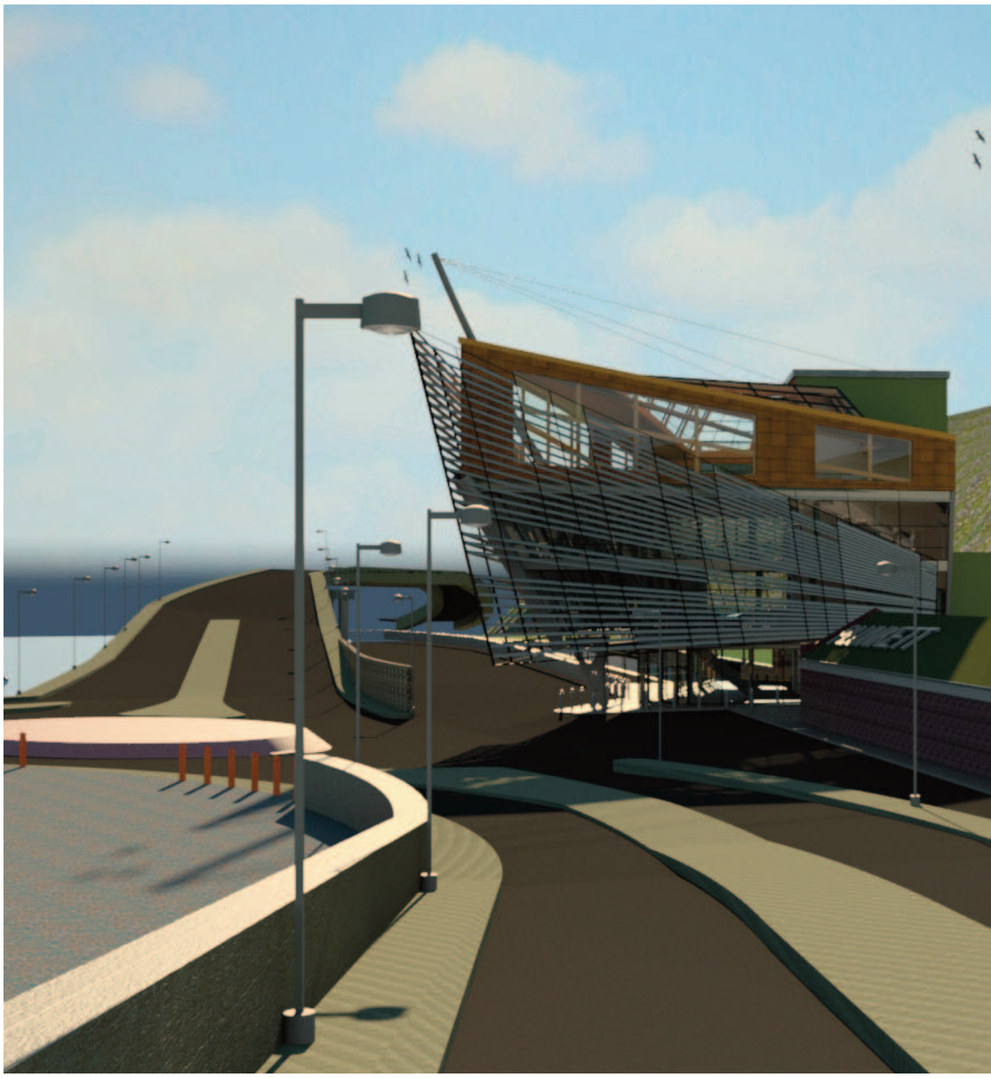
aspirATion

The magazine for CIAT student members

Issue 4, spring/summer 2015



In this issue

For further information on the articles featured, or to contribute to *aspirAtion* magazine, contact Danielle Jombla, Education and Membership Administrator. Email danielle@ciat.org.uk

Cover: Concept for railway offices in Waterford, by Cian Gilligan

Editor's foreword

By the time you have read through this special BIM edition of *aspirATion*, you will understand exactly what Building Information Modelling is. CIAT has a dedicated BIM taskforce and is committed to keeping its members up to date with relevant industry related topics.

CIAT has even partnered with BRE to create a series of webinars which aim to get you up to speed with BIM-related terminology, how BIM is being implemented as well as the standards being adopted. The first of these webinars took place in May but stay tuned as more will be announced soon!

Also in this issue:

Southampton Solent University and Adam Architecture team up to deliver an insightful article on embedding employability in the curriculum, and Daniel Owen, ACIAT, who was Commended for the 2014 Student Award for Excellence in Architectural Technology (Report) on the Passivhaus Standard, gives a clearer insight as to why the standard may be the solution to meet carbon emission targets by 2050.

Danielle Jombla
Education and Membership Administrator

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Getting to know BIM

By **Jennifer Hardi MCIAT** Senior Lecturer and Course Director for BSc (Hons) Architectural Technology at London South Bank University

What BIM is and isn't about

Building Information Modelling (BIM) – some refer to it as Building Information Management – has been a hot topic in the UK construction industry for the past few years.

Interest in it was accelerated in 2011, following the UK Government's announcement that BIM would be mandated on all UK centrally procured public sector projects by 2016.

BIM is more than just about 'sharing information'. It is about multi-disciplinary collaborative working. It is seen as the catalyst for a positive change in the current cultural process within the construction industry, which is currently known for its fragmented and silo working attributes.

BIM is often mistakenly thought to be just a new version of CAD (Computer Aided Design) and/or a clash detection software. It is often referred to as 2D, 3D, 4D or any dimension (nD), but it should not be confused with the number of dimensions used to represent a building or an asset. It combines technology with new working practices to improve the quality of the delivered product and the reliability, timeliness and consistency of the process.
The aim of BIM is to draw the project stakeholders together at an early stage so that individual parties are able to co-ordinate their input, which in return encourages a more integrated approach to a project delivery.

BIM is implemented to increase productivity and efficiency, save costs in the design and construction stages and to reduce running costs, after construction.

The structure of BIM

In 2013, the UK Government published an Industrial Strategy report, which stated that part of the vision for the year 2025 is the provision of an industry that is efficient and technologically advanced, with BIM as one of its objective to support the delivery of this aim.

The strategy paper for the 'Government Construction Client Group' divided BIM into various levels of maturity. Figure 1 below shows the BIM maturity levels in greater detail.

BIM in Higher Education

Although there is no requirement yet within the Built Environment Higher Education sector to implement BIM, it has been recognised that Higher Education Institutions (HEIs) need to respond to these changes to ensure that the future graduates have the right employability skills for the construction industry. Collaborative working can be in the form of in-class groupwork, both multi-disciplinary and inter-disciplinary. While much of the course curriculum at London South Bank University (LSBU) has implemented in-class groupwork and students haven been exposed to various CAD softwares, multi-disciplinary and/or inter-disciplinary collaborative work is still considered new. A key feature of BIM is in facilitating multi-disciplinary teamwork and hence it is vital that its implementation is integrated in a multi-disciplinary environment for it to work effectively.

