
# Visual Building

Collaborative approach to facilities lifecycle management

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A collaborative approach to facilities lifecycle management.

## What is Visual Building?

Visual Building is a solution set that automates and supports collaborative facilities management.

It provides an opportunity for building industry professionals to move from 'old school' practices relying on pockets of human craftsmanship to an evidence-driven, systems-thinking approach that aims to build value, as well as reducing costs.

The Visual Building solution builds on the Building Information Model (BIM) approach, facilitating the synthesis of design information, collaboration between different disciplines, more accurate commissioning, and informative benchmarking.

## The Challenges of Facilities Management

Facilities are too often managed using ad-hoc pockets of 'soft knowledge' residing in the heads of a multitude of experienced tradespeople (eg, plumbers, electricians, structural engineers, and interior designers, etc.), and the related data often sits in a myriad of databases.

Consequently, building records are often outdated, incomplete or differ from the reality on-site, making integrated problem solving a real challenge.

This fragmented approach also hinders the creation of value and creates unnecessary costs for building owners, contractors and users alike.

It also leads to reactive maintenance, not pre-emptive efficient planning. Information generated throughout the lifecycle of facilities management should be readily available and accessible anywhere at any time to those who need it.

With Visual Building, you can capture, view, amend and add to the entire lifecycle of information relating to all phases of facilities management from project scoping, planning and construction, to the ongoing maintenance of facilities.

You can access this information through a number of channels, including the web, mobile phone, or other handheld devices.

## Moving Beyond BIM

The building industry is embracing Building Information Management (BIM) as a way to solve these challenges. Originally popularised by consultant Jerry Laiserin[1], BIM is "a system where all the intelligent building objects that define a building can coexist in a single project database."

The BIM philosophy emphasises:

- digital models of buildings,
- databases in lieu of 2D drawings to store information,
- a distributed and collaborative approach,
- the value generated from a combination of tools and processes.

A survey of senior US construction industry executives found that 62% will be using BIM for over 30% of their projects in 2009[2]. 82% of those who had some experience with BIM stated that it had a very positive impact on their productivity and 44% of those now regularly track BIM ROI.

To date, BIM has been primarily adopted during the construction of buildings, without extending the benefits throughout the entire lifecycle of that facility.

[1] Laiserin, J. (2003). *Comparing Pommes and Naranjas* on www.laiserin.com.

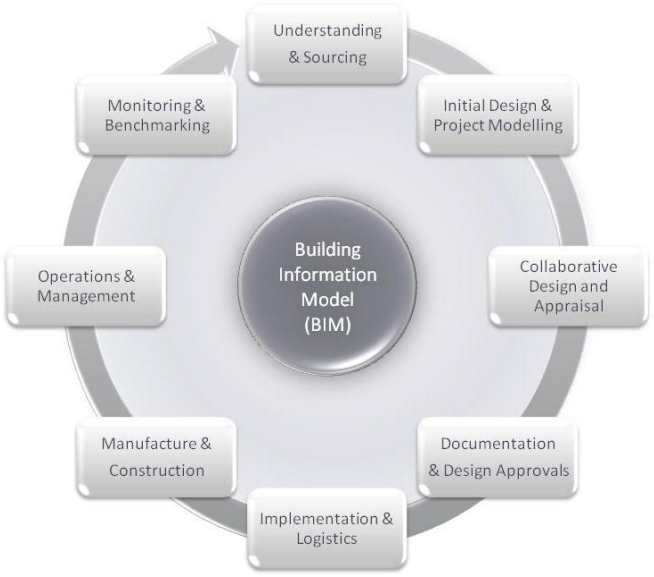
[2] Young, N., Jones, S. & Bernstein, H (2009). *Building Information Modeling: Transforming Design and Construction to Achieve Greater Industry Productivity*. McGraw Hill Construction SmartMarket Report.

## Nextspace's Visual Building solution

Nextspace's solution for Visual Building builds on BIM concepts and adds:

- a focus on value over the entire lifespan of the building, not just the cost of construction
- a central 'clearing house' for a wide range of data to provide better evidence for decision-making
- visual presentation of complex, inter-related data to aid understanding and collaboration
- easy access for an 'ecosystem' of stakeholders including non-technical users
- integration with other data sources, such as remote sensors, local authority databases, corporate databases.

