

BUILDING INFORMATION MODELING  
MODELOWANIE DANYCH BUDOWLANYCH

**BIM 0123 3D4D5D6**

Adam Glema

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# BIM - 0123 - 3D4D5D6D7D

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## BIM levels

United Kingdom Government has recognized the progressive process of moving the construction industry into advanced implementation of building information modeling with full collaborative work and BIM data transfer

UK Gov program defines in the form of ,levels' in 2011 with distinct and recognizable milestones within that process:

Level 0

Level 1

2011

Level 2

2016

Level 3

2018

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## Level 0

2D CAD drafting only is utilised.

Output and distribution is via paper or electronic prints, or a mixture of both

No data transfer.

Effectively means no collaboration.

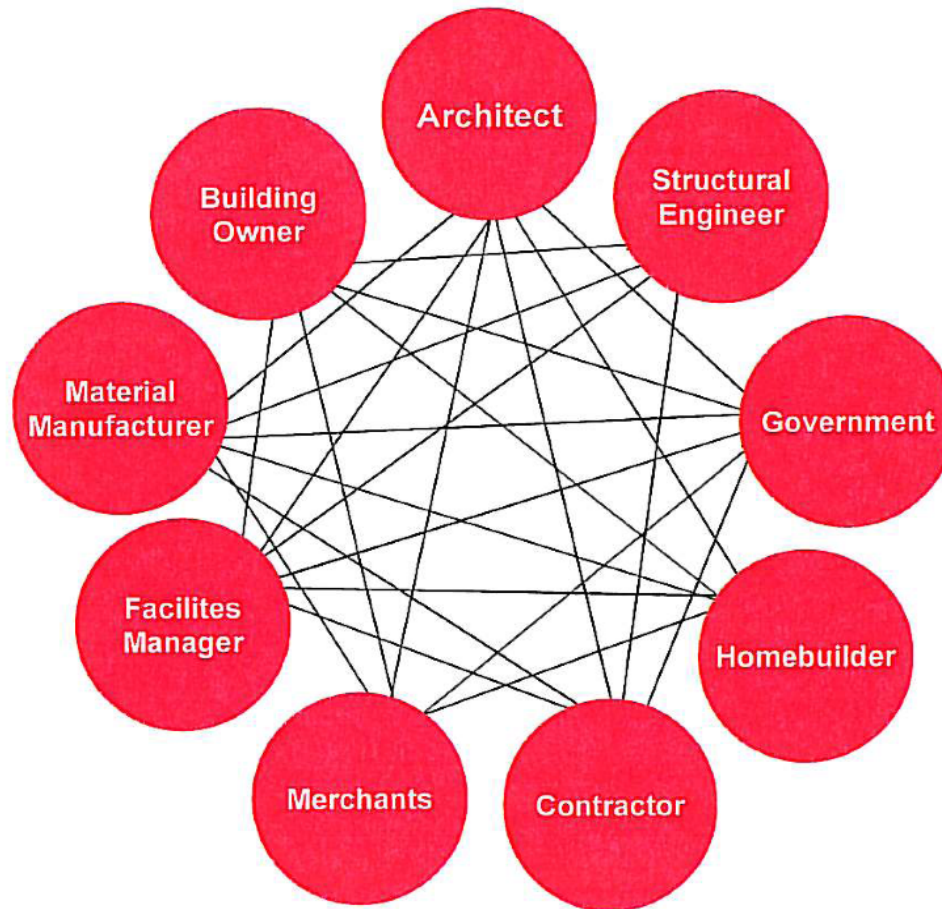
The majority of the industry is already well ahead of this now.

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The classic way of working...



## Today's "document centric" situation



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## Level 0

No collaboration between parties collating information about a built asset.

Most data is 2D CAD drawings.

Information is exchanged using paperwork.

Level 0 is described as ,CAD - no BIM'  
as no models are present.

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## Level 1

Beside CAD 2D drawings, the concept of 3D model appears.

This typically comprises

a mixture of 3D CAD for concept work and 2D for drafting  
as statutory approval documentation  
and detailed design documentation

Models are not shared between project team members

This is the level at which organizations

start BIM operation,

partners work and publish only own data,

No common data and no model transfer.

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## Level 1

No communication and no collaboration of different disciplines,  
still distance to collaboration between parties being achieved  
still distance between life-cycle stages.

CAD standards BS 1192:2007 could be managed

Electronic sharing of data is carried out from a common data environment (CDE), often managed by the contractor.