There was some evidence that universities both in the UK and globally have started using BIM to stimulate multi-disciplinary collaborative work amongst students. To enhance students employability skills, the Faculty of the Built Environment and Architecture at LSBU (now School of the Built Environment and Architecture) decided to break the boundaries in semester two of the 2013/14 academic year, and run an extracurricular module where students from different courses (Architecture, Architectural Technology and Architectural Engineering) participated in a multi-disciplinary project. The emphasis of this extracurricular module is on the multi-disciplinary collaborative working experience rather than in learning particular BIM software.

The extracurricular format of this BIM collaborative working module proved to be challenging due to staff and students commitment on their formal workload and coursework but feedback gathered from everyone who participated in the extracurricular activity showed that they have enjoyed the experience.

We have decided to re-run the extracurricular again in the 2014/15 academic year. This time with even wider reach with students from Construction Management, Building Services Engineering and Civil Engineering taking part in the extracurricular activity as well as Architecture, Architectural Engineering, Architectural Technology. Initial observation of the extracurricular activity so far suggests that students gained more experience and better understand the role of other 'professionals' by being exposed to a multi-disciplinary collaborative working environment. A further detailed review will be undertaken at the end of the extracurricular to determine lessons learned from this experience.

Conclusion

To make BIM happen, it is crucial that the construction industry is moving away from the silo culture and moving towards a full collaborative working approach.

As BIM is still considered to be in its early maturity level, it is important that the construction industry and the Higher Education sector continue to share knowledge and lessons learned from their experience. To ensure that BIM delivers what it should: efficiency and cost effectiveness. It is crucial that everyone understands that BIM is more than just 3D or clash detection software and that it can be used throughout the life cycle of a building or an asset by every profession in the construction industry.

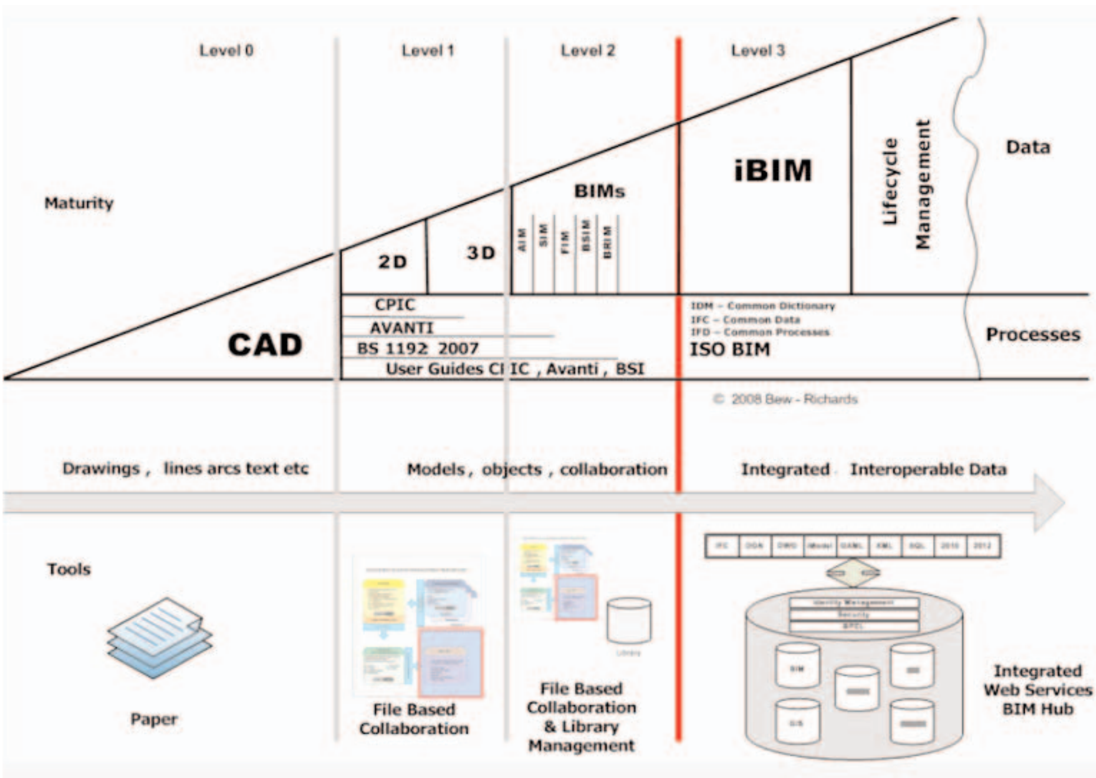
Figure 1.: Taken from PAS 1192-2:2013

Level 0, data exchange process is in the form of an unmanaged CAD and the use of 2D design application.

Level 1, data exchange process in the form of both 2D and 3D CAD. A collaborative tool is embedded at this stage to provide a Common Data Environment (CDE). The approach to data structure is also standardised at this stage.

Level 2, data exchange is in the form of CDE and is when construction sequencing and cost information might be utilised as well.

Level 3, when a fully integrated and collaborative process has been implemented on an online network/web service and is compliant with the Industry Foundation Class (IFC). This level utilises not only cost and time information but also other information which supports the project delivery lifecycle.



Student Awards 2015

CIAT

Apply today for your chance to win!

The Student Project and Report Awards for Excellence in Architectural Technology are now open. These Awards recognise outstanding design and research from final year students.

Those shortlisted will receive a free place at CIAT's 50th Anniversary Celebratory Luncheon at The Savoy.

The Winner of each Award will receive a cash receieve a cash prize £800. Shortlisted entrants will also be rewarded.

For more information, please visit:
www.ciat.org.uk/en/awards/student-awards

The closing date for submissions is 26 June 2015.

Embedding employability within the curriculum

A story of collaboration

By **Sarah Radif MCIAT**, Programme Leader and Senior Lecturer in Architectural Technology, Southampton Solent University and **Alex Naraian MCIAT ICIOB**, Associate Director, ADAM Architecture and Regional Councillor for the South East Region.

Southampton Solent University (SSU) and ADAM Architecture have teamed up to deliver a live brief where second year Architectural Technology students can engage in employability and have a real understanding of life in the 'real world'. This article explores some of the benefits gained from such collaboration.

Collaboration

The BA (Hons) Architectural Technology Programme at SSU is fully Accredited by the Chartered Institute of Architectural Technologists. The curriculum is based on three core themes: design; technology; and professional practice, procurement and contracts. Central to the ethos of the programme is embedding employability throughout the syllabus and preparing students for life after university in order to be able to hit the ground running once in employment.