Visual Building considers the full lifecycle of a facility, as illustrated below.




The Nextspace solution acts as a data hub. Applications are available at each phase of the facility's lifecycle, where relevant data - ranging from building designs, materials, occupancy records to CO2 footprints - can be measured, modelled and therefore managed.

This data might come from CAD designs, corporate databases, real-time building sensors, government agencies and others, and can be managed, evaluated and shared with external parties. For instance, building data can be published to Green Building XML or DOE 2.0 (US Department of Energy) standard or other industry-standard formats. Accurate plans and building data could be exported to fire or resource consent agencies.

### Consolidation, accessibility and collaboration.

The strength of the Visual Building solution lies in unifying these multiple sources of data – not least of all complex 3D CAD models.

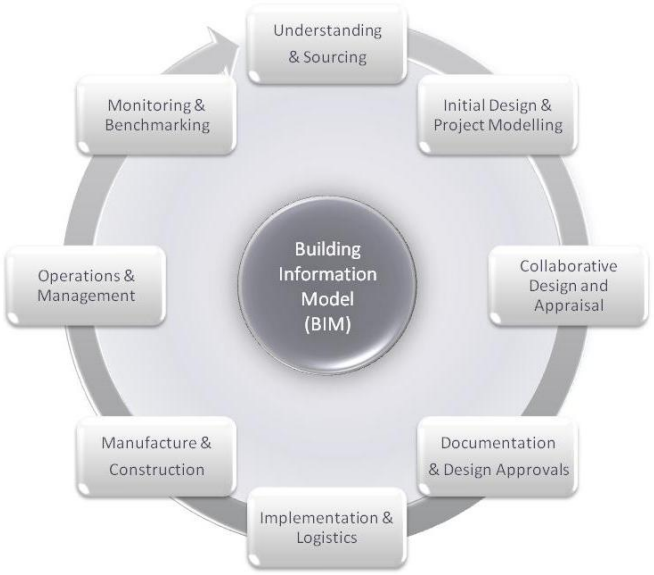
Importantly, this information is easily accessible via standard desktop PCs, web browsers or mobile devices. For instance, a 3D model with annotated quantity information can be emailed to a supplier inside a standard MS Office document. This information can also be accessed onsite for immediate problem-solving. Appropriate, authenticated access can be granted to stakeholders who only need occasional access such as tenants, emergency services, real estate agents or maintenance contractors.

By embracing all this data, Visual Building goes beyond just replicating a physical structure and becomes a comprehensive tool for decision-making throughout a facility's lifetime.

## Benefits of Visual Building

The benefits of a Visual Building solution relate to improving the overall building lifecycle through better communication, coordination, quality, cost control, and productivity.

Visual Building also has specific benefits at each stage of the facilities lifecycle.




### *Stage 1: Better understanding of project requirements*

#### Documenting initial requirements

For a greenfield development, the lifecycle management begins with understanding the requirements.

This includes capturing client needs, expectations, project scope and budgets for both capital investment and ongoing operational costs.

Planning information and site-specific factors such as geotech, environmental, services and ownership information also need to be recorded.

Greater investment (of time and money) in this initial phase of requirements gathering has significant payback, especially as these decisions have implications for the next 50 to 100-plus years.

80% of a building's total cost is allocated in the first 20% of the project.

Beginning design without sufficient requirements gathering often leads to problems down the line. Once an initial concept drawing is produced the concept tends to stick even if requirements change significantly.

#### Capturing Best Practice

Initial briefings are often not informed by best practice nor supported with evidence of past experience. Clients don't fully know what is possible or what questions to ask.

Visual Building can capture and better present valuable briefing information such as site boundaries, sunlight and shadow envelopes from multiple perspectives in 3D.

Best practice from previous Visual Building projects can be drawn upon and compared. This can include references to projects in like facilities, similar or neighbouring sites and performance requirements of materials.

Visual Building's briefing tool systematically captures client requirements and relevant best practice. The output is the starting point for a project and briefing documents for contractors.

The briefing tool can improve collaboration between project stakeholders, track and document agreed changes and reduce 'scope creep'.