Some parties work with BIM models

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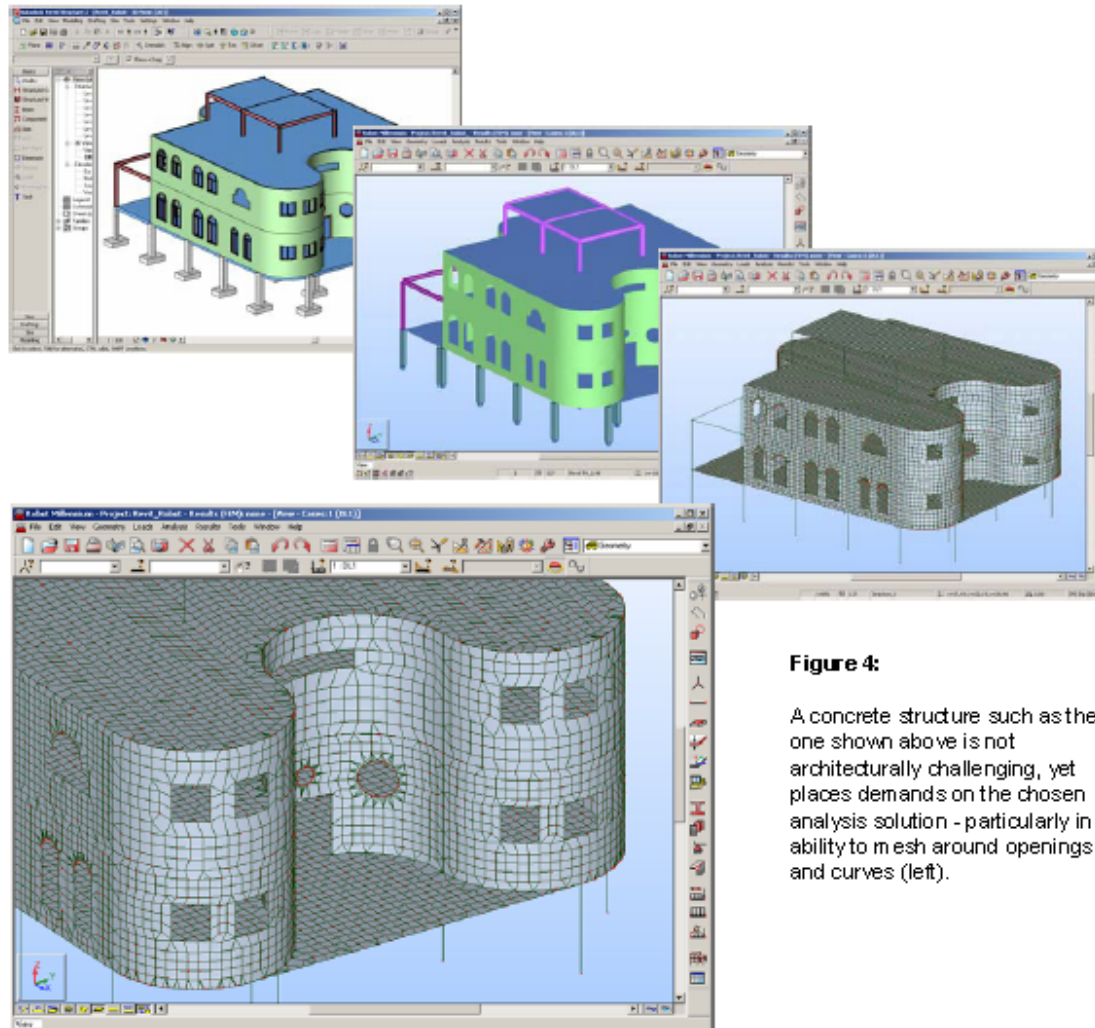
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## Level 1

Level 1 is described as 'Lonely BIM'  
as models are not shared between project team members.

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**Figure 4:**

A concrete structure such as the one shown above is not architecturally challenging, yet places demands on the chosen analysis solution - particularly in the ability to mesh around openings and curves (left).

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## Level 2

All parties use their own 3D CAD models,

Level 2 is distinguished by collaborative working

The collaboration comes in the form of how the information is exchanged between different parties – and is the crucial aspect of this level.

Design information is shared through a common file format, but not necessarily parties work on a single, shared model.