ADAM Architecture and ADAM Urbanism

ADAM Architecture has offices in both Winchester and London and is owned by five directors: Robert Adam, Nigel Anderson, Paul Hanvey, Hugh Petter and George Saumarez Smith. The practice was established in Winchester in 1955 and evolved to Robert Adam Architects in 2000. In 2010 the practice name was changed to ADAM Architecture to recognise the individual design profiles of the five equal shareholding directors. During the 1980s the practice developed a speciality in classical design, and has become a pioneer in contextual urban design. Since this time the firm has progressed from strength to strength, cultivating its profile to its current national and international level, and establishing a solid client base across the UK and overseas. The five directors all lead projects and have their own design ethos, while all working together as experts in the field of traditional architecture.

In 2010 ADAM Urbanism was formed, a sister branch to ADAM Architecture, to recognise the quantity and variety of projects and experience in master planning and urban design, whilst sharing the strong expertise and support of the whole practice. ADAM Urbanism has led some pioneering work in master planning of new urban areas for the Duchy of Cornwall in Newquay and major urban extensions in Somerset, Norfolk, Edinburgh, Dover and Hampshire.

Commitment to Education

The practice has a strong history of supporting education and understands the important and critical role universities and education play in the future of our industry and profession. Alex Naraian, Associate Director at ADAM Architecture was initially encouraged by Paul Hanvey MCIAT ACIOB, Director at ADAM Architecture, to foster a collaborative working relationship and now this established relationship continues to be supported by the Board with great enthusiasm. Alex's personal connections and the shared enthusiasm has forged a collaborative relationship between ADAM Architecture and Solent University, which continues to go from strength to strength.

Project

Alex, who is Regional Councillor of CIAT's South East Region, working closely with Sarah Radif, Architectural Technology Programme Leader at SSU, devised an assessment brief based on a live project carried out by ADAM Architecture for a well-known insurance company in the centre of London. The project is a multi-storey building which consists of 8 floors of office and retail space plus a two-storey basement, located on a sloping site with approximately 2m difference in level, in a highly prestigious part of London. The jointly prepared brief draws on specific aspects of the original client brief, thus exposing students to some of the real issues likely to be encountered on a project of this magnitude.

From the onset, Alex meets with the students at the beginning of the academic year to introduce the brief and share with them some of the main challenges his practice encountered whilst developing the project, including client demands, site limitations, planning and legislative constraints (being a central London location) as well as design and technical issues. After the initial briefing meeting, Alex visits and participates in regular studio sessions, every four to six weeks on average, where he provides formative feedback to students both on their design and technical solutions. He also attends the final presentations at the end of the year.
In devising their schemes, students are required to consider the aesthetics of the building especially being on a site that is sensitive from a planning point of view, design the layouts to achieve very tight floor area requirements (as per the original brief), produce sections and elevations and, crucially, technical details for key junctions in the buildings using current products and building standards. In addition, students are expected to incorporate aspects of Building Regulations, formulate appropriate fire strategy in accordance with Approved Document (B) and consider the important matter of access to and within the building in line with Approved Document (M).

Students are expected to incorporate aspects of Building Regulations

Furthermore, CPD events are organised alongside normal teaching where guest speakers from well-known manufacturers provide technical information which students can use when specifying certain aspects of the projects such as waterproofing of the basement and composite flooring systems.

From the academic perspective, the university wants its students to be productive from day one of starting work and believes that having the opportunity to work with employers while studying will give them an edge in an increasingly competitive market. Working on live briefs not only complements university teaching and enriches the

The jointly prepared brief draws on specific aspects of the original client brief, thus exposing students to some of the real issues likely to be encountered on a project of this magnitude.

curriculum, but also enables students to develop a real solution to a design problem for a professional client, providing in effect, an opportunity to 'dress-rehearse' for the real-world. It is effectively campus-based work experience!

In addition to subject-specific skills and knowledge, students gain a range of valuable transferable skills from this collaboration. For starters, Alex treats students as they would be treated in an office environment. Other key transferable skills including communication and problem solving as students are expected to develop, present and defend a professional design solution. Time and record-keeping, hitting tight deadlines, justifying their decisions and conducting themselves in a professional manner are just a few of those transferrable skills.

Students have to display their work in the studio on the final hand-in date and give a brief presentation to explain their work further. Alex takes part in the review panel, and his comments are taken on board when marking the projects and his feedback is passed on to students.

The university is pleased that its students have the opportunity to work alongside a role model like Alex and learn the latest trends in the fast-moving Architectural Technology profession, which is an important step in their journey to becoming Chartered Architectural Technologists.

From the practitioner perspective, it is clear and encouraging that Southampton Solent University reaches out proactively to employers so that through collaboration and the sharing of real experience of practice, the student experience, knowledge and employability are enhanced. The staff at the university put their students first and are genuinely interested in ensuring that the courses they run are continually improved and meet employers' needs, so that graduates are able to efficiently maximise learning key and pertinent core skills during their degree education.

As a practitioner, ADAM Architecture believes that to deny collaboration with Universities that reach out would be irresponsible and detrimental to our industry and profession. In an age where it is easy to criticise and pick fault in education, it has chosen to go against this negative and corrosive attitude to influence positive change.

Engaging in education is vitally important to help ensure that graduates are given the best opportunity to be aware of how their theoretical academic study is applied 'on the ground'. Industry, and in particular, practitioners, are best placed to provide this input. This helps those who are studying to become much more aware of real business pressures and the many variety of tasks and responsibilities an Architectural Technologist is required to consider.

Working with universities and students also gives the practitioner the opportunity to get to know the ability and personalities of the students, which can be incredibly useful and mutually beneficial if a practice is looking to employ a graduate – it gives both parties a knowledge of each other in terms of soft and social skills or ability,. which would not necessarily be apparent in an interview environment.

For ADAM Architecture, it also provides the opportunity to inspire students and sow the seed of interest in classical and traditional architecture, which is not always encouraged in a modernist agenda driven industry. At Southampton Solent University, it is refreshing that on the Architectural Technology degree course there is not a stylistic agenda and that freedom of choice is embraced and encouraged – true education.


Alex Naraian MCIAT

National Student Designer Awards 2015

The Association for Project Safety (APS) is pleased to announce its National Student Designer competition for 2015 with a total prize fund of £6,500.

The APS National Student Designer Award is intended to encourage continuous improvement in design and recognise excellence in Design and Construction Risk Management within the architectural professions.

The Scheme is open to all Part 2 architecture students and final year architectural technology students. The Awards scheme is intended to introduce them to the issues of Buildability, Maintainability and Usability, and their responsibilities as Designers in terms of construction health and safety risk management.