## *Stage 2: Initial design and project modelling*

### Tracking iterations

The agreed requirements become a brief for a wider team of design contributors and contractors - all with differing domains of expertise.

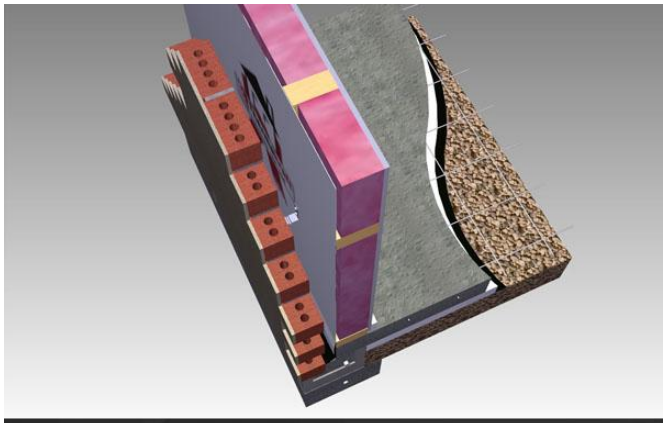
During this phase there may be several concurrent design options. The challenge is to evaluate these options against evidence and well-scoped requirements.

The Visual Building configuration tool can be used to speed this process. Early interaction with clients using 3D visualisations helps ensure the building will meet client expectations in terms of aesthetics, function, performance and budget. Various iterations can be explored and any changes clearly communicated to the entire design team. Supplier and contractor components and costs can be included and reflect the latest iteration. Models of best practice from previous projects can also be included.

### Using metadata to improve project modelling

Increasingly, building components and materials are available via online catalogues which also embed metadata about product specifications, performance and logistics. The sourcing of component objects from such an online catalogue can inform design decisions on aspects such as carbon footprints, low impact building innovation, rainwater harvesting, waste management plans, localised sourcing of product and total cost of maintenance in addition to aesthetics.

It is already common practice for materials suppliers to provide 3D CAD models of their components as templates that architects and draughts people can include in their plans (for example, window frames). In addition to the supplier confirming the information as accurate, they can add this metadata to plans and BIM models.



Cross-section of building materials

Composed together, these objects define a building model. If an object is changed or moved, it need only be acted on once. This is a clear advantage in the early stages of design when the process is usually quite iterative.

A manufacturer of steel frame kitset houses, uses Visual Building's Configuration Tool to greatly reduce the time required to provide customer cost estimates, a previously labour-intensive task. This has reduced their overall cost of sale.

## *Stage 3: Value-creating, collaborative design*

### Collective agreement on the design proposition

When the initial design is successfully validated against the brief, it becomes a design proposition to be further developed by a multi-disciplinary team including structural engineers, mechanical engineers, service technicians, quantity surveyors, landscape architects, interior designers, contractors and more.

With so many different parties and disciplines, coordinating and indentifying potential clashes becomes a challenge.

BIM tools have proven themselves in this area, with 70% of BIM users surveyed reporting at least a moderate impact on their internal work practices, and 66% citing at least a moderate impact on their external project practices[3].

Visual Building goes beyond BIM. It adopts a 'systems design' philosophy that aims to bring all stakeholders together early and strategically so they jointly create value - not merely avoid clashes.

### Facilitating stakeholder collaboration: the clearing house

The Visual Building solution collates relevant and quantitative metadata from all disciplines (not just the architect or client) in an accessible and timely way. Visual Building's server acts as a 'clearing house' for all relevant data. It supports over 140 different CAD formats and can synchronise data from architectural, interior design, structural, services, surveying, project management and trades disciplines.

The Visual Building solution becomes the primary forum for collaborating on the project and provides a common language and definitive data to remove ambiguity.

### Definitive 3D master models

The accuracy of the data being shared is improved, leading to better quantity surveying and cost certainty. Many conventional estimating techniques, which rely on two-dimensional drawing measurements, have substantial potential for ambiguity, inefficiency and error. A three-dimensional master model can quickly provide clear quantities which are linked directly to published or internal cost data. This information can be used for project cost planning and subcontract bidding. Many measurements are automated, removing laborious and error prone manual quantity takeoffs and updates.