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## Level 2

Any software that each party used must be capable of exporting to one of the common file formats such as IFC or COBie

Any organisation is able to combine partner data with their own data

Any partner is able to make a federated BIM model  
for individual use,  
to carry out interrogative checks on it  
to correct own data quality.

No access of other parties to federated BIM model.

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Level 2

Level 1 is described as 'pBIM'  
as proprietary **BIM**.

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## Level 3

Level of full multidisciplinary collaboration between all disciplines.

BIM model is held in a centralized repository.

Single, shared project model is used by all parties.

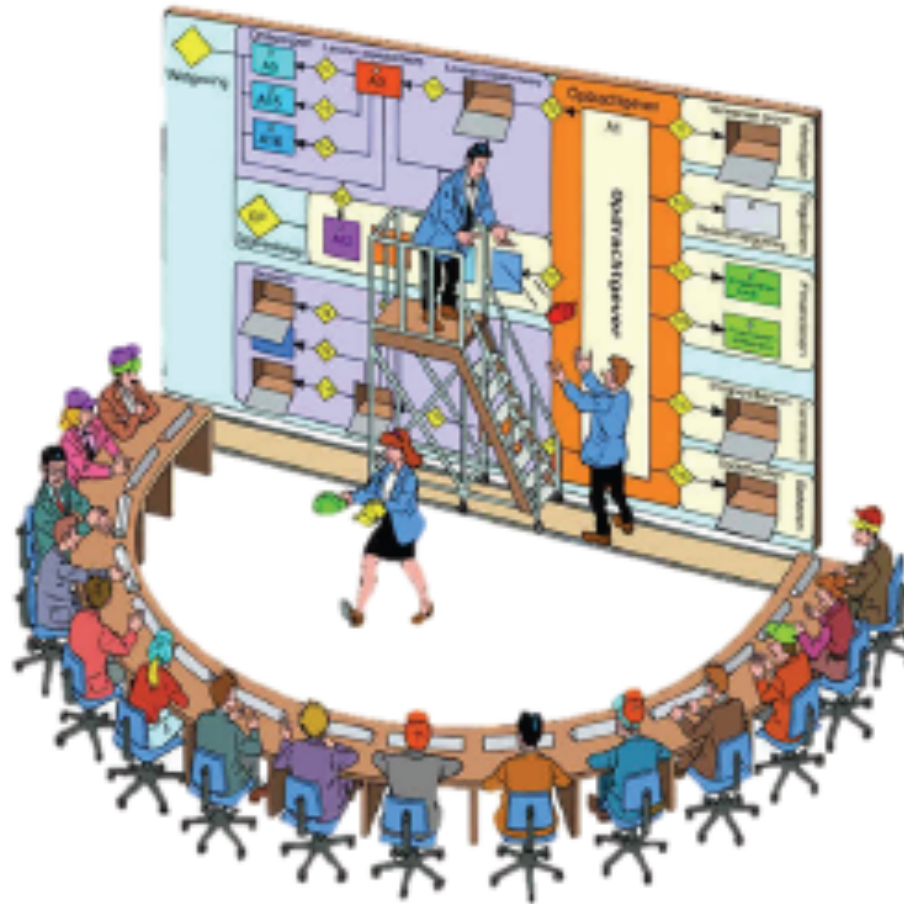
All parties can access and modify that same model.

The model is sufficient for everybody and for all teams,  
with elimination of conflicts and errors.