Details of the winning entries for the Student Awards in previous years, which demonstrate the quality of submission anticipated, may be viewed on the APS website at: **www.aps.org.uk/award-schemes.html**

Shaping and sharing best practice in construction health and safety risk management

Entry Requirements

- Entries should be selected from the student's portfolio of studio design projects completed within the current academic year.
- Submissions must be accompanied by a completed Entry Form which can be downloaded from the APS website at **www.aps.org.uk/award-schemes.html**
- Entries should be in electronic (high resolution jpeg or pdf) format only, consisting of one A1 sheet and up to two A4 pages of supporting text.
- Entries must demonstrate compliance with the ethos of the CDM 2007 Regulations i.e. Buildability, Maintainability and Usability together with a good understanding of the concepts of Construction Health and Safety Risk Management.
- Graphic presentation skills are also important and will be taken into account in the judging process. Accompanying notes on drawings are an excellent way of demonstrating how risks to health and safety have been managed and diagrams showing sequence of construction are also useful in explaining safe methods of construction. For example, sketches showing the method of accessing external elevations for maintenance and cleaning also demonstrate the students understanding of managing risks after the construction stage.

The finalists will be invited to attend the APS Annual Awards Dinner in Edinburgh on 7th October 2015 to receive their Award.

Further details of the entry requirements can be found at **www.aps.org.uk/award-schemes.html**

Entries must be submitted to:

APS, 5 New Mart Place, Edinburgh, EH14 1RW
E: james.ritchie@aps.org.uk

Entries to arrive no later than **Thursday 31st July 2015**

The Award

A total prize fund of £6,500 will be awarded as follows:

1ST PRIZE	£2,000
2ND PRIZE	£1,500
3RD PRIZE	£1,000
INNOVATION AWARD	£1,000
TECHNICAL EXCELLENCE AWARD	£1,000

The Judges

The judging panel will be made up of representatives from the Royal Institute of British Architects, the Chartered Institute of Architectural Technologists, the Health and Safety Executive and the Association for Project Safety.

The Brief

Students should outline how their thought process, during the development of their design project, contributed to the elimination of risks in the maintenance and eventual deconstruction of the building. Where risks cannot be reasonably eliminated, students should consider innovative ways in which the risks can be managed.

Further advice, regarding issues that students should consider when preparing their designs, is given on the APS website. In addition, the student's attention is directed to the Approved Code of Practice "Managing Health and Safety in Construction" which is available for free download from **www.aps.org.uk/code.html** or via the Health and Safety Executive's website at **www.hse.gov.uk/construction/cdm/acop.htm**

About the Association for Project Safety

The Association for Project Safety (APS), is a not for profit membership body, made up of professionals representing all the major disciplines in the construction industry, whose aim is to shape and share best practice in Construction Health and Safety Risk Management as related particularly to the CDM Regulations 2007.

Student membership is free and open to any individual in full time education of any discipline in the construction industry. Upon graduation, student members will be invited to progress through the APS membership structure.

Benefits of Student Membership include:

- Access to the student area of our website where copies of our Practice Notes, Digest magazines and best practice examples are downloadable free of charge;
- Discounted publications;
- Entry to Regional CPD events free of charge;
- Notification of National CPD events;
- Entry onto the APS Directory of Student Members;
- Enhanced CV giving students a commercial advantage when looking for employment.

For further details about APS membership and an application form go to:
https://www.aps.org.uk/student-member.html

Association for Project Safety 5 New Mart Place Edinburgh EH14 1RW
T 08456 121 290 F 08456 121 291 E info@aps.org.uk

Celebrate fifty years of excellence

Join us in celebrating the Institute's Golden Year at the 50th Anniversary Celebratory Luncheon

Dining in the opulence of The Savoy, CIAT will be commemorating its 50th Anniversary at this Celebratory Luncheon which will include presentations of the 2015 Awards and fifty years of memories.

Date: Friday 25 September 2015
Venue: The Savoy Hotel, Strand, Savoy Way, London, WC2R 0EU

Time: 12:15 for pre-lunch champagne reception. Ends at 16:00

Dress: Lounge suits with medals

To book, visit:
www.ciat.org.uk/en/50th/celebratory-luncheon/index.cfm

Deadline for bookings is 31 July 2015.

Please contact Isabelle Morgan, Administrative Coordinator, with any queries about this event. Tel. +44 (0)20 7278 2206. Email isabelle@ciat.org.uk

Utilising BIM as a means to achieve sustainable design

within contemporary architecture

By **Jamie Cooper**, student member studying Architectural Technology and the Environment at Plymouth University, and Junior Architectural Technologist at Stride Treglown Architects

Building Information Modelling (BIM) is an important innovation in regard to the design and documentation processes within the architectural and construction industries. BIM is not just primarily used to create 3D architectural models; it involves the process of attaining information about the entire building and provides a comprehensive set of associated design documents stored in a cohesive database.

All of the information attained is parametric and therefore interconnected. Any modifications that are applied to a certain object within the integrated model are instantly updated throughout the entire project in all views. For instance, if a wall is moved in a plan view, the change is inherently reflected in the other related views such as the elevations, sections, and other views in the documentation set. After the integrated model has been developed to a level of completion by the design team, it could then be passed over to the contractor to manipulate, potentially using it as a visualisation tool to view the design intent. Therefore, BIM could be defined as an interdisciplinary and collaborative model-based tool that could provide a potential solution to improving a business's overall procedures.

The BIM protocol is the integrated process of designing a building collaboratively using a singular comprehensible system of digital models rather than as a separate set of drawings. The use of BIM within architecture has been praised as a means to provide significant gains such as saving cost and time, with high levels of accuracy being obtained and the noticeable advancements of co-ordination of information between disciplines. The reduction in the amount errors and the loss of information can be an evident difference in comparison to previous traditional methods.

Construction progression overlaps with ever-growing environmental concerns and the increasing cost of energy

So, this form of realistic and integrated building modelling could provide numerous benefits to appropriate companies within the workplace, but could the possibility of achieving 'sustainable design' by means of using BIM within architecture be a realistic prospect?

As construction progression overlaps with ever-growing environmental concerns and the increasing cost of energy, the practice of sustainable design has certainly become more of a common part of architecture, taking into consideration various aspects that minimise buildings' impacts on the environment. Spaces and facilities designed with sustainability in mind, on the whole, usually show reductions in energy and money over time as these 'green buildings' are created to be environmentally responsible and provide places to work and live that are healthy to the occupants.

There are numerous benefits to using architectural BIM software with increased capability for a project, including the accurate prediction of potential environmental issues that a building could produce post-construction.

Applying BIM throughout the design process can enable designers to create a 'prototype' that can be rigorously manipulated prior to the commencement of construction. Besides visually portraying the design, Autodesk Revit's parametric technology aids the support for sustainable design that can be automatically achieved during the design process. Appreciating and exploiting these parametric interrelationships normally takes multiple repetitions that span multiple projects.

Understanding and testing integrated technologies and structures requires a stringent look at considering how they work together to deliver the best potential. BIM has the ability to analyse this information more effectively and efficiently than traditional methods. Applying the intelligence and integration of BIM to various simple concepts within the architectural design of a building can provide an extensive range of advantages, if the software is used correctly. Architectural concepts such as the building orientation, daylighting, energy consumption, building massing and materiality are just some of the concepts that could be explored and tested with the utilisation of BIM.