### Focus on value, not just cost

The data in the 'clearing house' can be used for a range of value-adding analyses. Separate models from architects and engineers can be integrated to form one comprehensive model used to analyse the impact of the building (such as energy consumption, carbon footprints, safety, occupancy) not just the physical shape.

Energy efficiency, ventilation, sunlight, water tightness, amenities, acoustics, access and egress, emergency response and evacuation, fire safety, building security and occupancy use can be modelled at this early stage. Collaborative design iterations can occur to optimise the building's lifetime performance in these areas – with a focus on value not construction cost.

Visual Building can provide the data necessary for such analyses and integrate with other services.

For instance, Autodesk's Green Building Studio service allows building models to be uploaded for a water, energy and carbon consumption analysis. This whole building analysis produces a DOE 2 (US Department of Energy 2) standard analysis on carbon footprint, energy consumption and advice on photovoltaic and wind energy potential to create a carbon-neutral facility.

Landcom's Precinx sustainability assessment tool provides greenhouse gas (tonnes CO2/year), potable water (kL H2O/year), total affordability ($/week) and vehicle hours travelled (hours/week) analysis for whole neighbourhoods.

[3] Young, N., Jones, S. & Bernstein, H (2009). *Building Information Modeling: Transforming Design and Construction to Achieve Greater Industry Productivity*. McGraw Hill Construction SmartMarket Report.

## *Stage 4: Timely and accurate documentation & approvals*

### Approving key milestones

Producing the paperwork in the required formats for a range of regulatory and local authorities, subcontractors and other partners is time-consuming and costly work. Comprehensive documentation is required at key milestones.

Once building information is in the Visual Building database, derivatives of the 3D model and metadata can be automatically generated according to templates and rules.

These could include detailed 2D blueprints, specifications, bills of materials, schedules, cost schedules, consent drawings, visualisations and physical models – of the entire project or specific parts. Even though these documents relate to different disciplines, they are consistent and in synch with the latest designs – reducing room for error.

Documents could be shared (or in future, submitted to authorities) electronically, and produced in electronic formats designed for easy sharing, such as the Green Building XML standard or the Leadership in Energy and Environmental Design (LEED) rating system.

### Reducing the cost of revisions

If documentation is required in a specific format, then a template can be defined once and subsequently reused for future design iterations or projects.

In reality, designs rarely remain unaltered. Tracking and approving changes is easily coordinated by Visual Building's server. For instance, only appropriately signed-off materials could be output for legal or consent processes.

If revisions, alterations or extensions are required, updated documentation can be automatically re-produced – significantly reducing the cost, time and impact of change.

At this late stage in the design process, changes are often overlooked and errors creep in as contractors expect that designs have already been signed-off. With Visual Building, contractors can adapt more quickly as they can access the visual model direct and do not have to wait for documentation.

## *Stage 5: Optimised implementation & logistics*

### Incorporating time & cost scheduling information

The six dimensions of BIM are often referred as the three spatial dimensions plus time, cost and management information respectively. Incorporating time and cost scheduling information makes BIM systems a particularly valuable tool for construction project managers.

Optimal scheduling and sequence planning can be undertaken as the design develops, during implementation planning or construction. Integrating the 3D model into project timelines encourages common understanding and pre-emptively avoids conflicts around logistics, construction staging strategies, resource loading management and site management.

Resource loading can be calculated from the master project model. Phased construction strategies can be developed and tested virtually to encourage 'just-in-time' supply of materials and trades people.

### Streamlining RFPs and tenders

The information captured throughout the facilities lifecycle can be used to streamline procurement by providing accurate RFPs and tender information. 3D models of the project can also be easily included in common documents such as MS Office files – greatly enhancing contractors' understanding of the project and getting them up to speed quickly.

## *Stage 6: Efficient and safe manufacturing & construction*

### Ongoing progress tracking

The Visual Building database can be a valuable 'living' project management tool. It can provide accurate information to all parties involved, track and report on progress, identify and solve clashes on the fly, provide accurate measurements and improve safety practices.

As a 'living' record of the project, construction's actual progress can be tracked and compared with the scheduled timeline already in the database.