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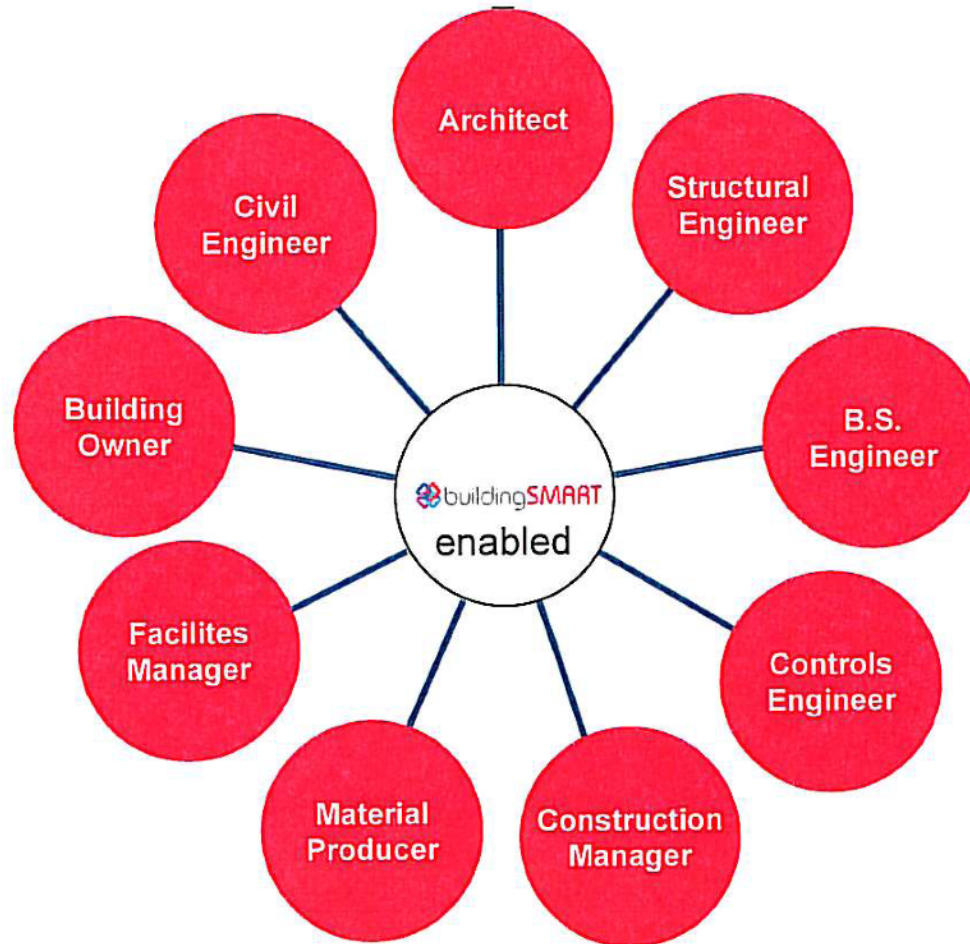
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... to an integrated proces.

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## Tomorrows “information centric” model





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## Level 3

Current nervousness in the industry around issues such as copyright and liability are intended to be resolved by means of robust appointment documents and software originator / read / write permissions, and the latter by shared-risk procurement routes such as partnering.

The benefit is that it removes the final layer of risk for conflicting information.

This is easier to obtain by application of openBIM initiative.

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## Level 3

The data is shared, collected and stored using a single source of data.

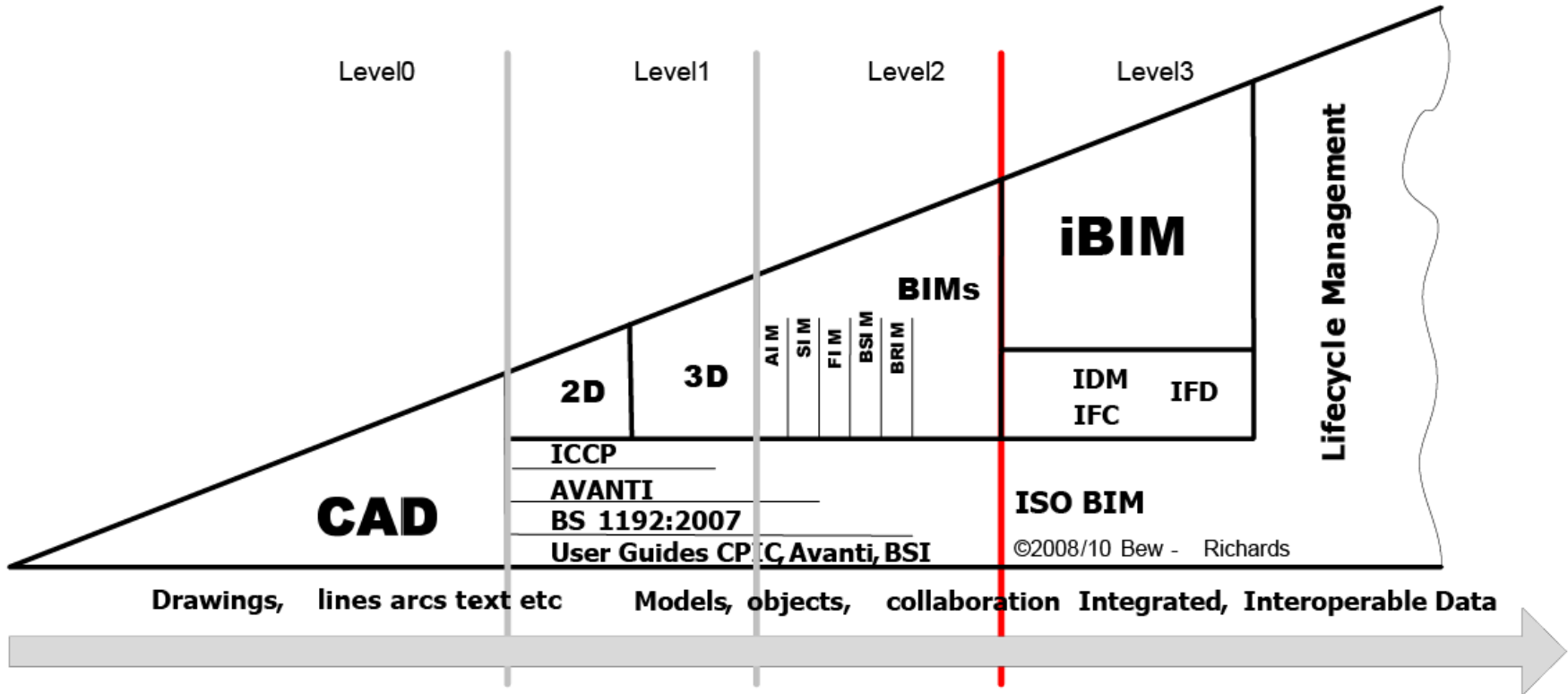
The complete and total collaboration in the planning, construction and operational life cycle of any built asset.

