

BIM as a whole life process and a Building Management Tool - Technical Case Study of The Dylan Thomas Centre.

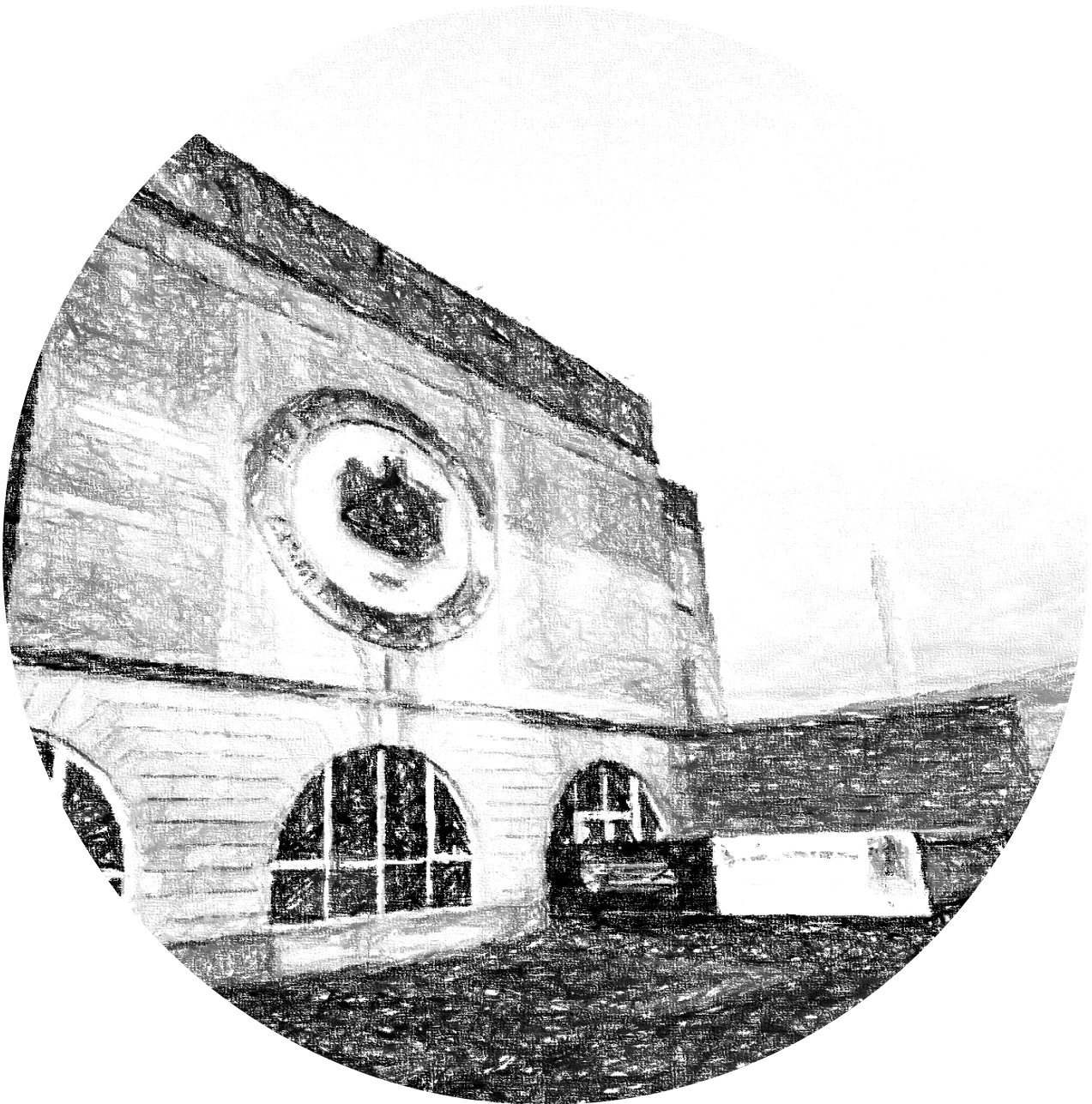


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Part A

BIM For Existing Building Stock

Introduction

This part of the report discusses the use of BIM Technologies in terms of the management of existing buildings. Covering what BIM Technologies currently exist that can be used to help the management of the building, the importance of storing data rich models and how this could potentially be implemented towards management of The Dylan Thomas Centre. An appraisal of the University of West of England (UWE) case study will additionally cover how this process has been conducted previously, reviewing its viability.

BIM Technologies

Technology has advanced massively in the construction industry following the initial proposal of AutoCAD in the early 1980's (Luke 2014). Software, systems, and programmes have all adapted following years of industry usage. Now software can be twinned with physical buildings to enhance its output. Equipment such as drones, Point Cloud and thermal scanners, just to name a few, offer great insight into the existing building information. Some of these technologies, when combined, can offer a data rich package of information on existing building stock. The use of BIM in construction is often associated with creating a digital twin of buildings. Digital twins alone are a static model of existing buildings, useful for original construction components (McKinsey & Company 2024). However, this level of data management comes with its own risks and complexities when sharing among several stakeholders (RFWireless 2026). A common fault with digital twins is the lack in data or having inadequate quality data resulting in inefficiency of the output (Pratt 2024). BIM facilitates a relationship between an existing building and the management team, allowing data collection for a detailed database (Altohami, Haron et al. 2021).

