

The CLAW BIM Toolkit for Clients

Making the Business Case for BIM including ICT

A comprehensive suite of documents and tools to explain and enable deployment of a BIM enabled approach in line with standards and protocols, and to achieve Welsh Government adoption date of March 2016.

The Toolkit is devised to support officers and members articulate the BIM business case and efficient deployment and procurement practice of BIM enabled projects.

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Purpose

The purpose of this document is to support technical officers articulate a coherent explanation and business case for the efficiencies and savings that can arise from the deployment of a BIM enabled approach on the creation and effective use of Built Environment assets.

This guide has been prepared following a series of CLAW workshops to introduce Building Information Modelling (BIM) to CLAW and prepare an All Wales BIM Toolkit. This is part of a suite of documents which support cross authority client competency and consistency to deliver BIM in line with Welsh Government aspirations. It is a base from which each authority can develop their own local and project specific variations. The documentation has been drawn together as the output from a series of workshops contributed to by various CLAW members and does not represent advice or the opinion of any single party.

The guidance has been created with the input and influence of Constructing Excellence Wales and the Welsh BIM working groups and aligns directly to the Welsh Govt Procurement Strategy, which mentions BIM , and the outputs and targets of the All Wales working groups which align directly to the mandation dates of March 2016 for adoption of Level 2 BIM.

Introduction

Welsh Government policy reflects the UK target for adoption of BIM. BIM is embedded into the Welsh Government Construction Procurement Strategy launched in 2013. The HM Government Construction Strategy mandates the use of Building Information Modelling (BIM) on all directly funded projects by 2016.

BIM is a development of 3D CAD linking visualised asset models to documents and databases to digitally and visually represent physical and functional characteristics of a facility. The resulting model becomes a shared knowledge resource to support decision-making about a facility from earliest conceptual stages, through design and construction, then through its operational life. BIM is used to model the entire building life cycle, supporting processes including cost management, construction management, project management and facility operation. The use of BIM is considered a significant enabler to reduce costs by 20%.

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BIM is a process which uses digitally produced data. It generates an interactive model which facilitates fully integrated planning, procurement, construction, operation, and maintenance of built asset and infrastructure projects. It saves money because mistakes made through poor communication between the numerous parties involved in construction using traditional methods are significantly reduced.

Managing and using common data results in greater clarity and accuracy through the option appraisal process. Faster construction, improved asset quality and reduced running costs will result in less capital and revenue investment.

It is one of the processes used by the car and aerospace industries which has allowed them to significantly improve the quality of their product whilst also reducing the end price.

The HM Government Construction Strategy mandates the use of BIM on all directly funded projects by 2016. This is based on the hypothesis that “a client can derive significant improvements in cost, value and carbon reduction performance through the use of open shareable asset information”. BIM will contribute towards an overall target of 20% saving. The total annual spend by Local Government in construction is c£10Bn pa. The opportunity to make significant savings or reinvest is therefore clearly one that should be explored.

Drivers to Introduce BIM

Reducing cost and time delivery

- Government strategy requires us to deliver a 33% reduction in the initial cost of construction and the whole life cost of built assets against current cost; BIM has been highlighted as one of the tools which should be used to achieve this target.
- 2025 Construction Strategy demands a combined CApex and Opex reduction of 50% and states that BIM is a contributory approach and technology to deliver this outcome.
- Delivering better facilities for less money, ensuring early programme and cost certainty. A Local Authority invested in supporting BIM on a Social Housing project and has recorded a Return on Investment of 250%. This was achieved through a programme reduction of 6 weeks by reviewing the full design prior to build with less waste produced.
- Lowering the cost of managing and maintaining our built estate including highways. Future savings will be realised by importing and manipulating survey and investigative works information directly into the BIM model.

Improving engagement with stakeholders

- Enhanced engagement with stakeholders during the design and construction phase. Allows end users to view new build in 3D model and on education projects provides an opportunity for curriculum use.
- Using our buildings in a more efficient manner, the visitor experience is enhanced by making them more accessible to the public.

Reducing carbon impacts

- BIM can promote enhanced energy performance. Targets on carbon reduction savings are challenging. Using BIM increases the chances of hitting the target.
- Promoting efficient management of building assets. Less time and money spent on contractors investigating where services are fed, where asbestos is contained, all as an accurate information BIM model.