This universal openBIM approach to built asset data is the construction industry's ultimate goal.

Level 3 is described as 'iBIM' (integrated **BIM**) and is intended to deliver better business outcomes

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## Requirements for openBIM model :

- 3D geometry model is present,
  - fulfill concept of reference model,
  - guarantee storage and read of data,
  - simple structure, neutral format, independent format,
  - content recognition by ASCII text editor,
  - contains a structure with parts devoted to special needs:
    - coordination,
    - cost,
    - energy analysis,
    - real estate management
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## Requirements for openBIM model :

- possible model export and model import,
  - does not belong to one software supplier,
  - open access for every software author,
  - allows easy code development, simple file structure,
  - content internationally understanding (English),
  - possible for local versions, national properties,
  - data base with required functions for selection, receive, ...,
  - registered standard **ISO 16739** (1,2,2x3) **IFC 4** [2013] **IFC 5**
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## BIM levels

YOUR process of implementation  
of building information modeling  
with full collaborative work and BIM data transfer

Your program of transformation to digital construction

Level 0	no BIM
Level 1	lonely BIM
Level 2	proprietary BIM
Level 3	integrated BIM

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# BIM - 0123 - 3D4D5D6D7D

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BIM      DIMENSION

3D      GEOMETRY

4D      TIME - SCHEDULE

5D      COST - ESTIMATION

6D      ENERGY - SUSTAINABILITY

7D      FACILITY MANAGEMENT

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## 3D BIM

BIM 3D model enables Architects, Civil Engineers, Structural Engineers, MEP System Engineers, Builders, Manufacturers and Project Owners to manage their improved multidisciplinary collaboration more effectively in modelling and analyzing complex spatial and structural problems.

They can extract and generate views and information according to their need. BIM 3D model improved visualization capabilities enable participants to not only see the building in three dimensions before construction, but also to update these views along the project life cycle, from first conception to demolition.

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## 3D BIM

New value can be added to predictive models  
allowing to resolve issues proactively,  
because accurate data can be collected along the project life cycle  
and stored in BIM model,  
reducing the effort of rework

TÜV SÜD BIM

<https://www.youtube.com/watch?v=FlpC2ubwghA>

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## 4D BIM = TIME

Time is an extra dimension of information added to a project model, to components which will build in detail as the project progresses.

Time-related information for a particular element include information on lead time, how long it takes to install or construct, the time needed to become operational, harden, cure.

With the data linked to the graphical representation of system components it becomes easy to understand and query project information.

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## 4D BIM = TIME

Working with 4D BIM model is enormously helpful when it comes to planning work to ensure it is safely, logically and efficiently sequenced.

Being able to prototype in digital form how assets come together before starting construction on-site phase allows for  
feedback at an early stage  
avoiding wasteful and costly  
on-site design co-ordination and rework.