For example, in terms of building orientation, the way a building addresses the sun and how the glazing openings are positioned can have a significant effect on the energy efficiency of the building systems and the comfort of the users internally. Autodesk Revit has the ability to accurately locate the building in the real world, setting the 'true north' within the project and correctly positioning the building on site. Setting the exact location in the BIM software will establish the latitude and longitude for the user based on the place in which the project will be built. Having the ability to set the orientation of the proposed building is key to optimising various other strategies.

On the surface, there are numerous advantages of using BIM when experimenting with sustainable solutions within a design. On the other hand, there can also be disadvantages. The software producing the integrated information for BIM will only be as accurate as the quality of the information that is inputted into it. In order for valid information to be successfully obtained from the software, it must first be entered accurately. The implementation of BIM within architectural companies of varying sizes has been difficult in certain circumstances and this implementation does involve significantly more than just switching the type of software that is used for BIM. To achieve all of the benefits it can potentially produce for an architectural team, everyone in the architecture, engineering and construction industries will have to learn to adapt and work in essentially new ways.

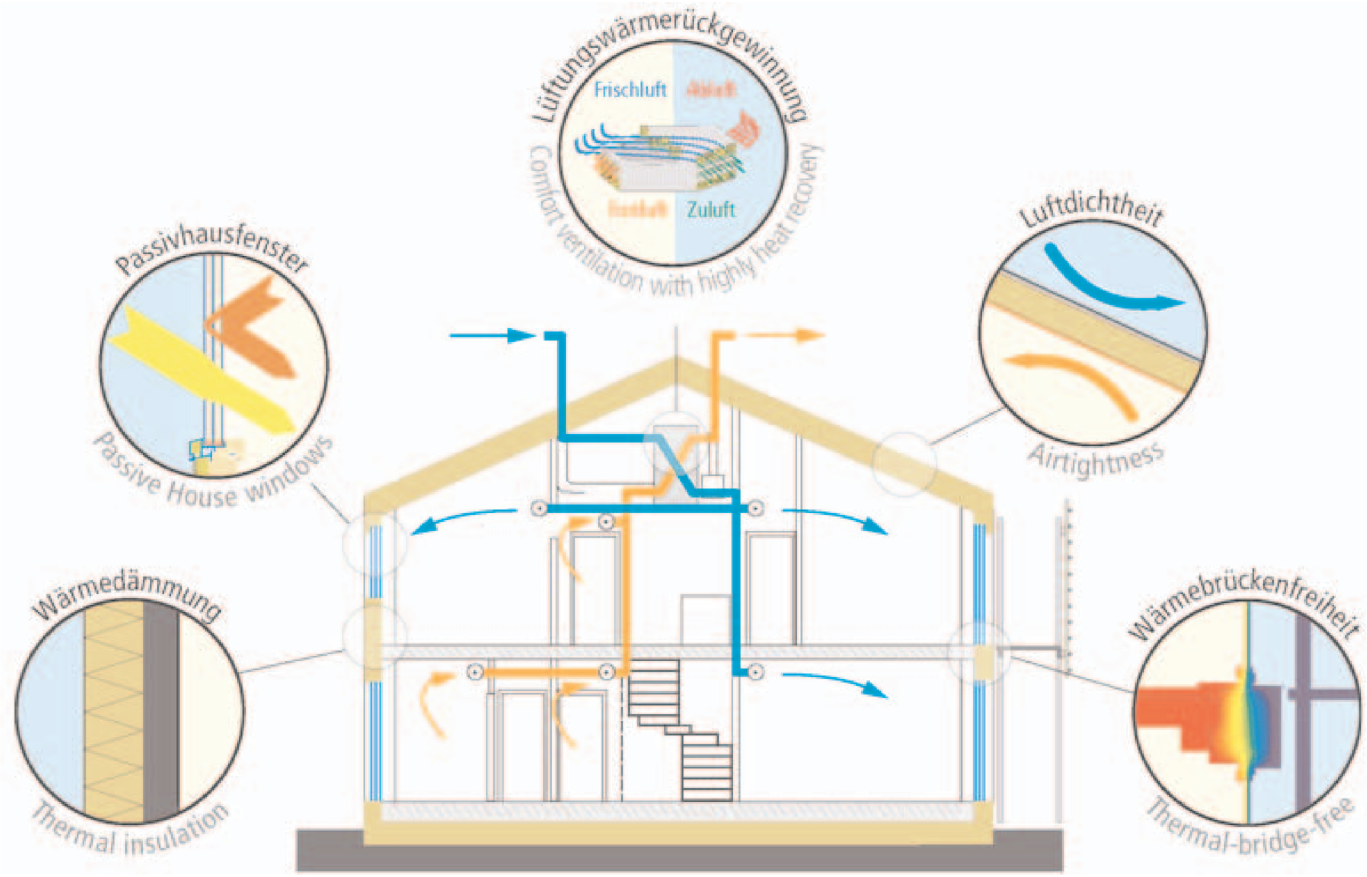
There are numerous advantages of using BIM when experimenting with sustainable solutions

Throughout the overall process of designing a building, consideration needs to be given to a range of options and sufficient information is required to decide upon the most appropriate one. BIM allows professionals to create and study multiple design options within a single model. These options can be set on or off when the user requires them to for analysis and inherently discarded or adopted with ease according to the design decision. A BIM based model comprises the information required for various aspects of a sustainable design. The model allows automatic tracking of building materials and their quantities, which subsequently can indicate how much of the material can be reused or recycling. With the 3D modelling interface, high-resolution graphics and advanced details, BIM helps to create an accurate and representable simulated model of a sustainable orientated project. Various methods of analysis such as clash detection and quantity take offs can be utilised.

With the appropriate training and experience, BIM software can be quick and easy to use and be a cost-effective solution to replicate the desired building with a 3D model, with the capability of creating multiple alternatives in a single project in order to compare and evaluate various options. Furthermore, the effective use of BIM gives designers the opportunity to analyse the effectiveness of the sustainable strategies and technologies a building could have, prior to construction.

Passivhaus Standard

An economically viable solution to meet UK government carbon emission targets?



Daniel Owen ACIAT writes about the principles of the Passivhaus Standard and how it can be economically viable in the UK compared to the Code for Sustainable Homes Level 5 /6 as we move closer to the Government's Carbon Emissions target for 2050.

The Passivhaus Standard

The Passivhaus Standard is a voluntary housing standard developed to help significantly increase energy efficiency and thermal comfort by following a set of principles/construction techniques and is a scientific design tool to create a building with :

- a comfortable internal environment,
- a low energy demand and
- low carbon emissions.