Benefits of Implementing BIM

Evidence taken from projects already using BIM demonstrates clear benefits to clients, primarily a saving in cost, and a significant increase in certainty and quality, not just in the project execution stage but also the operation and maintenance of the asset.

Benefits

The data can be visualised in real time which allows the asset to be designed in a virtual environment prior to going on site.

End users and stakeholders can contribute with more confidence and clarity at all stages of project option appraisals through design development, thus creating a robust engagement process which reduces the risk of misunderstanding and improves clarity. This will deliver efficiencies when working with Regulatory and Statutory Bodies.

The model generates a far higher level of coordination such that risks of additional cost and time delays are all reduced significantly. Detecting clashes between building elements provides the most basic yet productive use of BIM.

Health and Safety improves as a result of greater clarity in the build sequence. Inductions are easier to engage with and understand resulting in safer sequencing of the entire works programme.

The greatest benefit to a facility owner (whether a built asset or infrastructure) will come during the operational life of the facility. This will be achieved by linking detailed current asset information to the model, for example linked to fire and security strategy as well as energy management systems.

Assets will be better utilised and more sustainable, with more efficient management and maintenance

Some examples:

Replacement of a broken lamp in a light fitting-

By using the information contained within a BIM model it is possible to precisely identify a part without the need for investigation. Savings of circa £100 per fitting have been identified.

Cost of Facilities Management staff assisting a contractor in a plant room working on faulty equipment -

By allowing the contractor access to information within the model to find the particular plant equipment detail including schematics/design drawings avoids the need for staff to waste time trying to source or recall historic information about the part. Savings of circa £280 have been identified.

BIM CASE STUDY

ALCOVE LIGHT REPLACEMENT
(Manchester Central Library)

Summary:
This case study compares how historically one of the Alcove lights in a heritage area of the Central Library needed a detailed investigation on how the light could be repaired and how this would be managed if the Facilities Management Team had access to accurate and robust BIM data, the saving in disruption, time and money is considerable.
The anticipated saving having access to BIM is £108.00
Using BIM Technologies would have potentially reduced the investigational period from 6 week to 1 day

Method	Initial Investigation	Further Investigation	Outcome
TRADITIONAL METHOD	<ul style="list-style-type: none"> Light fails to come on in an alcove on 1st floor (Heritage Area) Lamp type unknown, no area cordoned off to allow FM to access light via ladder £5000 SON lamp but none in stock. Area re-cordoned until replacement of lamp can be carried out. (2-day wait) Staff/Customers not happy - conditions too dark to see books Man Hours for Labour - 2 hour 	<ul style="list-style-type: none"> Area Cordoned off & Lamp replaced. Still not working Electrician called in 11-day waiting time Electrician struggles initially to isolate power as the 2nd nearest fuse distribution boards are not adequately marked up. After further testing, the Electrician deems the lamps control gear (Ballast, etc) is at fault & assumes the kit is directly above the fitting in the roof void. Access to the control gear needs investigating Man Hours for Labour - 3 hours 	<ul style="list-style-type: none"> Access to the relevant void is worked out and nearest access point is via 2nd floor. Access stairs checked & initial access hatch area not identified as a risk. However, peering into the relevant duct void highlights that the area is extremely confined. Various HSE representatives also join in the discussion & further asbestos tests carried out. (2 hrs) Due to many 'Unknown Factors' the job was never resolved.
USING BIM	<ul style="list-style-type: none"> Model used to find out what lamp fitting is needed. Lamp replaced but not working. Electrician called to investigate. Electrician deems the lamps control gear is at fault & uses BIM data to establish that the kit is directly above the fitting in the roof void. BIM checked to show relevant access routes, duct space size, Load bearing, length of access point to ensure asbestos presence, light specifications, etc. 	<ul style="list-style-type: none"> With the detail provided from the BIM, a thorough Method Statement and Access/repair Method could be put together to ensure the safety of the electrician & to procure relevant responsibilities prior to commencing with the job, therefore minimising the need & risk to access the duct more than necessary and increasing the repair time. Alternative repairs require investigation (i.e. accessing the lamp kit from below but English Heritage would want reassurance on how this would be done. Therefore the model could not only provide Material information but also visual representation of proposed repair method. 	<ul style="list-style-type: none"> Anticipated cost Saving £108.00 Time Saved man hours - 8 Hours Reduced disruption & inconvenience to Public/Staff & Avoids adverse reputational damage

Quote P. Thompson, Manchester City Council Facilities Manager
"BIM provides an Operational FM Team the ability to provide right first time, every time solutions to everyday issues. BIM manages multiple information sources and presents them in a logical manner that Operational Teams understand. This brings real savings in cost, time and effort and ultimately an enhanced service for my customers."

Manchester City Council
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- Accurate information on warranties stored within the BIM model would ensure cost savings. For example, in the private sector a company is reporting savings of £40k per year.

- Supporting Estate Rationalisation by providing accurate data on the asset, how it is used, the condition, plus energy consumption and maintenance records.

Specific ICT Impact

The tools, training and integration of ICT systems associated with BIM will be dependent on the internal departmental use of BIM.

For Strategic, Planning and Procurement teams; information provided by BIM can be accessed with traditional data modelling and reporting software. The mandated COBie UK 2012 data interchange standard is modelled as a spreadsheet. Visualisation tools where required, are increasingly provided by BIM software supplier's free of charge. Standard procurement documentation including BIM specific clauses (such as PAS91) has recently been introduced.

The impact of introducing BIM into existing working practice and current ICT implementation is Low.

For Project & Asset Management teams; direct access to the BIM authoring and modelling tools is not typically required. Again with visualisation tools often free of charge and the use of traditional project and asset management tools with visualisation upgrades the cost can be contained and future proofed through aggregated and coordinated buying across authorities. The interface of BIM outputs can radically improve CAFM costs and functionality – if correctly aligned and specified.

The impact of introducing BIM is Low.

For Design and Development teams; the software overhead is greater typically equating to a capital investment of c£10k per head for the modelling tools and software training. For any Authority maintaining a competitive design function this investment should migrate into normal CPD.

The impact of introducing BIM is Medium.

Back Office; the back office system impact of BIM will depend on the corporate systems and policies in place. BIM models do bring a significant increase in both bandwidth and data storage requirements. This is however a small overhead in comparison to normal project and asset electronic data storage and access requirements. BIM is about the managed and structured storage and access to asset data. The requirements to integrate BIM into the corporate data system environment should be the subject of a full strategic

review. A dedicated collaboration and data storage facility may be required where a Cloud based solution is not used. BIM thrives on the collaborative access to this project and asset data linked to traditional corporate data and external libraries and standards. ICT should support Asset, Capital and FM teams to ensure Security and data access both internally and externally as models and associated data will need to be transmitted and accessed from both development and managed asset sites or by external suppliers. ***The introduction of BIM can be seen as an opportunity.***

Early exemplars are currently working with industry to adopt a consistent approach to BIM Collaboration Tools – a development on Project Extranet, common data Environments and EDMS (Electronic Document Management Systems). This approach will see the integration of BIM into Whole Life Asset and Estate Management with common and integrated systems across the full asset lifecycle.

A number of organisations have devised progressive enabling of their BIM capability with key services, departments and individuals being equipped with “BIM Stations” accessed through multi licences whilst the training and competency builds within the staff . This effectively reduces immediate cost and provides for the benefits of the rapid change occurring within the market as the software providers enhance their offering during this period of extreme competition. This approach should be considered as part of a longer term plan and programme and not as a short term stand alone fix.

The market is offering increasingly complex bundle packages, and emerging rental options instead of licences, and there is merit and potential for further savings through the exploitation of a cross authority buying, and aggregated savings by all Authorities working to a Welsh BIM performance standard as created by this toolkit.

Risk – The impact of not implementing BIM

- The Council is unable to comply with HMG Construction Strategy to use BIM on all projects by 2016 and is unlikely to achieve the savings target.
- Efficiencies identified in the budget will not be realised.
- The Council is unable to comply with Welsh Government mandation to use BIM on all projects by 2016 and is unlikely to achieve the savings target.
- A client's ability to deliver construction projects will be diluted.
- BIM is gaining momentum and will be normal practice throughout the Construction Industry. Suppliers are already using the more advanced software, if the Council don't adopt BIM some teams will be unable to function.
- There is risk attached to an underinvestment in Leadership and competency terms which will diminish the potential savings that could be harvested from a BIM enabled approach.