Visualization how projects will be constructed is also handy when engaging with stakeholders, giving everyone  
a clear visual understanding of planned works  
and what the finished construction will look like  
with no surprises for any parties.

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## 4D BIM = TIME

Adding sequencing information is extremely useful, not just in the design phase, but earlier allowing for assess the feasibility of schemes at tender stage this kind of information can allow initial concepts to be explored and communicated to inspire confidence in the team's ability to meet the brief.

Important: note that working with 4D information doesn't negate the need for planners who remain an integral part of the project team.

In a digital workflow planners can now influence and shape proposals from a much earlier stage in a project. Indeed, planners by being closer to the wider project team and providing feedback earlier in the process, there is the potential to add significant value to a construction project.

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## 4D BIM = TIME

Model can represent the sequence in which components should be installed, dependencies on other areas of the project.

The information in the form of scheduling data allows to obtain accurate program and visualizations, showing  
how a structure will visually appear at each stage  
how your project will develop over time.

With time information federated in the shared information model planners are able to develop an accurate project program.

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## 4D BIM = TIME

4D BIM model allows participants:

- to extract and visualize the progress of their activities through the lifetime of the project.
- to plan and optimize construction site related activities,
- to improve control over conflict detection or over the complexity of changes occurring during the course of a construction project.
- to provide methods for managing and visualizing site status information, change impacts as well as supporting communication in various situations such as informing site staff or warning about risks.

Builders and manufacturers can optimize their construction activities and team coordination.

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## 4D BIM

BIM 4D Scheduling

<https://www.youtube.com/watch?v=zvbcFozUkYQ>

Animated Construction

<https://www.youtube.com/watch?v=tQkDRXo7tLM>

What is 4D BIM? | The B1M

[https://www.youtube.com/watch?v=Sz6JK6\\_ZtGA](https://www.youtube.com/watch?v=Sz6JK6_ZtGA)

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## 5D BIM = COST

The cost components contribute as new dimension associated with 3D and 4D (Time) of information model. Model makes able to extract accurate cost information of the project.

Contribution includes calculation

- capital costs - the costs of purchasing and installing a component,
- the associated running costs
- the cost of renewal/replacement.

The presence of BIM model data enables for

- clear understanding of the value of a contract,
  - ensure budget tolerances,
  - predict project realization efficiencies,
  - regular cost reporting and budgeting,
  - easily track of predicted and actual spend over the course.
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## 5D BIM = COST

An information model is likely to contain three types of quantity.

1. Quantities based on actual model components (with visible details) which you can explore through the model are the most obvious.
2. Quantities may also be derived from model components (such as mouldings around windows) that aren't always visible.
3. The third kind of quantity is non-modeled quantities (these include temporary works, construction joints etc.).

Many elements of a project will still be modelled in 2D or not at all. There's also likely to be differences between models in how things are classified and the cost manager will need to clarify and understand differences between model components and under construction. Cost consideration in BIM need a process of information verification due to completeness of model objects.

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## 5D BIM = COST

The cost calculations are made on the basis of the data and associated information linked to particular components within the graphical model.

The benefits of a costing approach linked to a model include the ability to easily see costs in 3D form, get notifications when changes are made, and the automatic counting of components attached to a project.

The accuracy of cost calculations in BIM technology is :

- reliant on the data produced and shared by multiple teams,
- inaccurate as information that they rely upon is inaccurate.

The quantity surveyors and estimators still have an important role to play, not only in checking the accuracy of information but also in helping to interpret and fill information 'gaps'.

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## 5D BIM = COST

Unless the construction phase is modeled then the design model will show, graphically, design quantities but not the construction quantities.

The cost manager works earlier and more iteratively than in a traditional process, plays important role in overall project delivery. A cost manager is likely to be skilled in picking up the quantities that aren't solely based on model components.

This information allows cost managers to easily extrapolate the quantities of a given component on a project, applying rates to those quantities, thereby reaching an overall cost for the development.

However, it's not just cost managers who stand to benefit from considering cost as part of your BIM process.

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## 5D BIM = COST

The advantage of extrapolating cost from the information model

- the data can be queried at any time during a project,
- the information that feeds cost reports is regularly updated.

Compare this to a traditional approach where a cost manager's report may be updated a few times during the early stages of a project with completed designs only fully costed at the end of the project team's design process.

The 'living' cost plan helps teams design to budget and allows for faster, more accurate reporting of costs at the early stages, because cost managers are engaged from the start of a project.