'The core focus of Passivhaus is to help dramatically reduce the requirements for space heating and cooling, whilst also creating excellent indoor air quality and comfort levels'. (*BRE Passivhaus Primer*)

One principle of the Passivhaus Standard is to help reduce primary heating demand to the point where a traditional heating system is no longer required. This, together with the required energy efficiency and comfort levels means that the typical features of Passivhaus buildings are:

- Super Insulated with minimal thermal bridging, ideally eliminated (all building elements achieving a U-Value[1] of 0.15 W/m²K or better).
- Extremely airtight building envelope (any uncontrolled gaps must be smaller than 0.6 of the total house volume per hour during a test with a negative pressure/excess pressure of 50 Pascal[2]).
- Mechanical ventilation with heat recovery (MVHR).

- Triple-glazed windows, largely south orientated to maximise passive solar gain (Total frame and glazing U-Value not exceeding 0.8 W/m²K and g-values[3] of around 50%).
- High thermal comfort.

Meeting the Passivhaus Standard

It can be difficult to meet the Passivhaus Standard and construction costs can rocket when compared to the Current UK Standard (Part L). The table below compares the standard to the current UK Building Regulations and the average performance achieved by current UK housing stock built to the minimum UK standard.

Below: Passivhaus mandatory technical requirements compared to Current Building Regulations (Part L) (Cotterell & Dadeby, 2012).

Requirement	Criteria to meet Passivhaus standard	Current UK Building Regulations standard (Part L - England and Wales)	Average achieved in existing UK housing stock
Airtightness	Below 0.6 air changes per hour (ach)	$10m^3/hr/m^2$, equivalent to approximately 10ach for a typical home.	More than 10ach
Annual specific space heat (or cooling) demand	$15Kwh/m^2$./yr needed to provide space heating to 20^0C, or cooling mostly below 25^0C in hot climates.	No energy standard is defined in current Building Regulations	Around $200 Kwh/m^2/yr$ for heating in the UK.
Specific heat load	$10W/m^2$ – the peak power needed to provide space heating to 20^0C internally when it is -10^0C outside.	No energy standard has been set.	No data available
Annual specific primary energy demand	$120Kwh/m^2/yr$ of primary energy, i.e. the energy consumed at source	No energy standard has been set.	Over $400Kwh/m^2/yr$

My research found that whilst the construction costs of properties using the Passivhaus Standard are expensive compared to the construction costs of homes built to the current UK minimum standard, it is more economically viable when compared to the homes built to the Code for Sustainable Homes Level 5/6, which the Government has made mandatory by 2016 in order to meet its carbon emission targets under the Kyoto Protocol for zero carbon in the UK by 2016 and 80% reduction in global greenhouse emissions by 2050.

The UK has been slow to adopt the Passivhaus Standard despite overwhelming evidence of helping to provide affordable, low energy, sustainable housing in other European countries. Energy bills in the UK are also rising rapidly and the Passivhaus standard could be a solution to this problem, but it must be seen as economically viable to housing providers and developers.

The research analyses the construction costs (capital costs) of building to the Passivhaus Standard as well as the operational costs (costs in use) and carbon emissions, compared to homes built to the Code for Sustainable Homes level 5/6 and the minimum standard for housing in the UK. Data for each of the three housing standards was obtained from both primary case studies and secondary sources. The results from the research were analysed and payback periods for each of the standards calculated in order to draw conclusions to the economic viability of the standard in the UK.

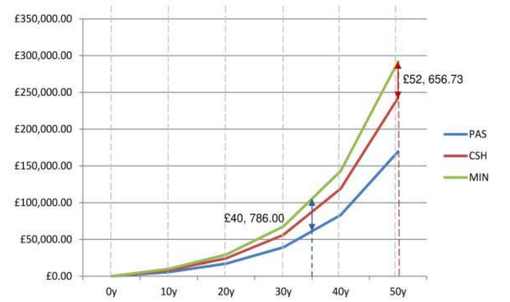


Figure 18 – Payback Periods and Difference in Construction Cost

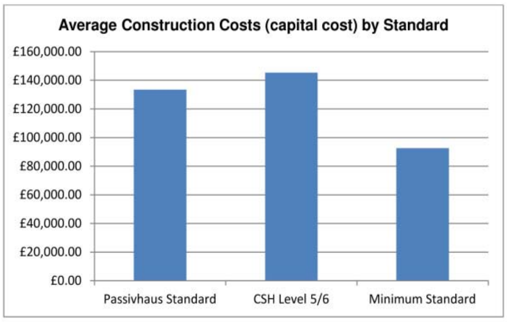


Figure 17 – Average Construction Costs by Standard

The results of the research found that on average the additional construction costs (capital costs) of building to the Passivhaus Standard are less than those when building to the CSH level 5/6, but there are also lower operational costs (cost in use) and equivalent carbon emissions when compared to the CSH level 5/6 and significantly less when compared to the UK minimum standard.

Due to the additional construction costs of the Passivhaus Standard compared to the minimum standard, it may not be viable for housing developers looking to make a profit at present but it may become more attractive as we move towards the 2016 Government targets and the UK minimum standards become more onerous. The more expensive CSH level 5/6, which will be mandatory by 2016 may force developers to adopt the Passivhaus Standard in order to meet statutory regulations.

The incorporation of renewable technologies and PVHR systems (passive ventilation with heat recovery) as opposed to an energy consuming MVHR (mechanical ventilation with heat recovery) system is seen as an opportunity to further reduce carbon emissions and operational costs to less than a house built to the CSH level 5/6 which will already incorporate renewable technologies. However, this would increase the capital cost of construction, therefore further research should be conducted into the cost of renewable technologies and PVHR systems compared to MVHR.

The research concludes that the Passivhaus Standard is considered to be an economically viable option for low energy, sustainable housing in the UK to help meet Government targets for the reduction of carbon emissions in the UK by 2050 when compared to the other UK housing standards.

Daniel (right, with President Karl Grace) was Commended in the Student Award for Excellence in Architectural Technology for his dissertation research project. It aimed to determine the economic viability of Passivhaus in the UK to help meet government carbon emission targets by 2050 compared to current UK housing standards.

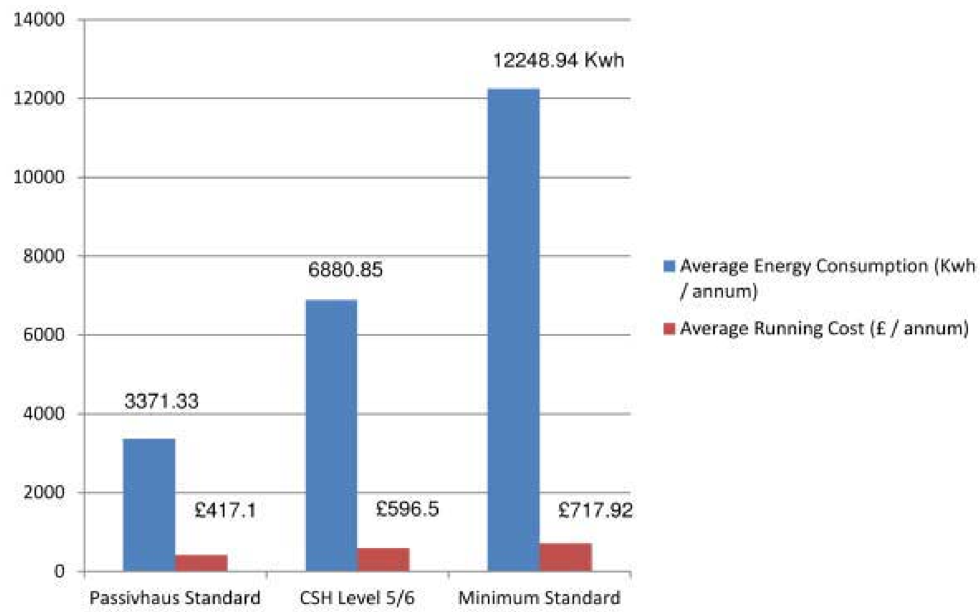


Figure 16 – Average Energy Costs Comparison by Standard

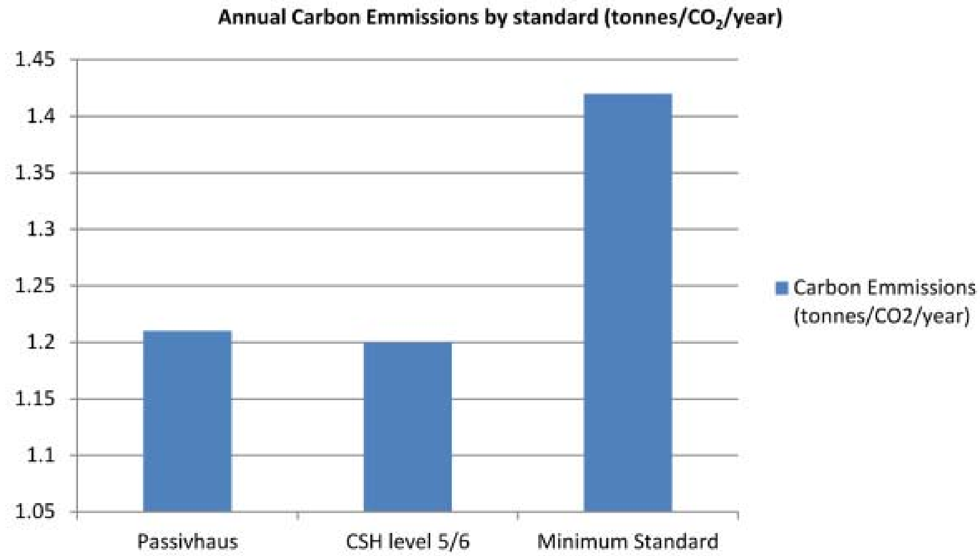
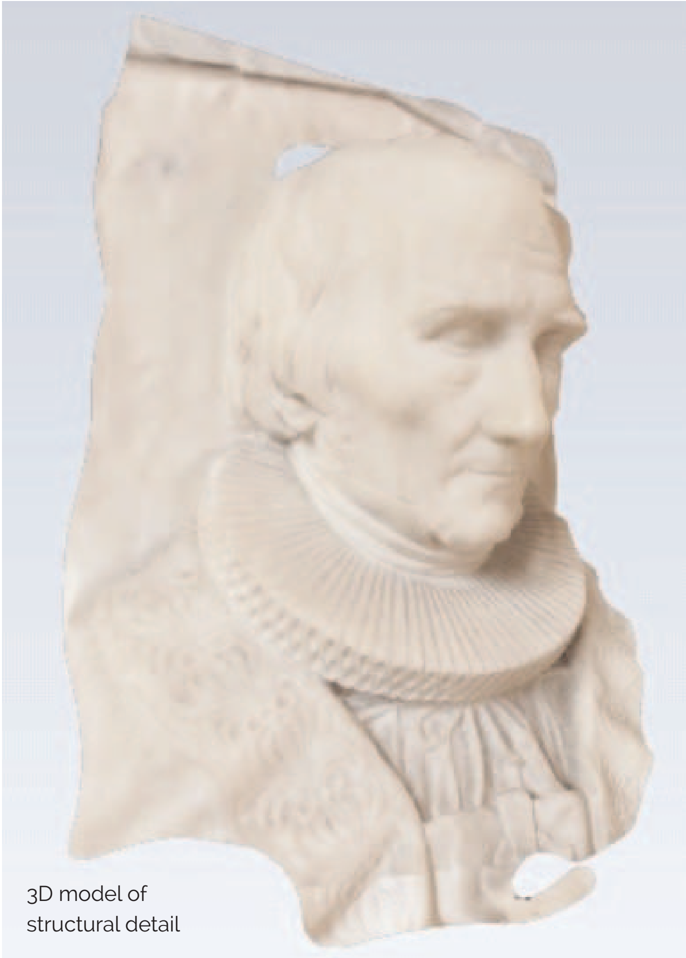


Figure 19 – Annual Carbon Emissions by Standard

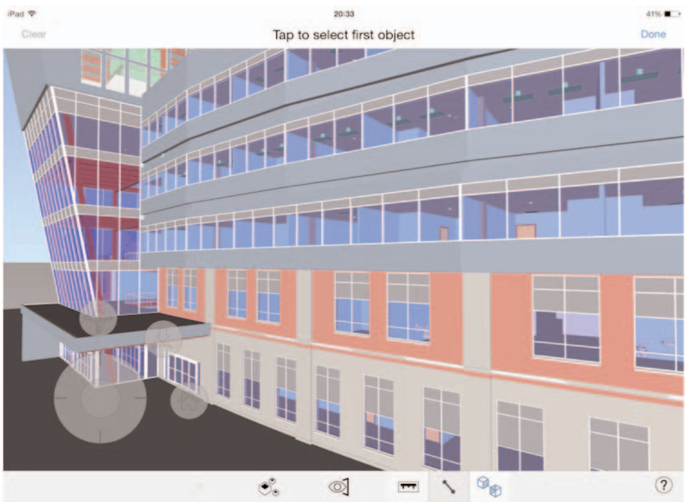
BIM and the use of emerging visualisation technology

Model sharing ('BIM 2') is the way ahead for Building Information Modelling, writes Richard Laing, Professor of Built Environment Visualisation at Robert Gordon University, Aberdeen

As we approach the 2016 deadline for the implementation of 'collaborative 3D BIM' in UK Government projects (probably 2017 in Scotland), an interesting discussion has emerged regarding the use of such information during the occupancy stages. Sometimes referred to as BIM level 2, the mandate requires that information be contained within 3D information models, which should be capable of transferring data form one format to another. That is, there is not a requirement for each party to use a single shared model, but there is an expectation (using established file formats such as IFC) that data can be passed between the various architectural, engineering and other models. It has been noted that many projects (albeit impressive) were closer to Level 1 (many 3D but non-shared models). It is arguable, though, that the truly exciting aspects of BIM are likely to be realised when we reach higher levels, with truly shared models (between project participants), and the potential use of models to support work of the occupier after construction has been completed.