Investment Required

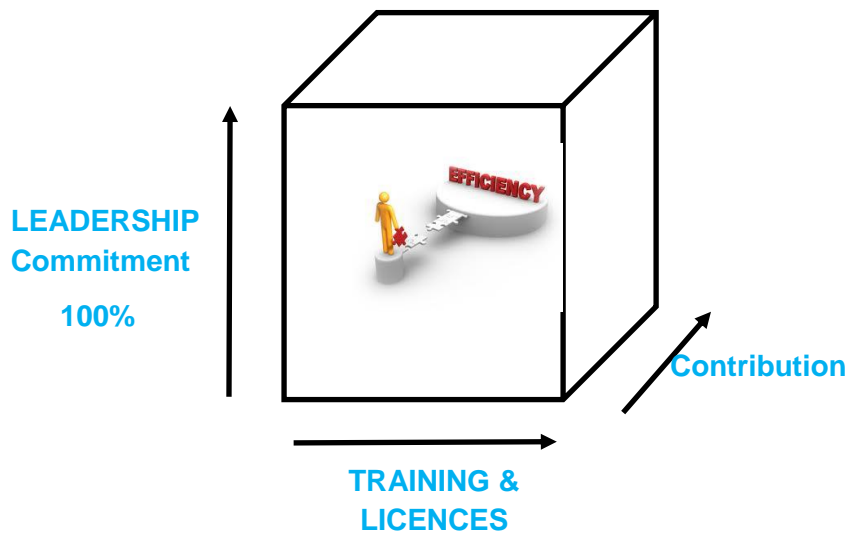
This will depend on the direct involvement an Authority has in the delivery and maintenance of their Estate.

For an Authority which relies on external providers for design, construction and management the principal investment will be to ensure that procurement and commissioning staff are aware of BIM and that it will be a new requirement in their procedures.

An Authority which delivers any part of the design, construction and operation of their Estate will be refreshing ICT software and hardware.

The investment in Competency and equipment must be balanced with Corporate and Individual leadership to ensure the supply chain engage and adapt. The relative impact of competency and contribution to leadership is demonstrated in the below “CUBE of competency” The diagram also shows a balance between Leadership, Technical competence and the deliverable savings and efficiencies.

It should be noted that CLAW, supported by CEW has already shown considerable leadership in developing this toolkit and this has been supported by training programmes. Individual clients may benefit from specific organisational programmes.



The cube represents maximum efficiency

Calculated by: Commitment X Contribution X Competence

Therefore: $10 \times 10 \times 10 = 1000$ (100%)

Assuming maximum commitment, consider the consequence of only minor changes to Competence and Contribution?

$$10 \times 9 \times 9 = 810 \text{ (81\%)}$$

$$10 \times 8 \times 8 = 640 \text{ (64\%)}$$

$$10 \times 5 \times 5 = 250 \text{ (25\%)}$$

Competence and Contribution are influenced by the quality of the training and implementation program

Investment costs fall into three categories. For an Authority with an Internal Design Team working on a traditional contract these costs (per workstation) are likely to be in the order of;

Hardware including storage £2k – 4k

Software £7k – 10k

Training £1k – 2k

The costs drop as the range of delivery decreases to a nominal figure for the D&B option.

Joint procurement may lead to volume discounts of c10% to 15%.

These costs can be offset against the appropriate figures set out in the cost savings section above.

BIM is an enabling approach to facilitate the collaborative working of Project and Framework teams, bringing together what is traditionally a highly silo'd sector into Integrated teams working in a collaborative manner.

As with any toolkit, for it to be effective in its deployment and gather in the maximum benefits and efficiencies the technology and process need to be deployed with organisations and individuals who are receptive to and culturally aligned to Collaborative and integrated team working.

The public procurement process provides a framework within which a progressive assessment of Collaborative behaviours and evidence can be used to support selection of appropriate organisations and individuals.

The CLAW All Wales BIM collaborative assessment tool and matrix based approach has been created to assist procuring officers in the assessing the evidence and messages regarding Cultural alignment and practical deployment of Collaborative working approaches by potential suppliers and bidders.

Case Studies

Evidence being compiled from projects in the UK and Europe that have adopted BIM demonstrates significant savings in both the capital phase of the project and the on-going maintenance.

Local Authority clients in the UK have recorded:

- Reductions in risk allocation and risk allowance totalling 1.25%.
- The ability for the client and construction team to properly understand a project early in the process means BIM projects will have a shorter programme duration, which is as much as 25%, with the resultant cost/budget savings.
- A 10% cost saving on the installation of a lift and stair core in a refurbishment project.
- A number of North Wales SME organisations have gained competitive advantage having invested in BIM technology, process and expertise – further exemplars are expected from other Welsh frameworks from future Welsh frameworks
- Significant reductions in cost and disruption to the public on simple maintenance tasks such as lift repairs and plant replacement.
- Significant cost reduction for mundane tasks such as light bulb replacement.

A major contractor working with BIM on projects in the UK and Europe has recorded,

- A return on investment of between 5 and 10 to 1 where 1 is the cost of hardware, software and BIM process training.
- Clashes (often measured in 100's) in the build process typically cost £5000 per clash. BIM has been proven to eliminate 80% of clashes which arise from a traditional design process.
- Significant savings in waste have been realised. Measured against industry norms a reduction in waste on BIM projects of between 5% and 18% has been recorded. These figures clearly have a positive impact on carbon reduction targets.

- The cost of Mechanical and Electrical Services in a building can be reduced by 4.5%, largely through shorter installation and commissioning time, together with less rework as a result of the clash detection process.
- Client satisfaction rises, with scores of 9.8 out of 10 being quoted on BIM projects.
- A highways project has shown a 50% reduction in accidents. On a recent project 20% fewer sign gantries were needed as a result of modelling the road in use. Typically, highways projects can be delivered 10% cheaper using BIM.
- In terms of the operation of a facility, savings of 7.5% are possible post handover. The building operator has a greater understanding of the facility and its component parts, allowing a more efficient Facilities Management process.

Several Authorities have been rolling out BIM and are measuring the benefits. A network is building where knowledge is being exchanged and where the challenges and benefits of BIM are being shared.

The following local authorities in Wales are currently trialling the use of BIM:

- Ceredigion County Council – Llandysul Comprehensive School
- Vale of Glamorgan County Borough Council – Ysgol Dewi Sant
- Flintshire County Council – Ysgol Taliesin

Lessons Learnt from the projects will be gathered by CLAW and CEW to further demonstrate the value of BIM. These will be made available via the [CEW website](#)

Evidence clearly demonstrates that the adoption of BIM is contributing to more efficient and cost effective delivery of projects.

Conclusion

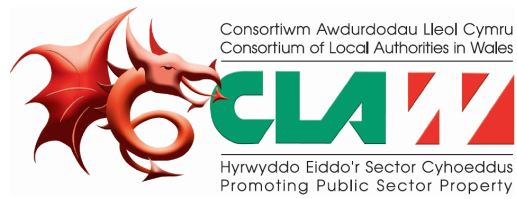
The use of BIM is a natural progression bringing together developments in design, building management systems and asset management

The costs of the adoption of BIM are often significantly overstated and easily outweighed by the benefits. The cost of entry will depend on the nature of the use of BIM across the internal departments and the impact on existing infrastructure, access and security landscape. The wider benefits and impact of introducing BIM are included in the Model Business Case which is available in the CLAW BIM toolkit where further information and help can be found.

Assets will be better utilised and more sustainable, with more efficient management and maintenance.

CLAWs lead in the BIM All Wales toolkit is transferable to other Public and Private Clients and will enable a clear Welsh Standard for BIM which will reflect additional cost savings and efficiency savings over those being delivered across the UK. This toolkit supports the delivery of the Welsh Governments Construction Procurement Strategy, efficiency targets and carbon reduction commitments whilst protecting the interests of the indigenous Construction Sector across Wales through a tiered, proportionate and progressive approach.

As with all business change projects, investment will be required to develop the vision, manage the culture change and develop working practices across internal departments and suppliers. Early projects using the new process will be benchmarked by CLAW and CEW to evaluate the anticipated efficiency gains. Local Authorities will achieve real benefits from adopting BIM.



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