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## 5D BIM = COST

The 5D BIM allows participants

- to visualize the progress of their activities and related costs over time,
- to provide methods for extracting and analysing costs,
- to evaluate scenarios and changes impacts,
- to track the budget and cost analysis related activities.

The utilization of 5D-BIM technology can result in

- a greater accuracy and predictability of project's estimates,
- project scope changes,
- materials, equipment or manpower changes.

Integrated 5D BIM simulation models enables the development of more efficient, cost-effective and sustainable constructions.

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## 5D BIM

Integration of 3D and cost

[https://www.youtube.com/watch?v=Gpbn\\_qsFcXU](https://www.youtube.com/watch?v=Gpbn_qsFcXU)

BIMestiMate - BIM-based Cost Estimation Software

<https://www.youtube.com/watch?v=tbmtjkSRc6I>

What is 5D BIM? | The B1M

<https://www.youtube.com/watch?v=X0LiBQ6Jhl0>

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## 6D BIM = SUSTAINABLE ENERGY

The utilization of BIM technology can result in more complete and accurate energy estimates earlier in the design process.

Allows for measurement and verification during building occupation, and improved processes for gathering lessons learned in high performance facilities, perform real energy consumption analyses.

Integrating BIM with 6D simulation models leads to an overall reduction in energy consumption.

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## 6D BIM

Energy analysis

[https://www.youtube.com/watch?v=Qimz\\_POA4bl](https://www.youtube.com/watch?v=Qimz_POA4bl)

Wind load simulation

<https://www.youtube.com/watch?v=kU8LsnPAM2w>

Solar analysis

<https://www.youtube.com/watch?v=3W2ft8u8P9c>

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## 7D BIM = FACILITY MANAGEMENT

The traditional focus of the construction industry  
on the capital costs of construction.

Most money is proportionately spent after building handover

BIM involves the inclusion of information  
to better understand the whole-life cost of assets,  
to support facilities management and operation  
to drive better business outcomes  
to make for better decisions in terms of both  
cost and sustainability.

This kind of information really adds value  
as it is passed on to the end-user at handover.

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## 7D BIM = FACILITY MANAGEMENT

the operation and maintenance of the facility throughout life cycle

BIM model offers an easily-accessible and understood way of extrapolating information. Details are easily interrogated graphically, that would have been hidden in paper files.

This approach allows facilities managers to pre-plan maintenance activities potentially years in advance and to develop spending profiles over the lifetime of a built asset, working out when repairs become uneconomical or existing systems inefficient.

The planned and pro-active approach offers significant benefits over a more reactive one - not least in terms of costs.

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## 7D BIM = FACILITY MANAGEMENT

The data referred to as integrated BIM or iBIM data might include information on the manufacturer of a component, installation date and required maintenance details of how the item should be configured and operated along with lifespan for optimal performance decommissioning data.

Adding this kind of detail to BIM model allows decisions to be made during the design process if it makes economic or operational sense to do so a device with a lifespan of 4 years could be substituted with one expected to last 10

Designers can explore a whole range of permutations across the lifecycle of a built assets and quickly get an understanding of impacts including costs.

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## 7D BIM = FACILITY MANAGEMENT

the operation and maintenance of the facility throughout life cycle

The utilization of 7D-BIM technology can result in :

- allowing participants to extract and track relevant asset data such as component status, specifications, maintenance/operation manuals, warranty data etc.
- streamlined asset life cycle management over time.
- managing subcontractor/supplier data and facility component through the entire facility life cycle,
- easier and quicker parts replacements,
- optimized compliance,
- optimization of asset management from design to demolition.

The BIM model should continue to develop during the operation phase with updates on repairs and replacements added in.

The operational and diagnostics data should be fed in BIM model to inform decision making further on.

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## 7D BIM

BIM for Facility Management

<https://www.youtube.com/watch?v=CjZAWlftBNU>

BIM based Asset & Maintenance management

<https://www.youtube.com/watch?v=cCe3SLLBgU0>

What is 6/7D BIM? | The B1M

<https://www.youtube.com/watch?v=N2ecyS7Odww&t=199s>

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BIM	DIMENSION
3D	GEOMETRY
4D	TIME - SCHEDULE
5D	COST - ESTIMATION
6D	ENERGY - SUSTAINABILITY
7D	FACILITY MANAGEMENT
8D	.....
9D	.....

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