Unmanned Aerial Vehicles (UAV's) and Terrestrial Laser Scanners (TLS's)



Figure 1: Drone Capture (Advancing Engineering Consultants2021)

Advancements in technology have provided equipment such as drones and lasers scanners, which offer no-contact imagery and photogrammetry of buildings. Gathering spatial data as well as information on the building that can be fed into a 3D model. UAV's offer mapping and digital reconstruction in short periods of time (Jofré-Briceño, Muñoz-La Rivera et al. 2021). Images captured require decent quality and quantity to ensure the process of densifying resolution can result in

sufficient data. Oliveira Sena, Souza Silva et al. (2024) reports on the implementation of drones in building

management and discusses studies by Rodrigues et al., (2023) and Solla et al., (2020) that found the use of UAV's alone was not enough. As a result, both studies integrated the use of TLS's to further collect data. UAV's and TLSs are often seen as complementary, as UAVs can provide geometry imaging from difficult to access and non-visible areas such as slopes or alcoves. Whereas TLS's obtain architectural detail to create the virtual space (Klapa, Gawronek 2022). A study by Hao, Huang et al. (2025) found the combination of imaging and BIM software can lead to accurate modelling, efficiency in building inspection and overall, a cost-effective approach. Introducing modern technology also introduces new boundaries. Some of which found by (Wang, Xiaowei et al. 2025) are safety risks with piloting the equipment, lack of global positioning system (GPS) while also unsupported by a lack in adequate training for specific trades.

Thermal Imaging



Figure 2: Example of thermal imaging capturing building services (Hero Plumbing 2023)

Infrared thermal imaging is recognised globally as a resource to gather data on historical buildings. In Brazil for example, a study by (Resende, Gambare et al. 2022), identifies the potential to source data on materials, individual components such as wool and steel and dimensions between construction items. Thermal imaging is a form of no contact, non-destructive testing of existing buildings that can be used by facilities teams to map out unknown utility data (Nikzad, Kari et al.). This form of mapping heavily relies on the importance of emissivity. Abdullah, Turek (2021) emphasises on the limitations of thermal imaging when emissivity cannot be fully determined. This can be due to materials conductivity capabilities as well as the requirement of a historic emissivity tables to support this form of building mapping. Other known limitations of thermal imaging are related to its lack of spatial recognition and capability to correctly identify materials (Fox, Coley et al. 2014).

Point Cloud Survey



Figure 3: Revizto 5- Scan of Dylan Thomas Centre

The vector-based geometric model which point cloud surveys can create then assists BIM software in producing accurate floorplans, levels, and elevations of existing buildings (Tan Qu, Wei Sun 2015). Often referred to as a cost-effective method of modelling, point cloud survey uses point cloud data and converts these into a polygon mesh to form a completed image (Kulawiak 2022). Use of point cloud surveying on existing buildings has its own challenges. Nouha, Chiara et al. (2013) mentions the irregular shapes, walls and elements found in some historic buildings resulting in more complex

characteristics to attempt to capture. Reconstruction via point cloud survey requires consideration for issues such as misalignment, non-uniform sampling, and potential missing data (Berger, Tagliasacchi et al. 2016).

Importance of Data Rich

As technology has advanced and the industry moves towards incorporating it more into building and estate management it is vital to understand the importance of rich data and how this impacts the suitability of the technology. Low quality modelling, scanning and information collation can result in insufficient data. Insufficient data is not only non-beneficial to facilities teams but can result in higher risk and costs in building management. A basic geometric model of a building often is not sufficient data to maximise the buildings performance and potential. Accurate geometry has benefits on project planning and building performance assessments (Attaran, Celik 2023). The more information the model collects, the more accurate the buildings performance can be assessed. Combining two streams of data, geometric and non-geometric, creates a rich model. Fully informed on internal systems and usage, allowing the model to collate and gather data. Reports on energy utilisation can be conducted through various forms of software (Nati 2025). These systems all require data rich and accurate information to report; without these key elements the outcomes are ill-informed and can result in incorrect measuring. The accuracy in data rich modelling directly impacts performance testing of buildings (PAS 2026).

Case Study

University of West England (UWE) Bristol successfully created a digital twin of their estate. The team worked with modern technology and BIM, and the accumulation of sourcing data through various methods and inputting this data into a model allowed the facilities teams to curate a well-designed digital twin (Nima 2021). The project was successful in its aim to create a true digital twin of the estates portfolio to assist facilities team. The technology used to digitise the campus comprised of modelling software and data scans and uploading to the collaborative platform, Revizto, where both data sets were combined (Revizto 2020). Merging all streams of data on a shared platform becomes key in the interoperability of the project. REVIZTO FOR EXAMPLE, COMBINES MODELLING SOFTWARE, COORDINATION MANAGEMENS AND ISSUING TRACKING.

This case study is an example of work that required the combination of multiple forms of modern technology, BIM, and well-trained professionals to complete. The results offer an efficient work force of BIM and Facilities Management (FM) to manage the building at its highest potential. As a result of successfully integrating a BIM model, UWE can conduct preventative maintenance work, regular inspections and is estimated to save between 20% and 40% in lifecycle costing (Stride Treglown 2026).

Current Facilities Management Regime

A form was submitted to the FM who currently work with the UWTSD portfolio including the Dylan Thomas Centre. The purpose of the form was to gather data on the current regime in place for the management of the building and how this might include Computer Aided Facilities Management (CAFM) or Building Information Modelling (BIM) software. By collating this information, it is possible to assess where there may be room for opportunity of BIM and CAFM systems if not already in use. