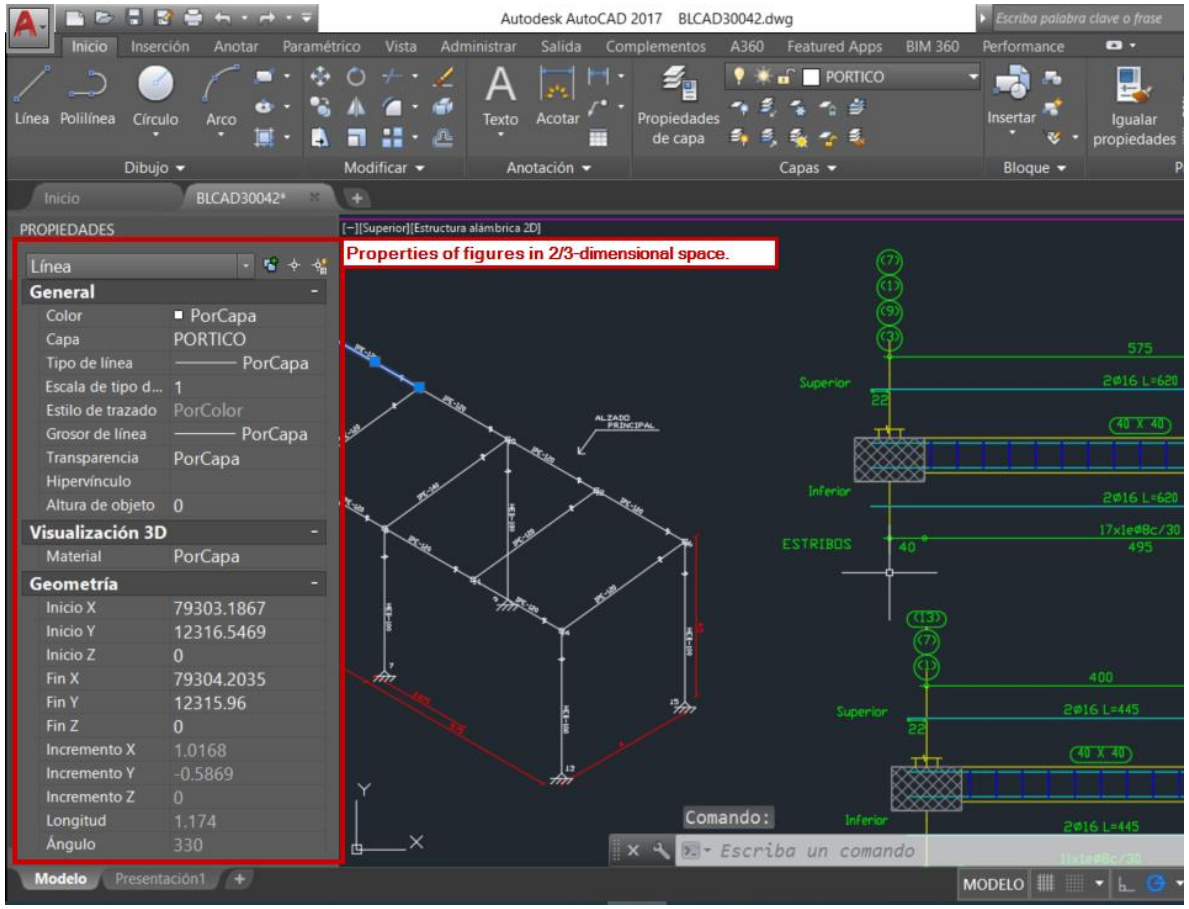
CAD (Computer Alied Design)

Computer Aided Design (CAD) is based on the graphic representation of vectorial geometric entities (such as: lines, points, arcs and polygons).

The software does not interpret what is being represented, the information has to be managed by the user through support tools such as layers, line styles, etc.

CAD programs:

AutoCAD, MicroStation, Catia, Sketch Up, etc



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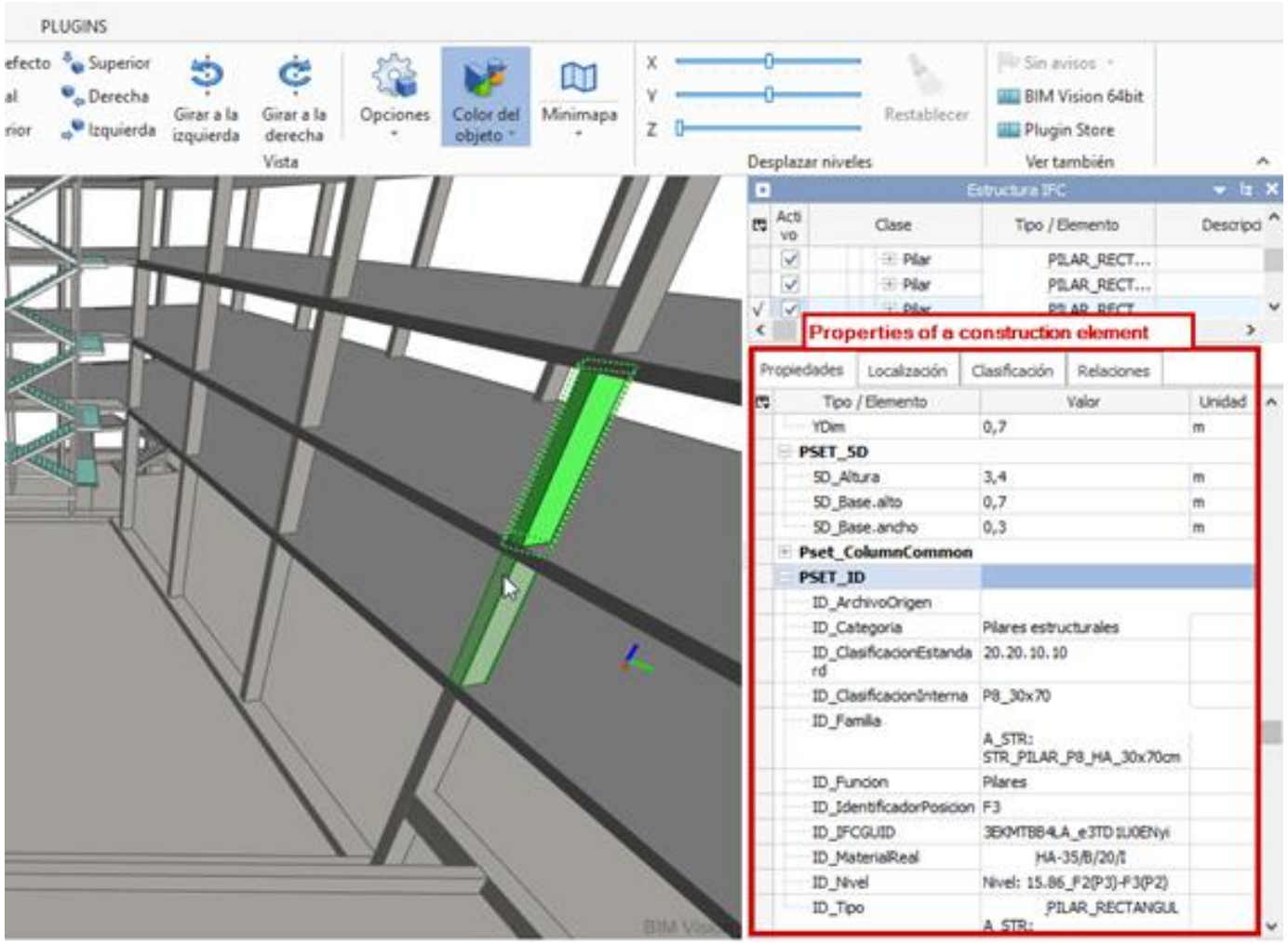
CAD vs BIM

While CAD is based on geometric vector entities, BIM is based on Parameterizable Objects.

The digitization of assets in BIM Objects, allows us to create parameterizable objects in which we can embed any type of information and benefit from it once the project is completed.

In addition, BIM software interprets that a wall and a pillar are different elements (CAD interprets that they are two rectangles) thus allowing the association of specific parameters according to the construction family to which each element belongs.



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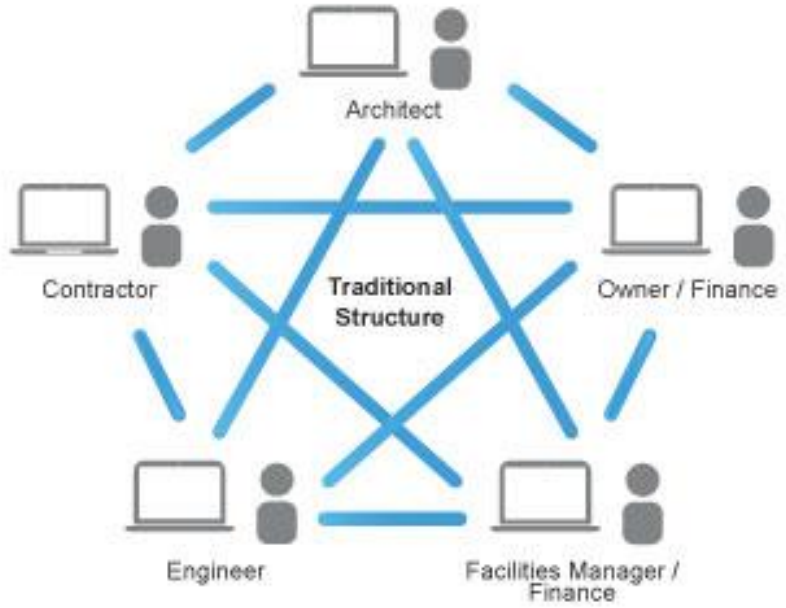
CAD vs BIM

Other key difference between CAD and BIM is the fact of using a centralized model data that you share with your project partners. There is only a model, a single source of information that is shared with all partners at the same time, so they all have access to the last model version.



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1. BIM uses and software

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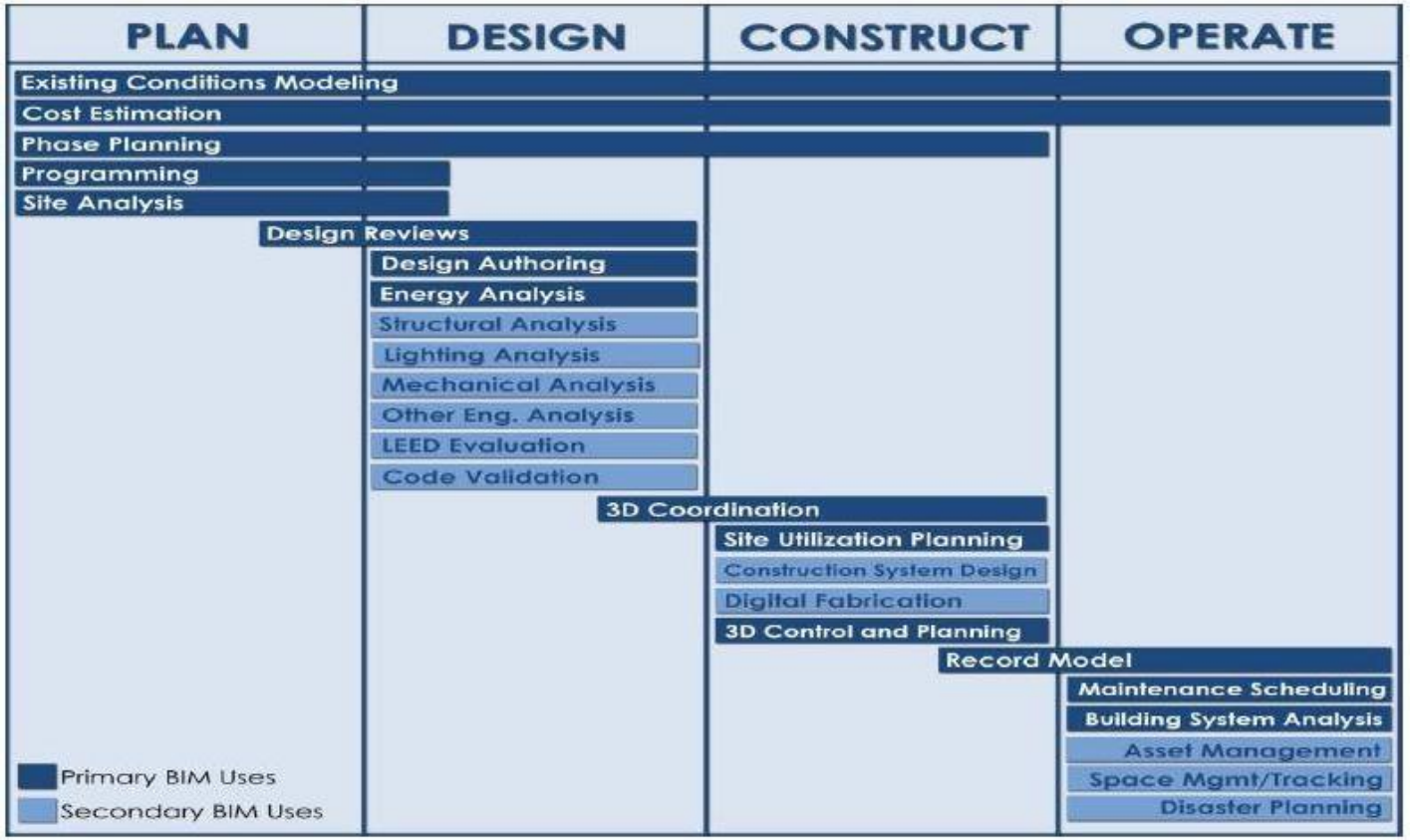
BIM Model exploitation: BIM Uses

Each of the actions we perform through a model are BIM Uses.

The first BIM Uses were defined in "The Uses of BIM" by PENN State University.

This document defines BIM uses, primarily by the purpose that they fulfil on a project, along with additional attributes for each BIM Use, e.g., the scope of work includes, the phase within the lifecycle, the level of development of the model, and the discipline to perform the modelling.



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BIM Uses: Programming

Process in which a spatial program is used to efficiently and accurately assess design performance regarding spatial requirements.

Potential Value

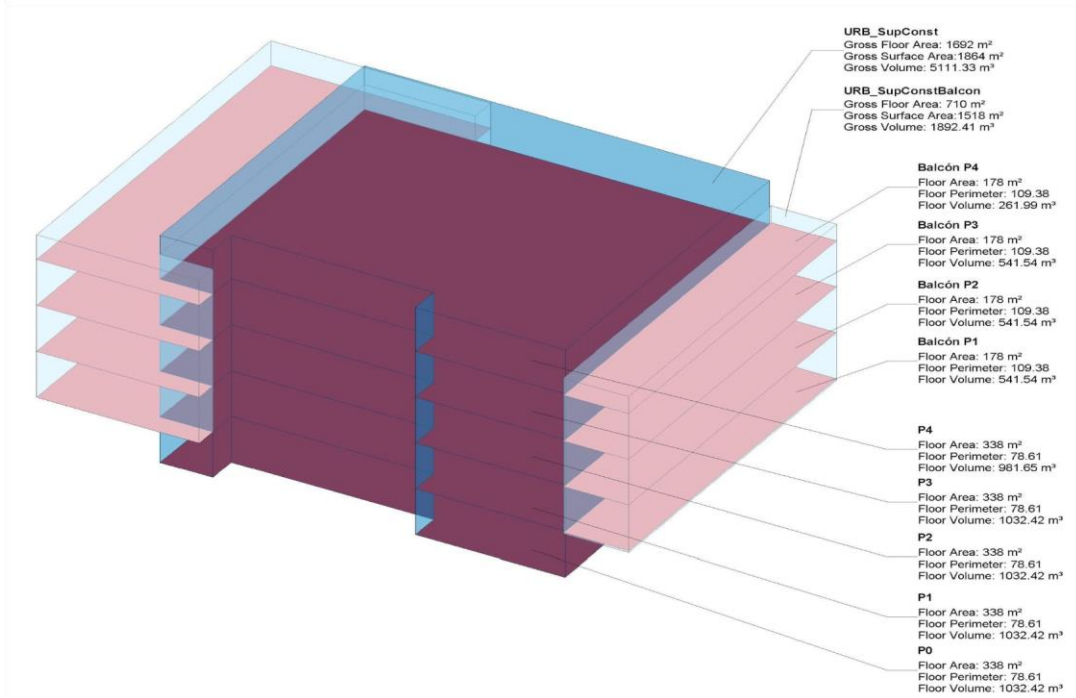
- Efficient and accurate assessment of design performance regarding spatial requirements by the owner.

Resources Required

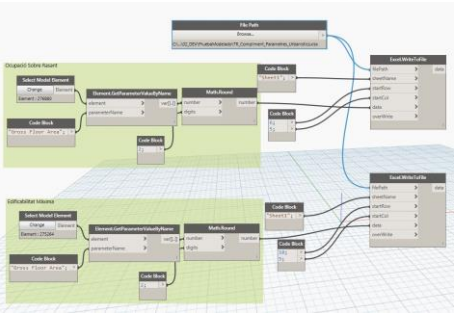
- Design Authoring Software
- Programming Software

Team Competencies Required

- Ability to manipulate, navigate, and review a 3D model.
- Knowledge of regulations and spatial requirements.



	A	B	C	D	E	F
1	1	2	3	4	5	6
2			PLANEJAMENT		PROJECTE	
3	Qualificació Urbanística					
4	Ordenació					
5	Ús del Sòl					
6	Superfície Parcel·la		1.319,48	m2		m2
7	Ocupació Sobre Rasant	40%	527,79	m2	512,84	m2
8	Espai Lliure d'Edificació	Mínim	791,69	m2		m2
9	Ocupació Sota Rasant					
10	Índex Edificabilitat		1,60			
11	Edificabilitat Màxima		2.111,17	m2	517,73	m2
12	Nº Màxim de Plantes	PB+4	5,00			
13	Sup. Const. Màx. Planta		422,23	m2	421,56	m2
14	Sup. Const. Màx. Balcons Planta		105,56	m2	103,26	m2
15	Sup. Màx. Pavimentada	30%				
16	Sup. Mín. Inalterada Parcel.la	10%	131,95	m2		m2
17	Alçada Reguladora		16,70	m		m
18	Alçada Planta Baixa		+/-1 m			



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BIM Uses: Design Review

A process in which stakeholders view a 3D model and provide their feedbacks to validate multiple design aspects.

Potential Value

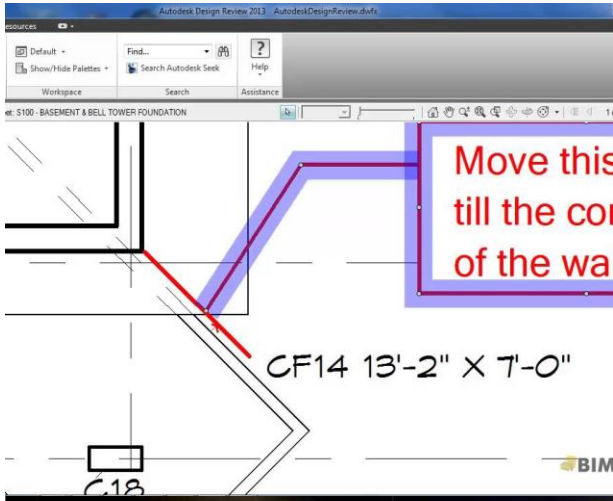
- Eliminate costly and timely traditional construction mock-ups
- Different design options can be changed in real-time during meetings based on owner feedbacks
- Create shorter and more efficient design and design review process
- Get instant feedbacks on owner's needs.
- Increases coordination and communication between different parties.

Resources Required

- Design Review Software
- Hardware which is capable of processing potential large model files

Team Competencies Required

- Ability to manipulate, navigate, and review a 3D model
- Ability to model photo realistically including textures.
- Strong sense of coordination. Understanding roles and responsibilities of team members and understanding how building systems integrate with one other.



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BIM Uses: Cost Estimation

This process allows the project team to see the cost effects of their changes during all phases of the project.

Potential Value

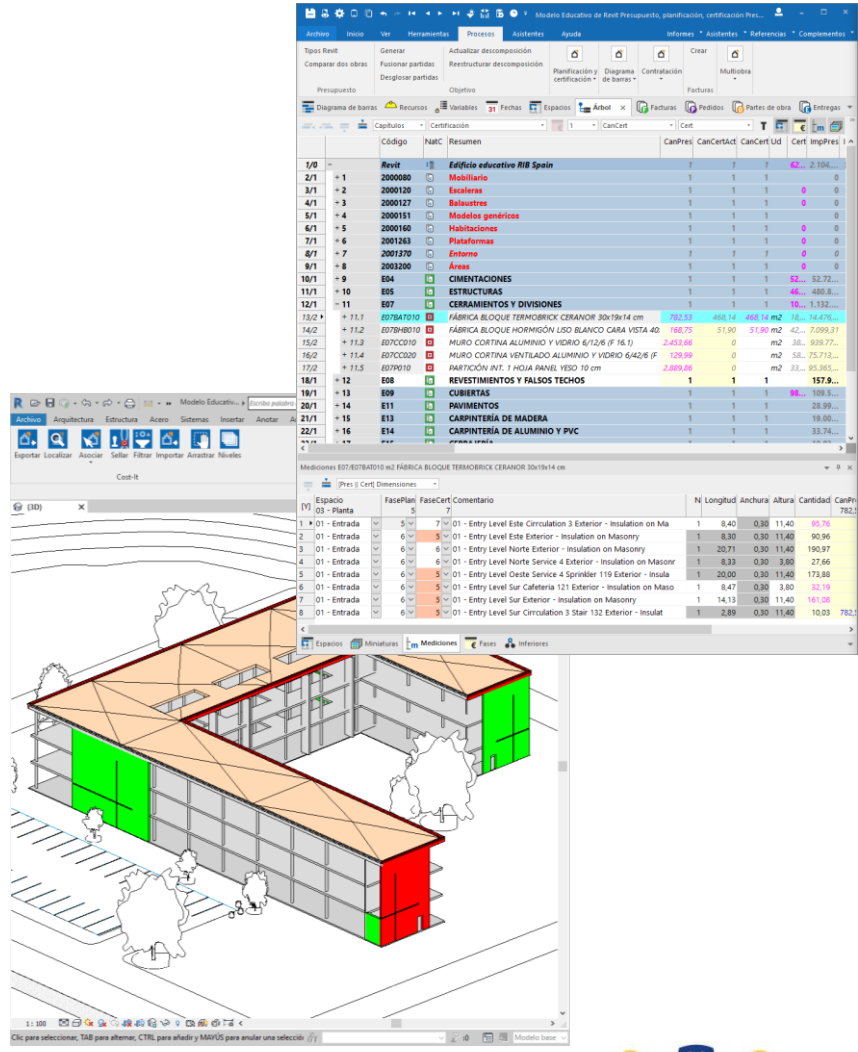
- Precisely quantify modelled materials
- Quickly generate quantities to assist in the decision-making process and generate more cost estimates at a faster rate
- Provide cost information to the owner during the early decision-making phase of design and throughout the lifecycle, including changes during construction
- Easier exploration of different design options and concepts within the owner's budget

Resources Required

- Model-based estimating software
- Design authoring software and accurately built design model
- Cost data (classification systems used in cost estimation workflows)

Team Competencies Required

- Ability to define specific design modelling procedures which yield accurate quantity take-off
- Ability to identify quantities for the appropriate estimating level
- Ability to manipulate models to acquire usable quantities



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BIM Uses: 3D Coordination also known as Clash Detection

The 3D coordination allows the professionals involved to assimilate the complexity of the design which translates into greater efficiency in its resolution.

Potential Value

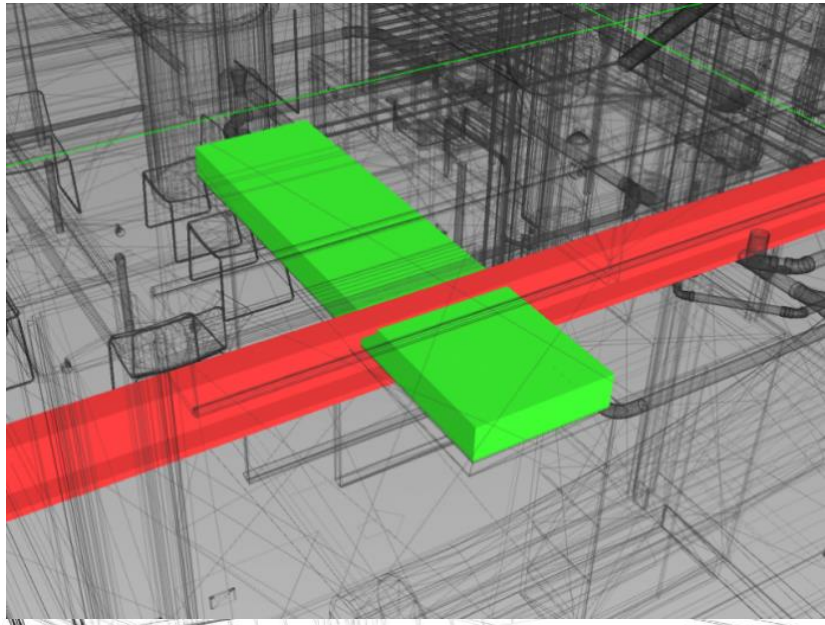
- Coordinate building project through a model
- Reduce and eliminate field conflicts.
- Reduced construction cost; potentially less cost growth (i.e. less change orders) and decrease construction time and increase productivity on site
- More accurate as built drawings

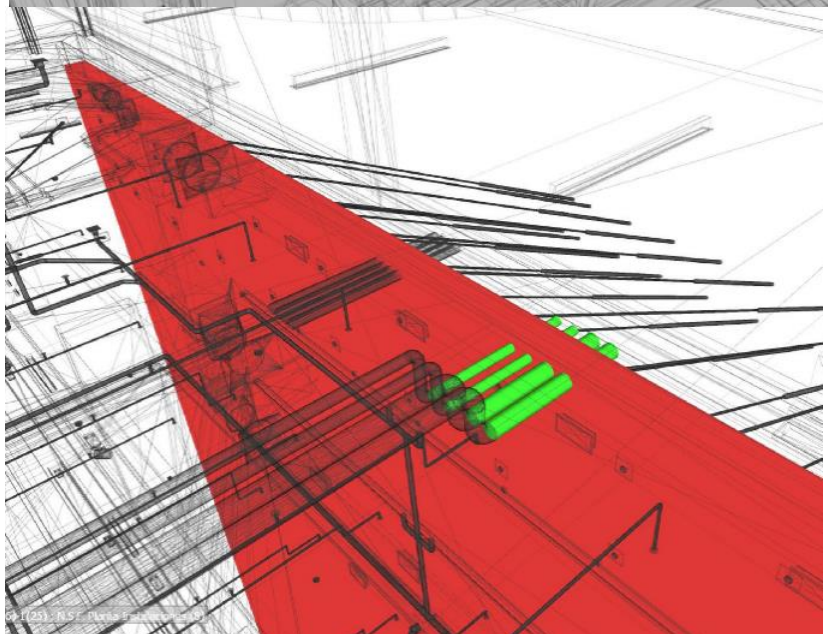
Resources Required

- Design Authoring Software
- Model Review Software

Team Competencies Required

- Ability to deal with people and project challenges
- Ability to manipulate, navigate, and review a 3D model
- Knowledge of building systems





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BIM Uses: Design Authoring

A process in which 3D software is used to develop a Building Information Model based on criteria that is important to the translation of the building's design.

Potential Value

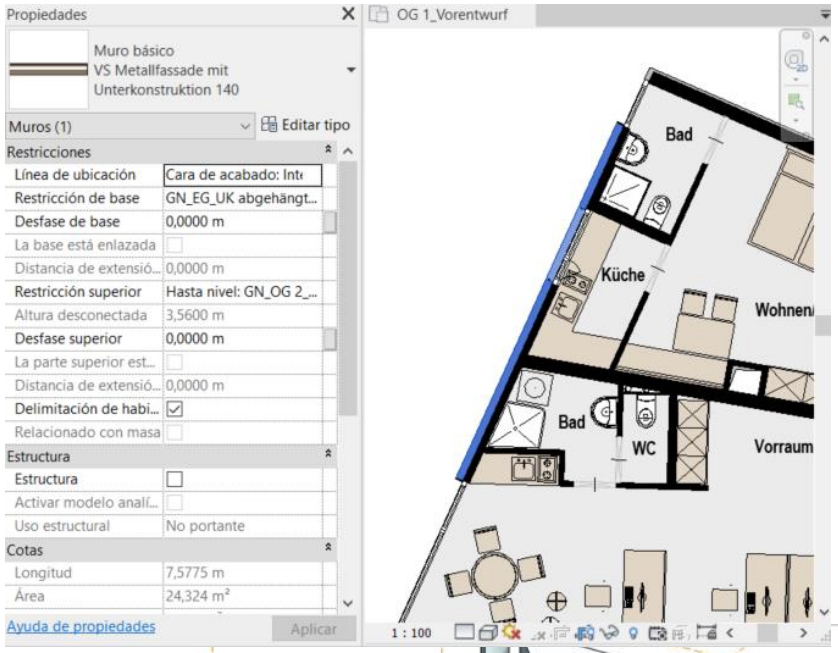
- Transparency of design for all stakeholders
- Better control and quality control of design, cost and schedule
- Powerful design visualization
- True collaboration between project stakeholders and BIM users
- Improved quality control and assurance

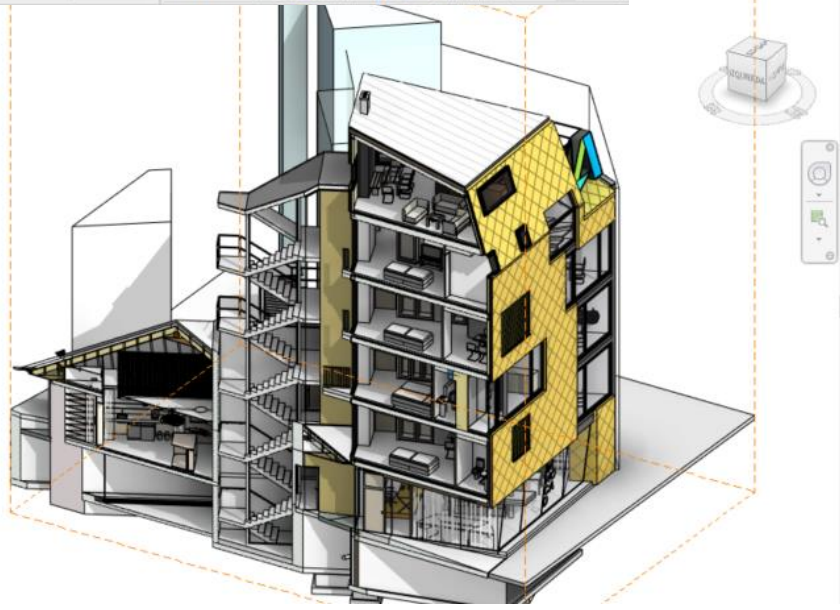
Resources Required

- Design Authoring Software

Team Competencies Required

- Ability to manipulate, navigate, and review a 3D model
- Knowledge of construction means and methods
- Design and construction experience





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BIM Uses: Energy Analysis

A process in the design phase which one or more building energy simulation programs use a properly adjusted BIM model to conduct energy assessments for the current building design.

Potential Value

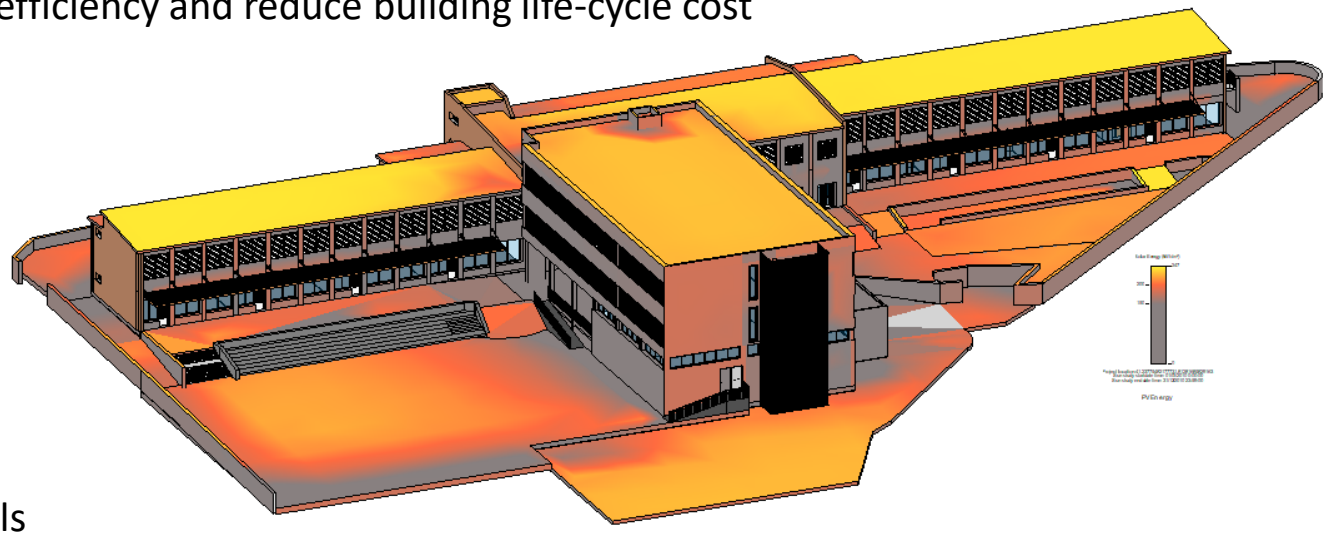
- Save time and costs by obtaining building and system information automatically from BIM model instead of inputting data manually twice. For example: geometries, volumes precisely from BIM model
- Help with building energy code verification
- Optimize building design for better building performance efficiency and reduce building life-cycle cost

Resources Required

- Building Energy Simulation and Analysis Software(s)
- Well-adjusted Building 3D-BIM Model
- Detailed Local Weather Data
- National/Local Building Energy Standards

Team Competencies Required

- Knowledge of basic building energy systems
- Knowledge of compatible building energy standard
- Knowledge and experience of building system design
- Ability to assess a model through engineering analysis tools



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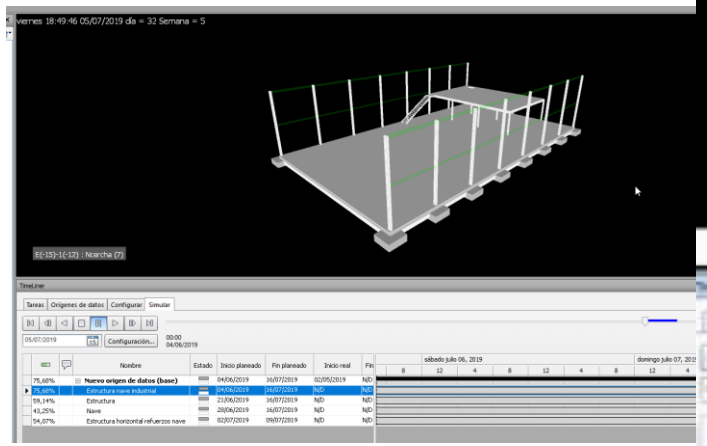
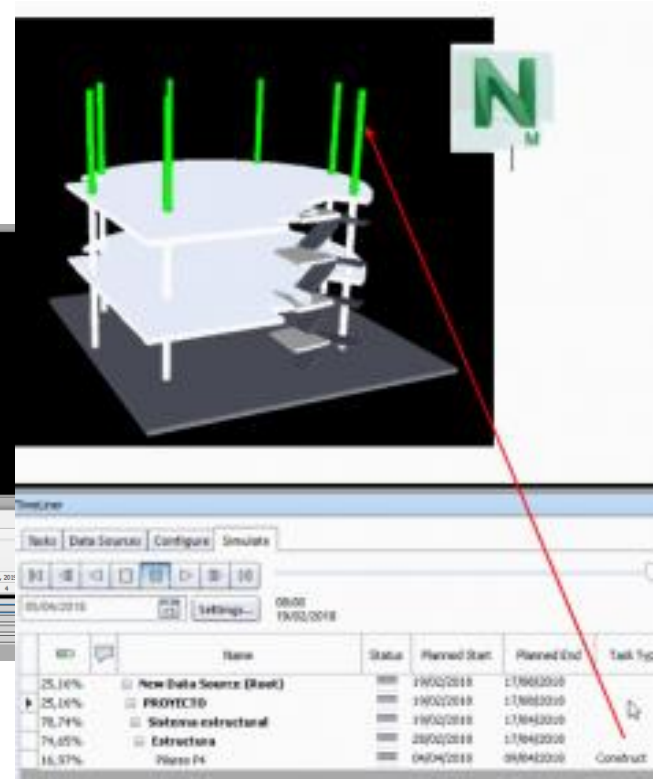
BIM Uses: Phase Planning

A process in which a 4D model (3D models with the added dimension of time) is utilized to effectively plan the phased occupancy in a renovation, retrofit, addition, or to show the construction sequence and space requirements on a building site.

Potential Value

- Better understanding of the phasing schedule by the owner and project participants and showing the critical path of the project
- Space and workspace conflicts identified and resolved
- Identification of schedule, sequencing or phasing issues
- Increased productivity and decreased waste on job sites





Resources Required

- Design Authoring Software
- Scheduling software
- 4D Modelling Software

Team Competencies Required

- Knowledge of construction scheduling and general construction process.
- Ability to manipulate, navigate, and review a 3D model.
- Knowledge of 4D software: import geometry, manage links to schedules.

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BIM Software

Authoring tools create models while audit and analysis tools study or add to the richness of information in a model.

We can have a huge amount of analysis tools depending on the type of analysis that they do.
It can be:

- Structural Analysis
- Energetic Analysis
- Clash detection analysis
- Virtual Reality and Visualization analysis
- Etc

Source: Parametric monkey

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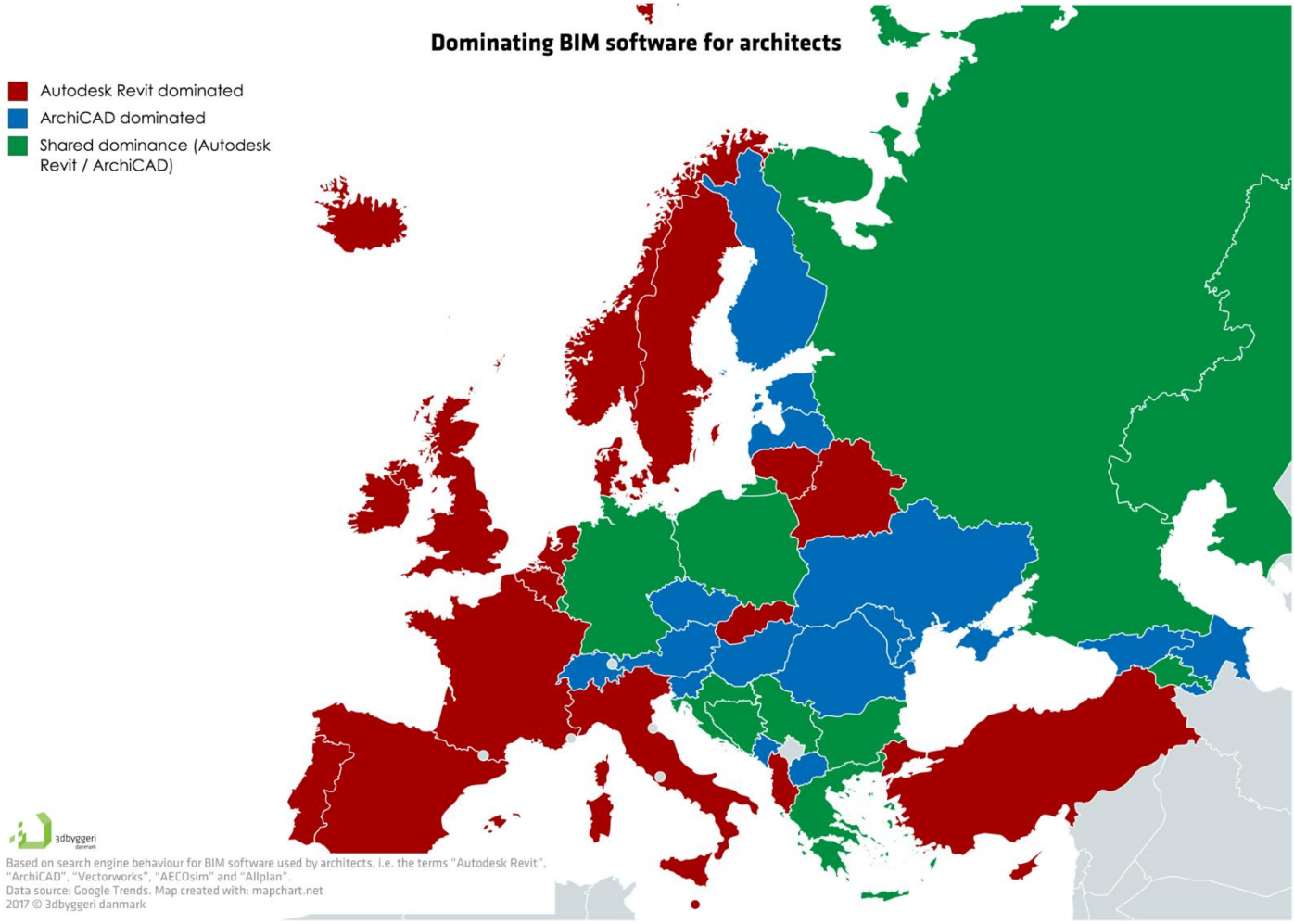
BIM Authoring tools

There are a lot of design authoring tools, some of them are:

- Autodesk Revit
- Archicad
- Allplan
- AECOsim Building Designer
- Tekla Structures



Data source: Google trends. Graphics: 3dbyggeri Danmark ApS

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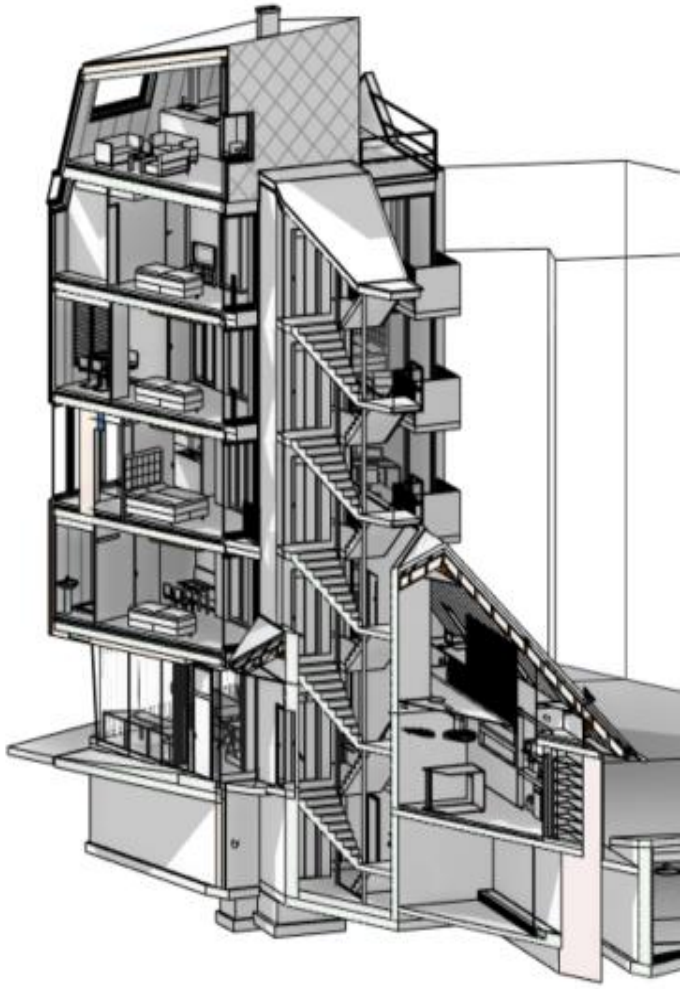
Considerations in the use of Design Authoring Tools

The use of these design authoring tools is critical for the BIM project, because you will condition the usability of the models for other purposes.
When we are creating building models, we need to do it in a proper and planned way and:

- Use the correct tool that fits with the purpose of the project.
- Use the correct modelling strategy
- Define the scope of the model and don't waste time with useless information



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DEMONSTRATION

Activity

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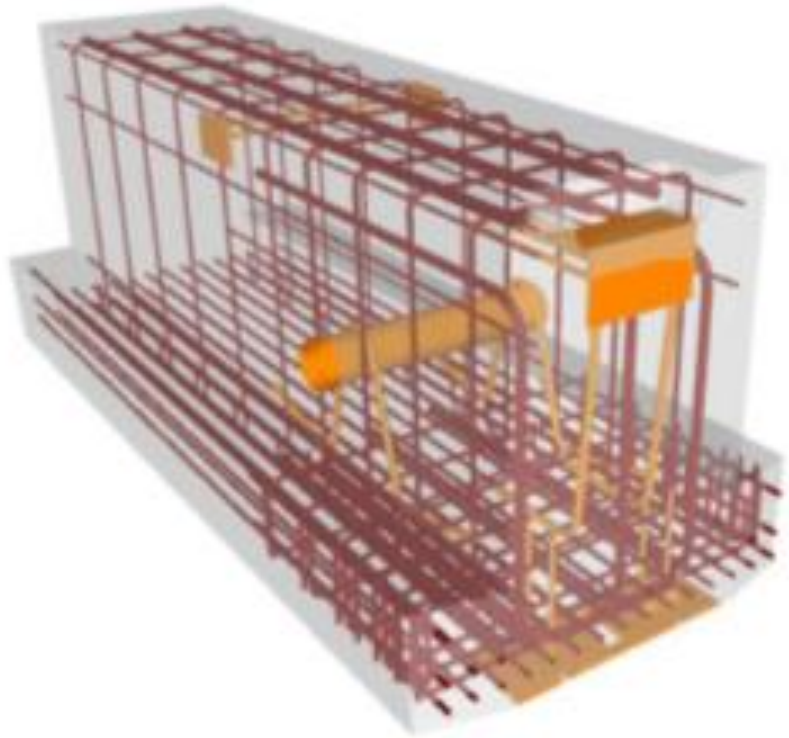
DISCUSSION:

- Do you think that is essential to model every single element in a 1:1 scale within a BIM Model?



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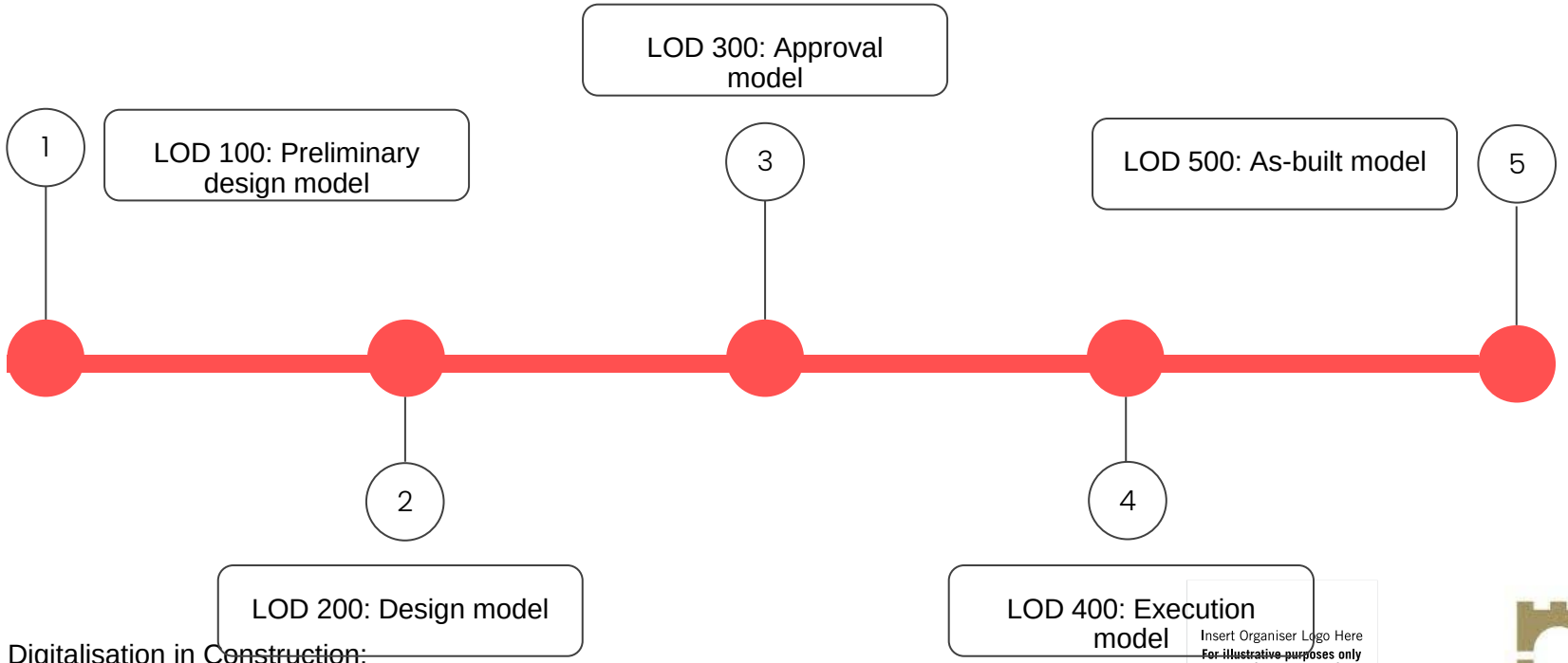
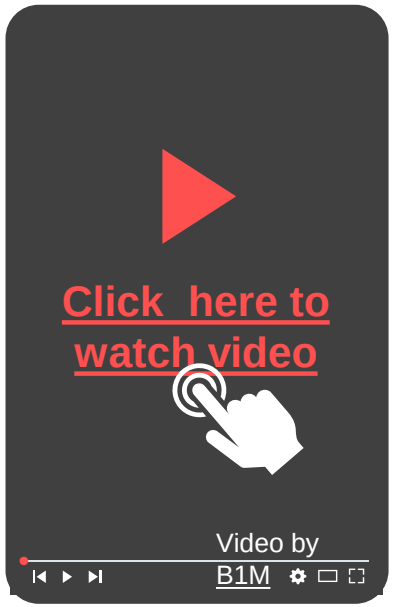
Level of Development (LOD)

LOD is the degree of both object's graphical representation and attached specification and information have been thought through and is used by professionals on the project to effectively and clearly communicate without confusion for faster execution. LOD framework spans from the LOD 100-500.





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BIM Fundamentals

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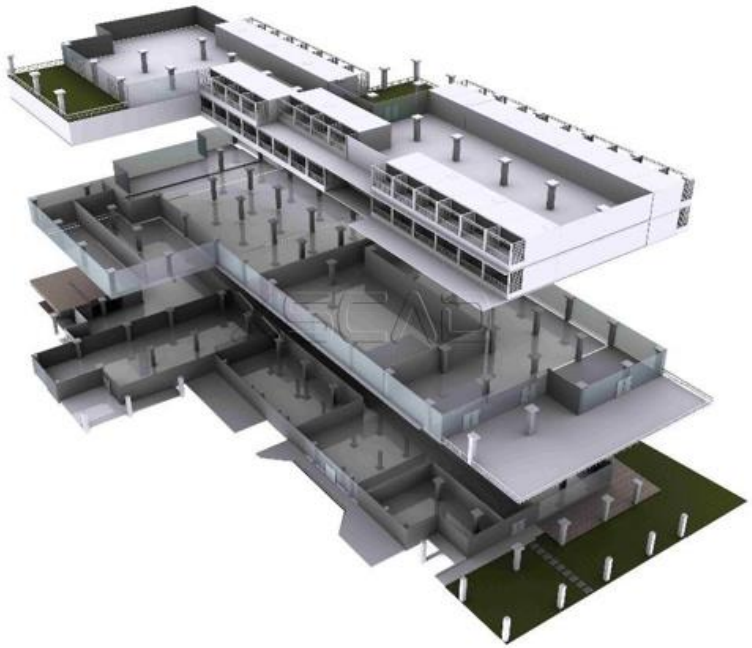
LOD

It is used to define information delivery a reference library of definitions is required. These levels of "definition" may be either described in terms of geometry or information requirements. Geometric also is described as graphic data and information as non-graphic data.



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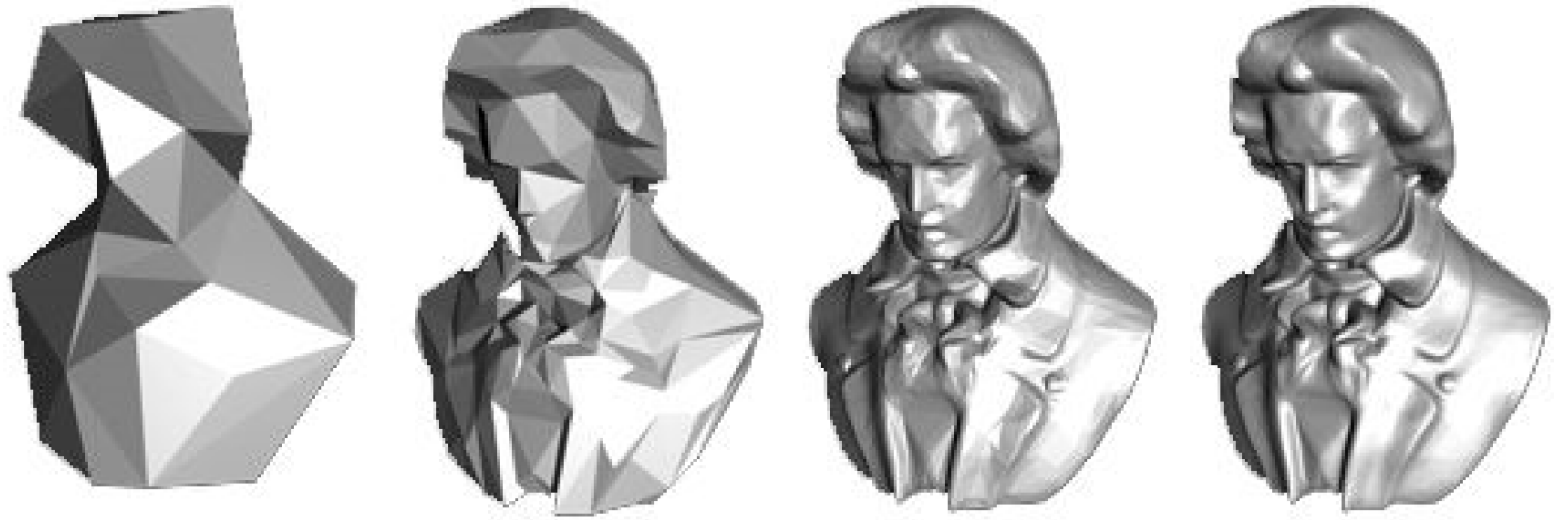
LOD: GEOMETRY

Geometrical accuracy of the element that will be installed on site.



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LOD: INFORMATION

Information levels of the product that will be installed on site.

Concept (Presentation)	Design Development	Documentation	Construction	Facilities Management
DESCRIPTION: Office Chair Arms, Wheels WIDTH: DEPTH: HEIGHT: MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: 100	DESCRIPTION: Office Chair Arms, Wheels WIDTH: 700 DEPTH: 450 HEIGHT: 1100 MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: 200	DESCRIPTION: Office Chair Arms, Wheels WIDTH: 700 DEPTH: 450 HEIGHT: 1100 MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: 300	DESCRIPTION: Office Chair Arms, Wheels WIDTH: 685 DEPTH: 430 HEIGHT: 1085 MANUFACTURER: Herman Miller, Inc MODEL: Mirra LOD: 400	DESCRIPTION: Office Chair Arms, Wheels WIDTH: 685 DEPTH: 430 HEIGHT: 1085 MANUFACTURER: Herman Miller, Inc MODEL: Mirra PURCHASE DATE: 01/02/2013

(Only data in red is useable)

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LOD PROGRESSION AND LOD MATRIX

To establish the information (graphic and non-graphic information from now on) requirements in every phase commonly use a resource or tool called LOD Matrix.

Here we define the different levels of information in different phases according with the BIM project strategy.

					GRAPHICAL LOD	Proyecto Basico/ Design Intent Model	Proyecto Ejecutivo/ Coordinated Design	Trade Coordination/ Construction Phase
REF	REF				ELEMENT	LOD	LOD	LOD
01.02.03	1	2	3		Beam demolitions	200	200	300
01.02.03.01	1	2	3	1	Steel beams demolition	200	200	300
01.02.03.02	1	2	3	2	Reinforced concrete beams demolition	200	200	300
01.02.04	1	2	4		Slabs demolitions	200	200	300
01.02.04.01	1	2	4	1	Pre-cast slabs demolition	200	200	300
01.02.04.02	1	2	4	2	In-situ reinforced concrete slabs demolition	200	200	300
01.02.04.03	1	2	4	3	Composite slab demolition	200	200	300
01.02.05	1	2	5		Floors demolitions	200	200	300
01.02.06	1	2	6		Walls demolitions	200	200	300
01.02.06.01	1	2	6	1	Reinforced concrete wall demolition	200	200	300
01.02.06.02	1	2	6	2	Masonry/blockwork wall demolition	200	200	300
01.02.06.03	1	2	6	3	Plasterboard wall demolition	200	200	200
01.02.06.04	1	2	6	4	Glazed wall demolition	200	200	200
01.02.06.05	1	2	6	5	Others	200	200	200
01.02.07	1	2	7		Openings demolitions	200	200	200
01.02.07.01	1	2	7	1	Wood doors demolitions	200	200	200
01.02.07.02	1	2	7	2	Steel doors demoltiions	200	200	200
01.02.07.03	1	2	7	3	Glazed doors demolitions	200	200	200
01.02.07.04	1	2	7	4	Windows demolitions	200	200	200
01.02.08	1	2	8		Wall finishes demolitions	200	200	200

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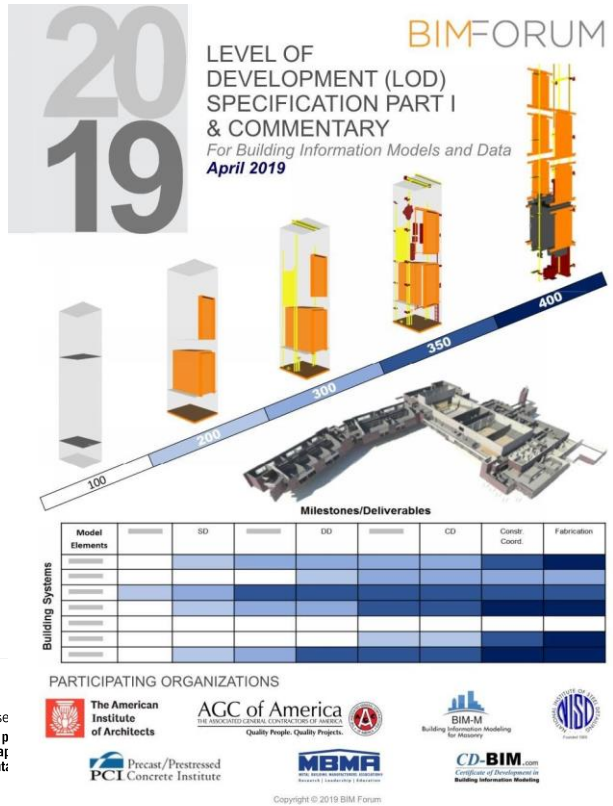
LOD VS LOD

There are two principle standards for this concept. Level of Development (AIA+BIM FORUM - USA) and Level of Definition (NBS – UK).

LEVEL OF DEFINITION – NBS

LEVEL OF DEVELOPMENT – BIM FORUM



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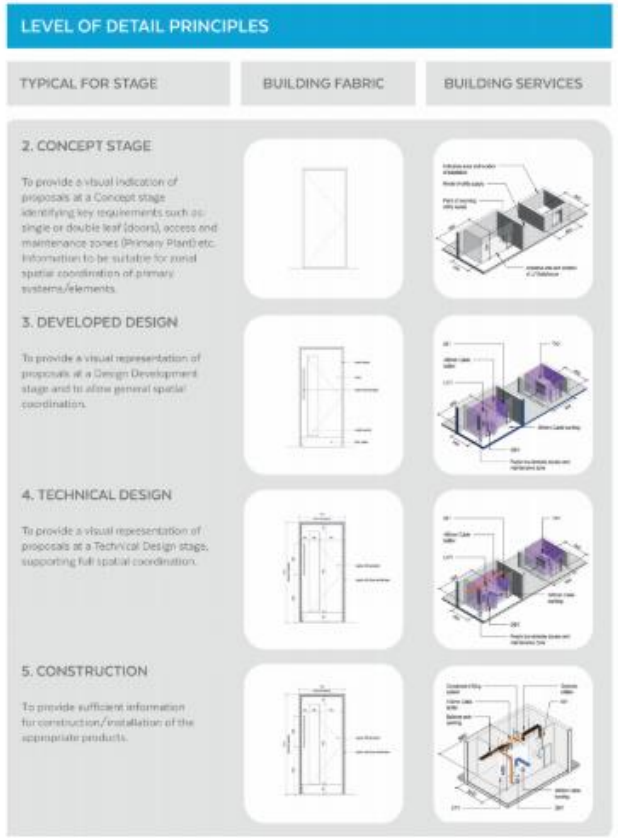
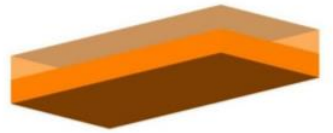
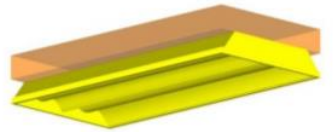
LOD VS LOD



D5040.50 21-04 50 40 50 Lighting Fixtures

Includes: Luminaires, lighting equipment, ballasts, and accessories. Includes fluorescent, high intensity discharge, incandescent, mercury vapor, neon, and sodium vapor lighting.

Associated Masterformat Sections: 26 50 00 / 26 51 00 / 26 52 00 / 26 53 00 / 26 54 00 / 26 55 00 / 26 55 23 / 26 55 29 / 26 55 33 / 26 55 36 / 26 55 39 / 26 55 53 / 26 55 59 / 26 55 61 / 26 55 63 / 26 55 70

100	See D50	
200	See D5040	
300	Modeled as design-specified size, shape, spacing, and location of lighting fixtures; approximate allowances for spacing and clearances required for all specified hangers, supports and seismic control; access/code clearance requirements modeled.	 *205 D5040.50-LOD-300 Lighting Fixtures*
350	Modeled as actual size, shape, spacing, and location of lighting fixtures. actual size, shape, spacing, and location for supports and seismic control. actual access/code clearance requirements modeled.	 *206 D5040.50-LOD-350 Lighting Fixtures*
400	Supplementary components added to the model required for fabrication and field installation.	

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TASK

In the case of a project, the employer wants to improve specific issues with the BIM application:

1. To improve buildings quality in order to avoid problems or surprises during construction works.
2. To control and monitoring execution costs.
3. To participate in the design process by providing feedback

Answer in 100 words maximum:

Which from the PSU BIM Uses would you apply to the project according to its objectives?

Which requirements or skills will teams have to achieve implementing them?

Resources

https://www.bim.psu.edu/bim_uses/

Activity

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Advantages of using BIM versus traditional models

Working with BIM models means working with parametric construction entities that provide precision, productivity and agility in changes, integrating different layers of information in a single container.

BIM MODEL

A CONSISTENT MODEL WITH SUFFICIENT INFORMATION TO GENERATE ANY DOCUMENTS NEEDED FOR DESIGN, CONSTRUCTION AND MAINTENANCE OF THE ASSET.

Definition of BIM

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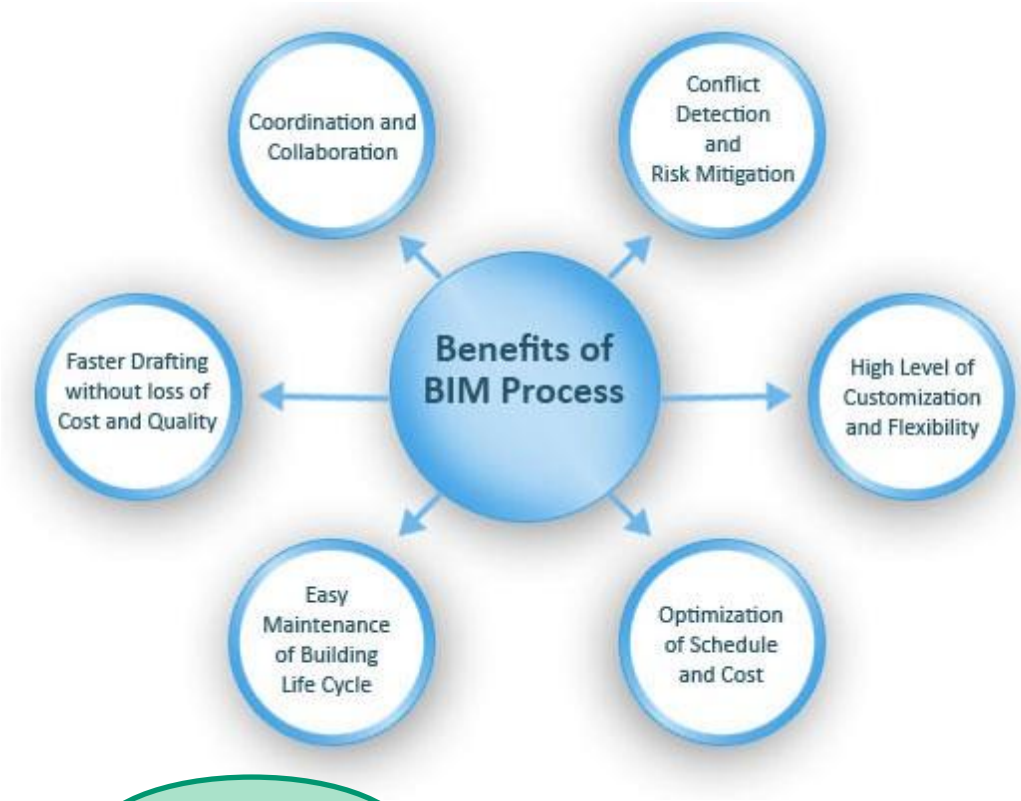
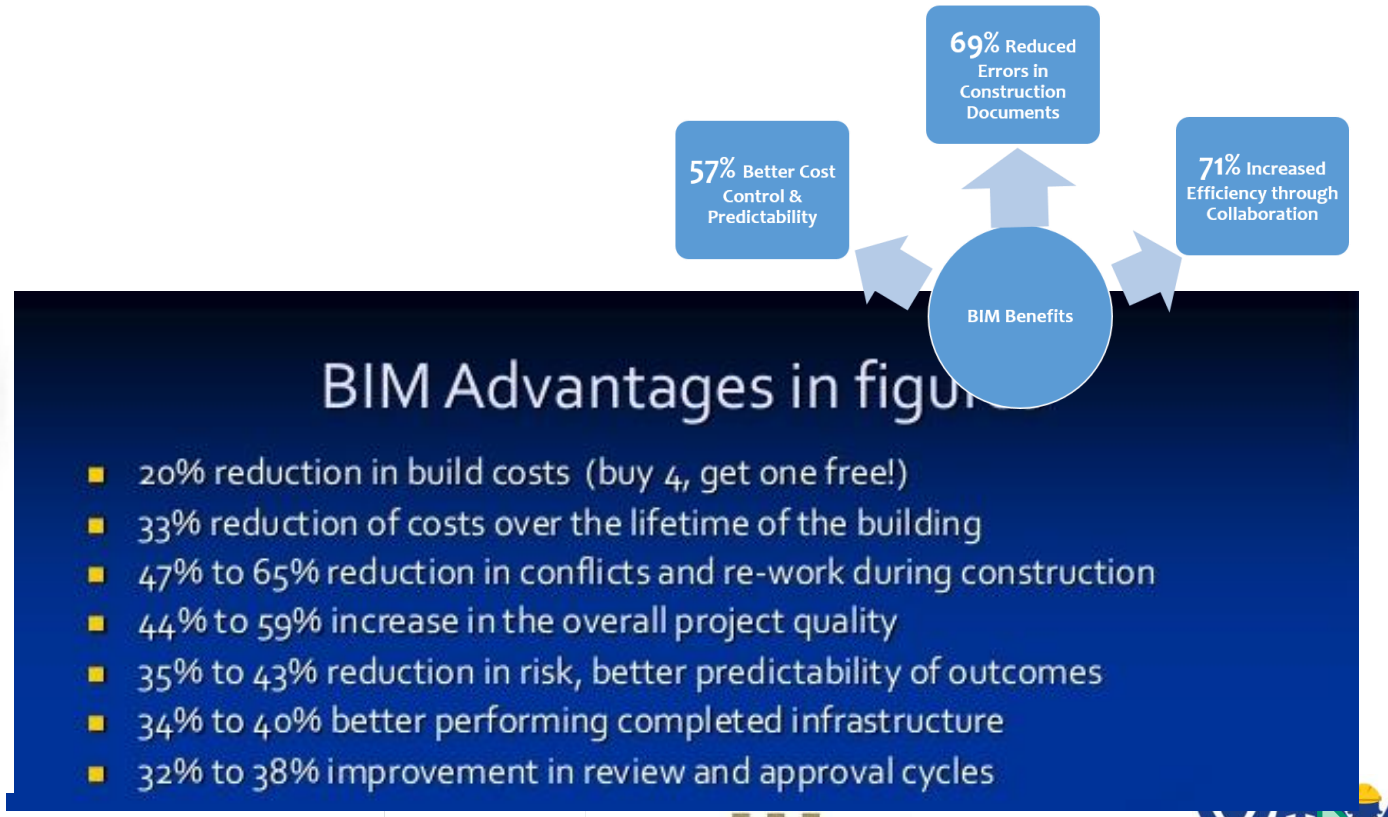
BIM benefits





Source: Si!BIM Project

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BIM: economic aspects

Average cost ratios in buildings:

75 % building in use (e.g.):
a) cleaning & maintenance
b) handling, inspection, services
c) fees & dues

20 % construction

3 % construction design

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BIM: economic aspects

BIM may strongly influence these costs:

a) energy
b) cleaning
c) maintenance
d) safety
e) inspections
f) logistics
g) communication
h) management of real estate & removal
i) administation
j) disposal

BIM may slightly influence these costs:

a) fees
b) real estate tax
c) local dues
d) building insurance

Source: Si!BIM Project

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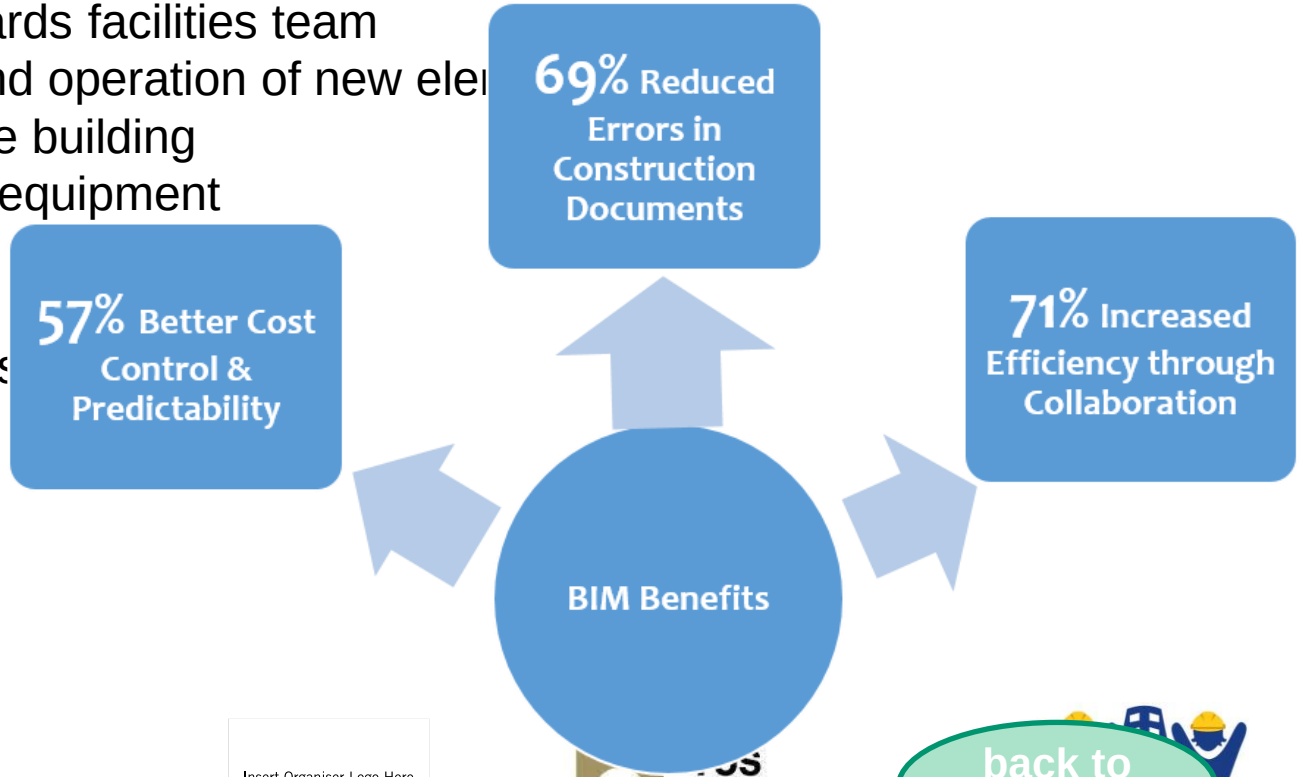
BIM: economic benefits (during use)

- ´as built´ documentation immediatey available at handover
- immediate know-how transfer from project team towards facilities team
- Ease of checking of legal conformity of installation and operation of new ele
- Optimisation of operational costs by simulation before building
- Consistent inventory and status of technical building equipment
- Maintenance by augmented reality
- Up to date documents
- Increase real estate value by improved facts & figures



Source: Si!BIM Project

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BIM: sustainable aspects

Growing aspect of BIM;
Examples: ´greener´ buildings.

- optimisation of glazed areas
- Improved ventilation systems
- Sustainability assessment of building materials

Certificates of sustainability could be taken directly from BIM in the future. The pre-requisite for this is a standard link of BIM with reliable sustainability databases. Two current options :

LEED**: Leadership in Energy and Environmental Design** is a green building certification program used worldwide

BREEAM**: Building Research Establishment Environmental Assessment Method** is the world's longest established method
of assessing, rating and certifying the sustainability of buildings.

Source: Si!BIM Project

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BIM: technical benefits

Investing in BIM-software and staff skill development results in technical benefits increasing over time:

- Centralised digital data model
- Worldwide access
- Accummulation of all architectural, technical, physical and functional elements/characteristics in one place
- All involved in project work on the same model
- Immediate clash detection
- Easy simulation of alternatives
- Manufacturer independent object databases are available to be embedded in construction plans
- Progress tracking
- Drawings are generated and updated automatically

Source: Si!BIM Project

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BIM: standardisation & European strategy

EU BIM TASKGROUP

EU BIM Task Group:
Network of public sector experts from:

- infrastructure
- public estate owners
- public clients
- policy makers

Source: Si!BIM Project

back to overview

Definition of BIM

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Best practice example: Inside Big Ben's Makeover

Watch the video “Inside Big Ben´s Makeover”.

You can watch the video with subtitles.

In the example of the renovation of the Elizabethan Tower - known also for its Great Bell called Big Ben - BIM is also crucial to make future restorations easier and by creating detailed records of every aspect of the tower.

Source: Si!BIM Project

Assessment

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BIM Terminology

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Big BIM

BIM Execution plan

Common Data Environment

BIM Software

Clash Detection

Closed BIM

Coordinated/ Federated model

Employer´s Information Requirement (EIR)

Little BIM

Level of development

Open BIM

Parametric Modelling

BIM Dimensions

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BIM Terminology

Big BIM

- Interdisciplinary application of BIM methodology throughout the entire life cycle of a project
- Incorporates the exchange of construction designs among different partners in the project

BIM execution plan

- Defines responsibilities as basis for cooperation in the project
- Contractual agreement between employer and project parties defining organisational structures and processes
- Defines the depth of information and details
- Standard model for cooperation between trades to guarantee efficient cooperation

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BIM Terminology

Common data environment

- Open format for data exchange, used to access information from the construction model like changes and/or clashes
- Often it is used to exchange of BIM generated data or to link BIM viewers
- Files contain direct links to relevant spots in the construction model, enables quicker coordination

BIM software

- Multiple data points
- 3-dimensional
- Digital copy of the construction including all geometric, technical, physical and functional attributes

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BIM Terminology

Clash detection

- Coordination of models from different construction disciplines which are checked for consistency
- Checking for clashes between different models whether
- Increase of efficiency because human mistakes can be anticipated before construction

Closed BIM

- All involved individuals work with one software
- Limited approach to BIM, because the chosen software might not be the best for all involved parties

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BIM Terminology

Coordinated/ Federated model

- 3D-construction models of project partners can be combined and checked for consistency
- Coordinated model develops with the progress of the construction and covers the entire process from design to maintenance

Employer´s Information Requirement (EIR)

- Requirements of the employer, regarding data in a BIM project
- Early definition and coordination of responsibilities and obligations in a BIM project
- Employer is able to make informed decisions throughout the project

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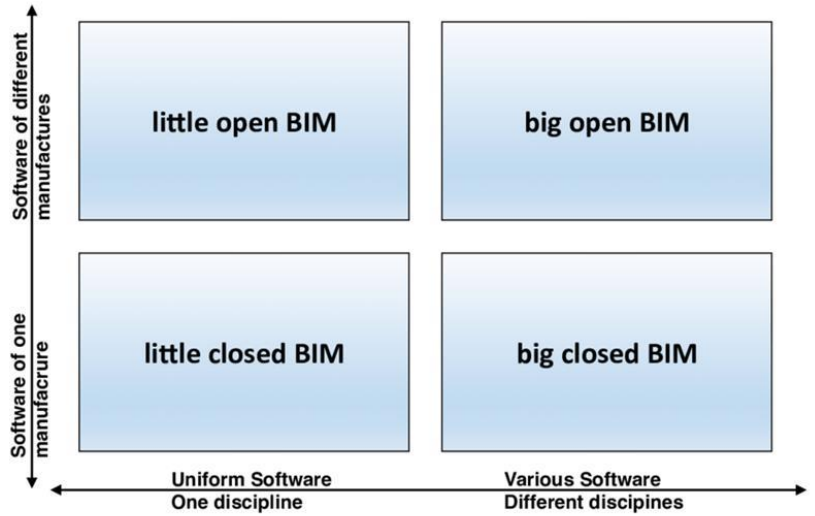
BIM Terminology

Little BIM

- Limited application of BIM methods by using only software from one developer
- Can increase productivity

Level of development

- Amount and depth of information concerning all elements, relevant to different disciplines
- Ranges from purely conceptual/graphical description up to ´as built´ models



(Liebich et al., 2011)

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BIM Terminology

Open BIM

- Open exchange of data independent of the software used
- Mapping entire lifecycle of construction
- Frictionless exchange of information which is independent of software used (interoperability)
- Most relevant format is IFC

Parametric modelling

- Defines interaction between different elements in a BIM model
- Single elements are collated to parameters like height, length, width, position etc.
- Change of one parameter determines changes in others

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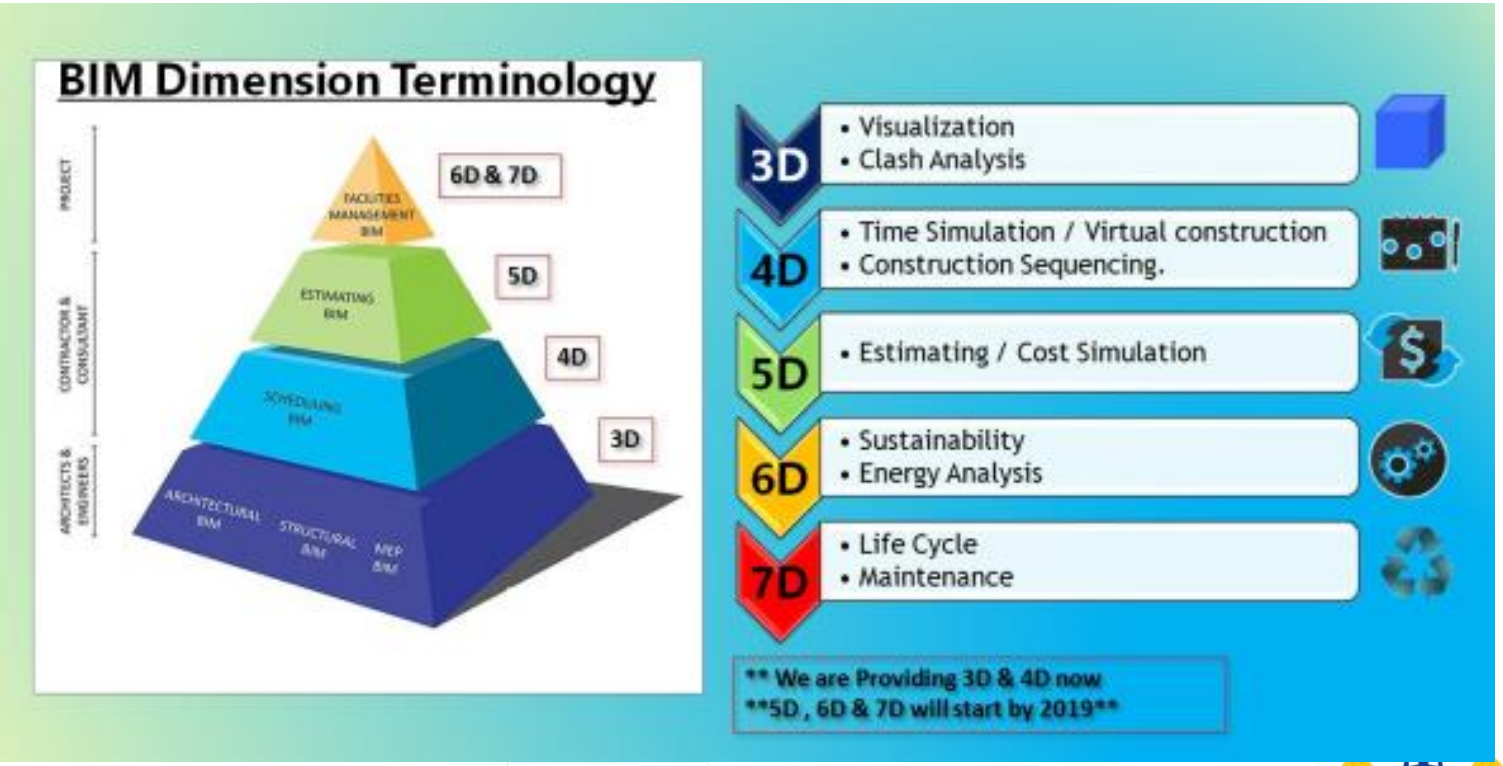
BIM Dimensions

BIM Dimensions

- Graphical or non-graphical information in a common data environment
- 3D-models

Benefits:

- Improved visualisation, communication and collaboration
- Reduced rework



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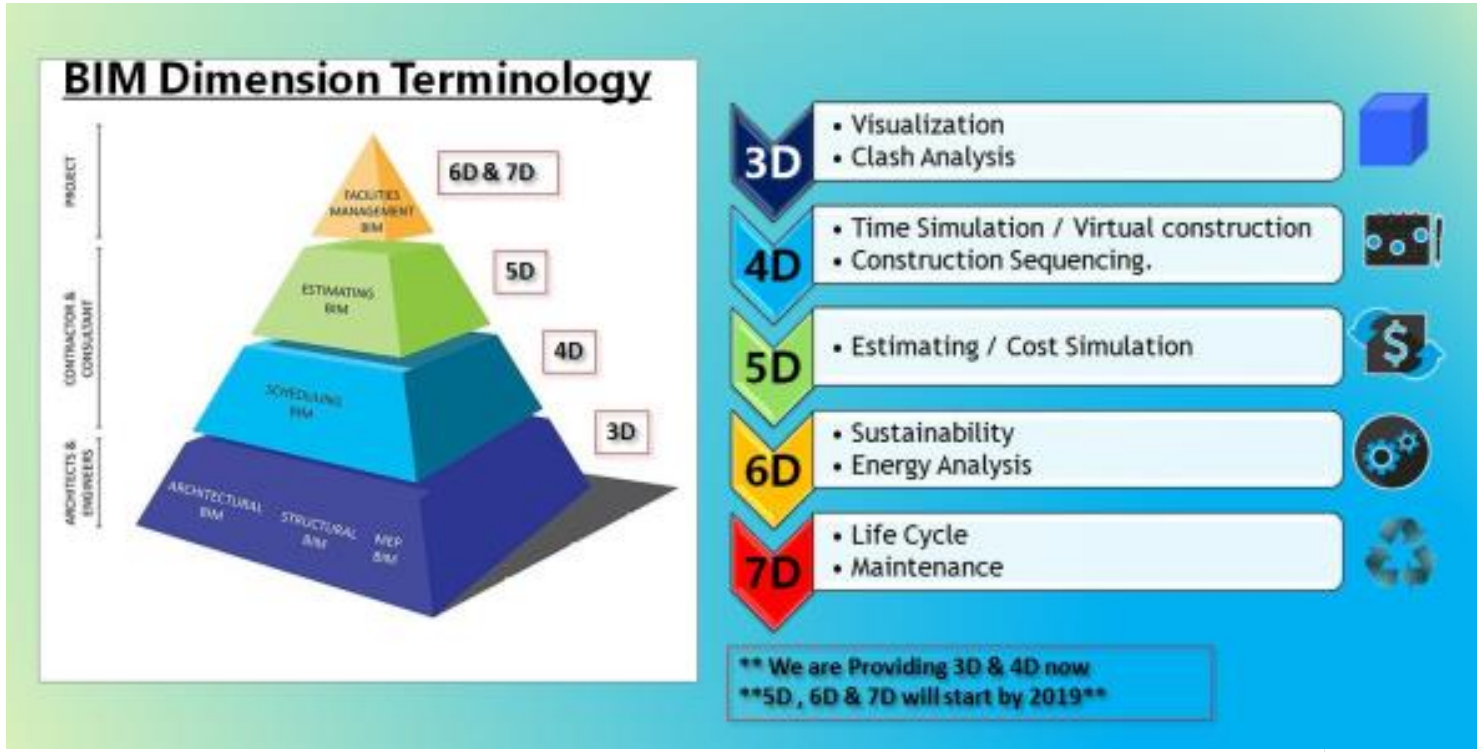
BIM Dimensions

BIM Dimensions 4D



- 4D = 3D + time schedule
- Time is added to model to show the development of the project
- This shows how a project develops sequentially

Benefits:

- Planning optimisation
- Optimisation of project activities and team coordination

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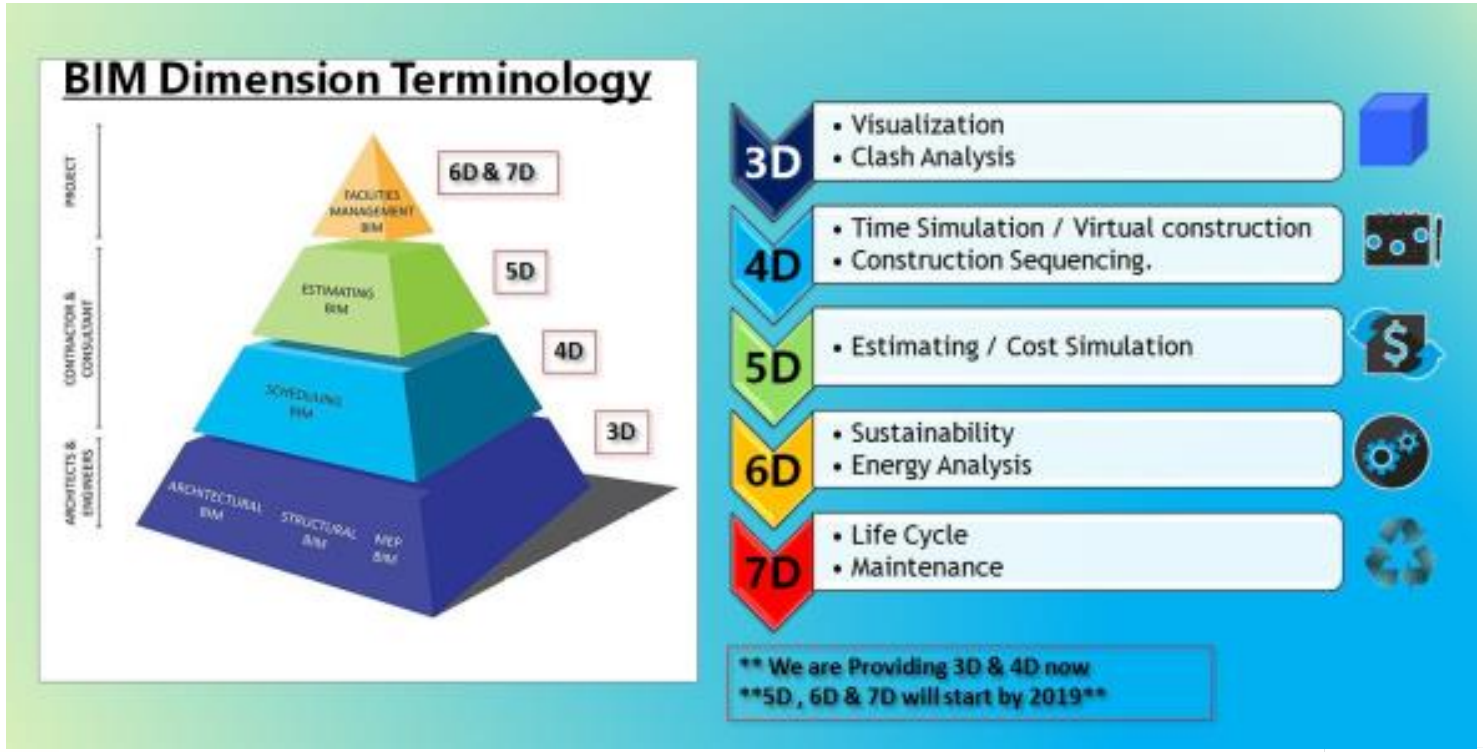
BIM Dimensions

BIM Dimensions 5D



- 5D = 4D + costs
- Refers to linking of project timescale with cost-related information

Benefits:
More efficient, cost-effective and sustainable constructions

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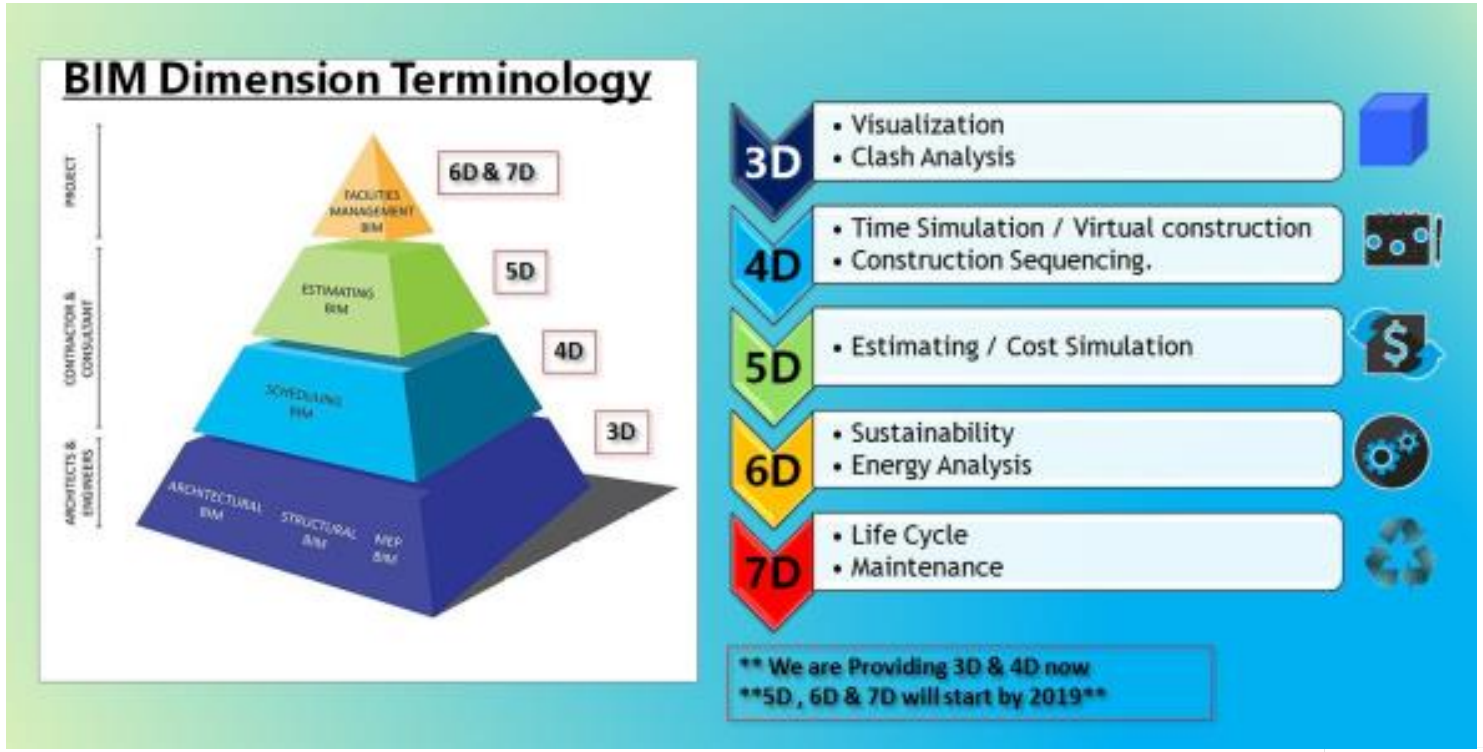
BIM Dimensions

BIM Dimensions 6D



- 6D = 5D + sustainability
- Operations and maintenance

Benefits:
Overall reduction of energy consumption

Insert Organiser Logo Here
For illustrative purposes only delete this shape from final presentation

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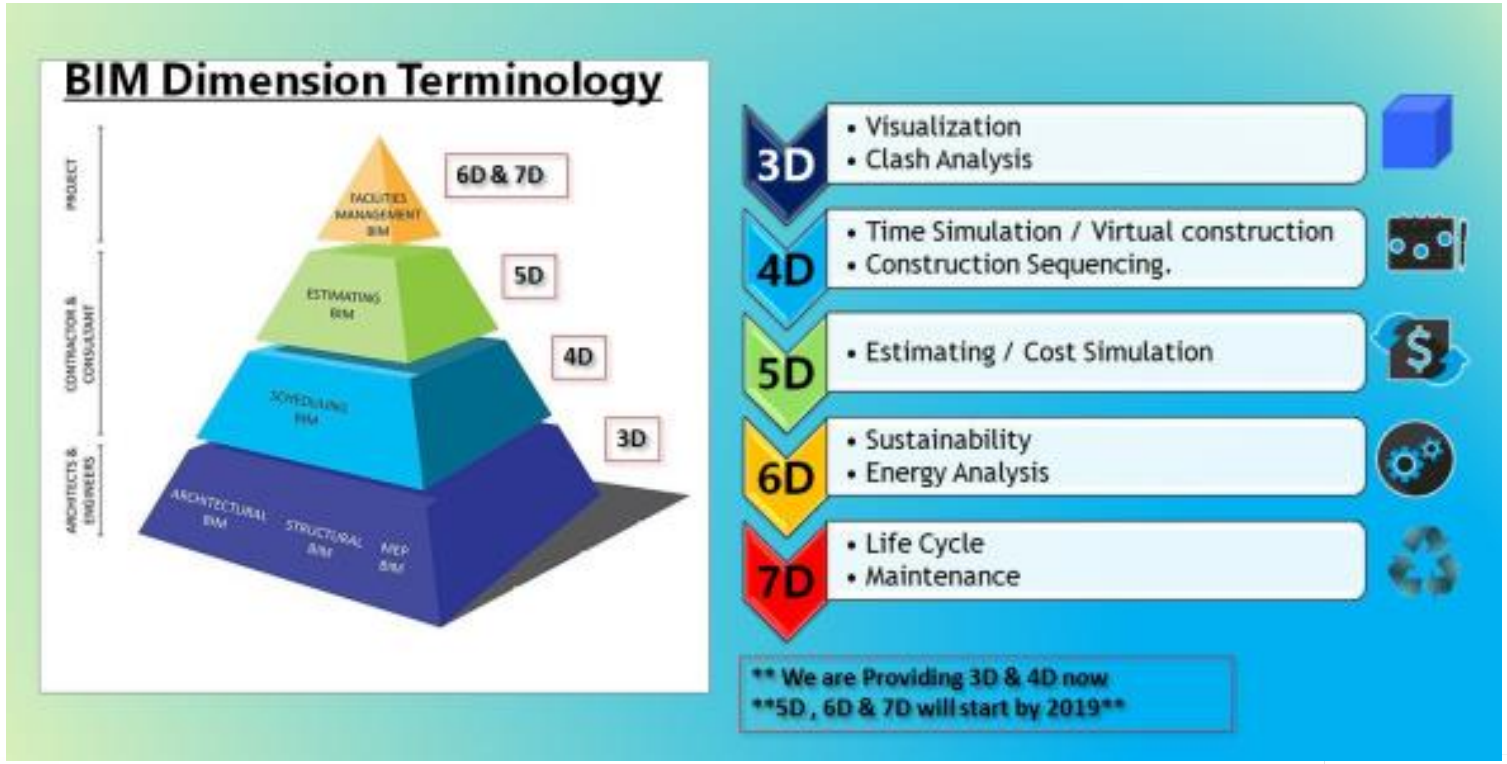
BIM Dimensions

BIM Dimensions 7D



- 7D = 6D + life cycle info

Optimisation of asset management from design to demolition

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Definitions and concepts

BIM Executive Plan (BEP) = Document that comprehensively defines the details of the implementation of the BIM methodology in the project and clearly states:

- The scope of implementation.
- The BIM processes and tasks.
- The information exchanges to be carried out.
- The necessary infrastructure.
- The roles and responsibilities of the actors involved.

Standardisation = Procedure that enables organisations and teams to be more efficient and effective and to save time and money in their daily work and operation. BIM methodology is closely linked to the establishment of standards and work processes.

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Definitions and concepts

Model= A three-dimensional geometric representation of an object. This representation is usually done virtually by means of computers and appropriate software. If the representation is physical, the model is a mock-up. (Source: uBIM Glossary).

BIM Model = A virtual computer model of a building that incorporates the 3D geometric, material, cost, time, enclosed energy, and material information that are relevant for decision making during the design or operation of a building. (Source: uBIM Glossary).

Viewer = Tool for consulting the information of a model (partial or federated). It gives access to the information included in an organised way in the model and enables the detection of collisions before moving on to the construction stage. Once in the construction stage, it allows to communicate them to the rest of the agents.

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Definitions and concepts

OpenBIM = Use of open standards or openBIM ecosystems. This is the result of ensuring interoperability, processes and tools, and the exchange of information between the different agents.

BuildingSMART is the organisation in charge of developing open standards that favour the work and interoperability between different software tools.

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Definitions and concepts

BIM IMPLEMENTATION PLAN

Developed with BIM, so that all those involved do a coordinated and coherent job. It establishes a place of storage of the documentation; format of the deliverables; system of coordinates to be used or work units; LoD of delivery of each discipline or category of elements; type of representation to be used; catalogue and database of prices to be used; communication protocol of the different intervening parties.

Coordinated by the BIM Manager in collaboration with all those involved in BIM processes.

(Source: Glosario uBIM)

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Definitions and concepts

Attribute = Non-formal information contained in a BIM object. The term parameter, metadata and properties are also used.

Building SMART (*BSA Building Smart Alliance*) = International non-profit association that aims to improve efficiency in the construction industry using open standards for BIM interoperability and collaborative business models to achieve new levels of cost and schedule reduction.

Interoperability = The ability of different systems or organisations to work together in a coordinated manner without loss of data and without requiring special effort or dedication.

BIM modelling platform = Software capable of creating a 3D model and connected to a database that provides parametric building information to the model.

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Definitions and concepts

openBIM = Collaborative process based on the use of open standards or openBIM ecosystems. Open standards are used to ensure interoperability.

closeBIM = Collaborative process based on the use of compatible software with the ability to read native formats of other applications. Applications of the same brand name are used.

Object = minimum modelling unit. Geometric model made with a modelling software application that has attributes.

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Definitions and concepts

Classification systems = Strategies aimed at defining a hierarchy within a project or an asset so that its elements are easily identifiable, and the added layers of information have a coherent meaning.

LoD (Level of Development)= Accuracy of the representation of a given object contained within a BIM model.

BIM Modelling = The action of constructing or generating a three-dimensional model of a building or structure, adding, in addition to the geometry, further information, through the use of appropriate software tools.. (Source: Ubim)

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Definitions and concepts

Clash detection = procedure that locates interferences that occur between objects in a model or when superimposing different partial models from various disciplines into a single combined model (federated model) (Source: BIM User Guide. uBIM Glossary)

Common data environment = central digital repository where all information concerning a project is stored. (Source: BIM environment)

As-built model = Model that represents the final state of the construction, with the modifications it has undergone during construction, and which will be used to carry out future construction interventions on the real estate asset

Federated model = coherent and coordinated union of different partial models referring to different disciplines: architecture, structures, installations, exterior urbanisation, etc.

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Definitions and concepts

BIM Execution Plan (BEP) = document that comprehensively defines the implementation details of the BIM methodology, through all phases of a project, defining among other aspects: the scope of implementation, BIM processes and tasks, information exchanges, necessary infrastructure, roles and responsibilities and uses of the model. (Source: BIM environment glossary).

ISO 19650 = standard developed to provide a method to organise procedures and facilitate the use of information to ensure the proper use of the BIM methodology throughout the asset lifecycle.

BCF (BIM *Collaboration Format*) = Open format file that allows the addition of comments, screenshots and other information in the IFC file of a BIM model to facilitate the communication and coordination of the different parties involved in a project developed under BIM methodology. (Source: BIM environment dictionary)

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Definitions and concepts

COBie (*Construction Operations Building Information Exchange*) = International standard for the exchange of information on building data with a focus on BIM methodology. The most common representation is a spreadsheet developed progressively throughout the construction process. (Source: BIM environment dictionary)

AIM (*Asset Information Model*) = Information model (documentation, graphical model and non-graphical data) that supports the maintenance, management and operation of an asset throughout its life cycle. (Source: BIM environment dictionary)

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