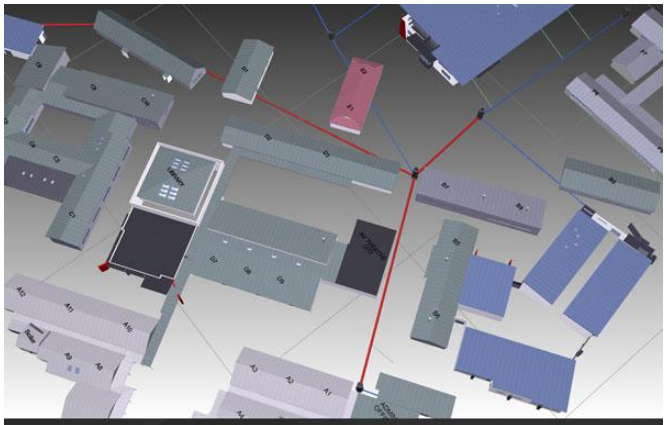
Digital surveying and measurement technologies can provide onsite data for the Visual Building database. Comparisons of specified versus actual construction can be used to alter plans, verify quality of construction or for future plans.

79% of firms who measure their ROI on BIM tool report improved project outcomes such as fewer field coordination issues[4].

### Early detection of conflicts & slippage

Continuously monitoring performance against the set schedule identifies slippages earlier, helps fine-tune adjustments and manage sub-contractors.

The three-dimension master model with associated building metadata is a powerful on-site problem solving tool. Errors and omissions traditionally buried in disaggregated two-dimensional drawings are much easier to see in 3D and when they are in a unified database. Automated "clash and clearance detection" allows spatial conflicts between systems (for instance, engineering, plumbing, electrical and other services) to be automatically reported.



School site and underground

### Informed on-site decisions

These spatial and timing clashes can be resolved in advance of construction, and accessed on-site via mobile devices to optimise daily site management.

The full intelligence of the Visual Building model does not need to be confined to the site office but can be carried around on tablet PCs or mobile phones.

### Safety and training

The model is a valuable instructional tool. Construction simulations can demonstrate proper and optimal working methods to on-site staff, clearly highlight hazards and highlight progress. 3D models can be animated to show assembly steps and interactive training tools.

A 3D representation is easier and more intuitive to understand than 2D blueprints, especially for workforces with varying literacy levels or multiple languages.

[4] Young, N., Jones, S. & Bernstein, H (2009). *Building Information Modeling: Transforming Design and Construction to Achieve Greater Industry Productivity*. McGraw Hill Construction SmartMarket Report.

## *Stage 7: Operations and management*

While design efforts have a large impact, ongoing measurement and management can reduce maintenance and repair costs as well as create value for building users.

80% of the total lifetime cost of a facility comes post-construction.

### User-centric analysis tools add value

Remote sensors and corporate databases can be integrated with the Visual Building model to provide real-time intelligence on the building's operations and better management analysis.

Remote sensors and RFID tags can record heating, sunlight, access, elevator and security data. Corporate databases can provide occupancy, leasing, security access information.

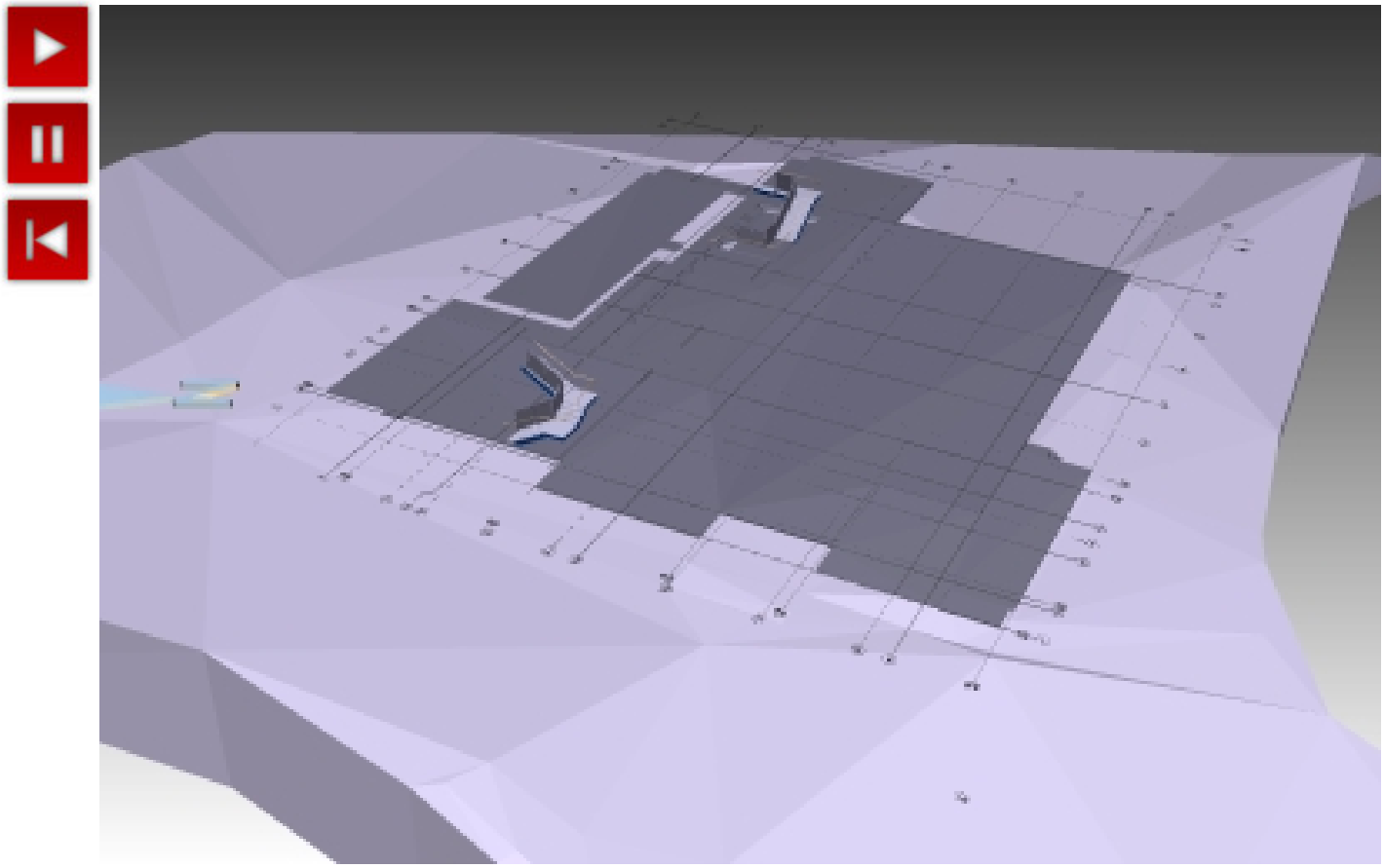
The Visual Building model records plant, equipment and materials warrantees plus maintenance inspection results.

These warranty documents and work orders can be accessed from the floor plan by tenants and facilities managers. Furniture and workspaces can be added, allowing facilities managers to maximise space occupancy.

This information informs 'user-centric' analysis such as smoke and fire modelling, energy usage, people flows, occupancy planning, hot-desk planning, flexible internal wall reconfigurations.

### Alterations and extensions

Scheduling optimisation tools can be used through the facilities lifetime for alterations and extensions, especially since relevant data is already available electronically. They provide accurate briefings for service contractors. For instance, a contractor could be given an annotated 3D model on a tablet PC so they can identify existing electrical or pipes to avoid in a particular wall.



## *Stage 8: Monitoring & benchmarking*

Too often, facilities managers rely on personal observation or, worse still, complaints from tenants to monitor building performance. The emergence of cheap, wireless or internet-connected smart monitors means this may be a thing of the past. The Visual Building platform becomes a natural interface for data fed from such sensors.

Services exist that clip non-invasive sensors onto breaker boxes providing online real-time energy consumption reports. Humidity, water consumption, water temperature can be measured similarly.

Performance can be monitored and managed against KPIs, for energy consumption or green building performance, for instance.

User information from post-occupancy evaluations can also be recorded and considered during refits and refurbishment.

### Benchmark setting

Ideally, benchmarks for best practice can be recorded and the experiences from one facility can be drawn upon when specifying the requirements of future extensions or new buildings.

Different sites using Visual Building solutions could be compared to identify improvements.

## Taking the Next Step

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