3D model of structural detail

It perhaps seems obvious, therefore, that a beneficial use of such models post-handover should reside within the facilities management sphere. After all, if an estates department is able to access and use a model which notionally contains full information regarding the 'as built' facility, then it should equally be possible for that model to be regarded as an ideal starting point from which future building management and maintenance can be undertaken.



Autodesk BIM 360 Glue ipad app

There is a clear opportunity for the construction and property industries to engage with the use of BIM within facilities management, both by using BIM in a fairly traditional manner, and also through the use of emerging augmented reality applications. By 'traditional', one may think of BIM as a data model, within which a facilities manager could conceivably continue to undertake their normal day to day work, and use the BIM database to record maintenance information (e.g. work required, work undertaken, condition surveys, and so on). However, this would miss the opportunity to benefit from

The truly exciting aspects of BIM are likely to be realised when we reach higher levels the intrinsically visual and three-dimensional nature of models within BIM. Most of the main software vendors have released software compatible with tablet computers, for example, which enable the user to view full BIM models when on site. Likewise, and perhaps more relevant to the wider design team, IFC (generic and non proprietary BIM file format) viewers have enabled the team member to view open versions of models and tablets and smartphones.

The ability to then 'record' data on site (including annotated photographs) and have these linked to data within the model provides a rapid and cost-effective route through which the building manager can build up a detailed, understandable, sharable and permanent record of the condition of building elements and components during the life cycle. Extending this, one can foresee the use of augmented reality technology, to support the facilities manager to access 3D visual information in real time, when on site. Similar technologies are already applied and common with the oil and gas sector, for example, to show the interior mechanisms and structure within already constructed buildings.

The vast majority of buildings which will exist by 2015 have already been built

A related discussion has emerged regarding the ability within BIM to capture, model and benefit from rich data pertaining to already existing environments. It has been said in many forums that the vast majority of buildings which will exist (in Europe at least) by 2050 have already been built. Such assertions have often emerged from debate concerning climate change, and a major challenge facing the built environment disciplines will be to recognise that much of the technical challenge which lies ahead relates not to the instigation of improved environmental design in 'new' buildings, but to addressing challenges related to poorly insulated building which stand as a legacy from past generations. Of course, one could equally argue that an overwhelmingly positive legacy has been to provide a rich record of the past, with many towns and cities defined architecturally by the built heritage.

In many cases, it will be important to properly reflect the existing built environment within 3D models, to ensure that the layout, scale, mass and detail can be properly recognised in virtual BIM environments. With new buildings, data contained in the model will naturally refer to materials, date of construction, and potentially the participants involved in design and site work. With older buildings, where the task


3D model from photographs

Scanning equipment on site

relates more to the retrospective compilation of a model, data may also relate to verifiable facts from the buildings life span to date, including key social, cultural and architectural information. Thus, we perhaps move towards a heritage-BIM (HBIM) model, as noted by Autodesk (2011), among others.

Specific technologies which can be readily employed by the Architectural Technology professional to help capture and embed existing buildings within BIM include the use of photogrammetry and laser scanning. These range in price (and complexity), but provide a clear methodology through

Specific technologies include the use of photogrammetry and laser scanning

which the Architectural Technology professional is able to rapidly construct a base from which new models and designs can be developed. Using applications (such as Autodesk 123D), it becomes possible to rapidly build 3D models from photographs taken on site, of both whole structures and details (as shown in the image opposite, top).

Likewise, laser scanning has become increasingly rapid and accessible in recent years, with numerous industry-standard CAD and BIM packages able to accept the resultant 'point cloud' data. Indeed, there has been a recent growth in studies dealing with 'Scan to BIM', each aiming to develop methods through which scan data can be incorporated readily as a key part of the virtual environment.

As the use of 3D models become ubiquitous within construction, the need to reflect and represent the existing built environment will be clear. Although there are clearly technical as well as industry-culture challenges to be overcome, the benefits in terms of improved communication, accuracy or information and ultimately the efficiency of working practice, provide a strong business case to invest. As new methods to present 3D models become prevalent (including augmented reality) and technology to capture the existing environment become cheaper, the Technologist will be ideally placed to apply and benefit from core skills in the manipulation of data-rich visualisation techniques.

References

Autodesk Research (2011) Building information modelling and heritage documentation, available online: www.autodeskresearch.com/publications/heritagedoc [accessed 4 March 2015]

Notes

Richard Laing is Professor of Built Environment Visualisation at Robert Gordon University in Aberdeen. He is Course Leader for the CIAT Accredited MSC Visualisation in Architecture and the Built Environment, and entirely online course, dealing with BIM, design and urban visualisation, drawing on many years of internationally leading research. Further details can be found via www.rgu.ac.uk/visualisation

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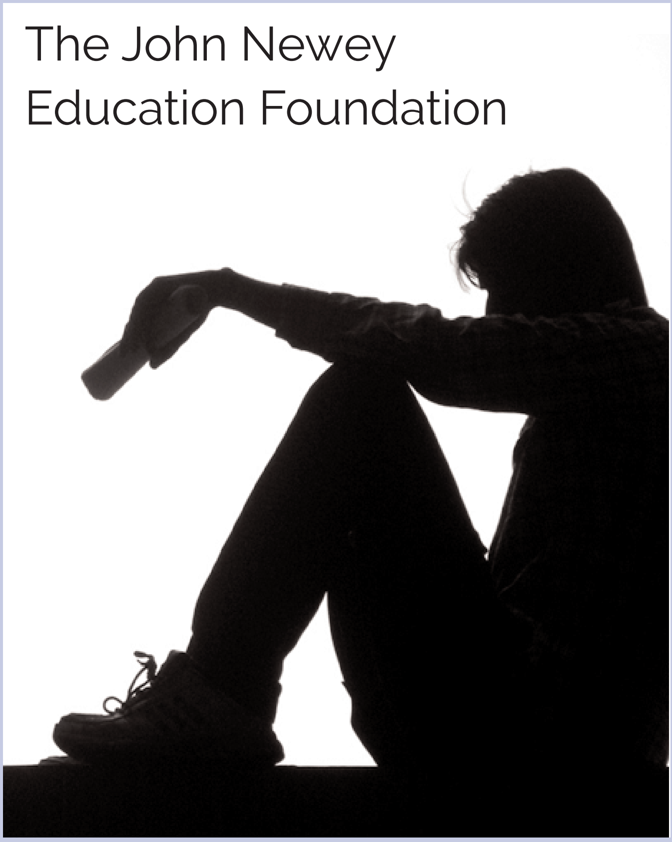

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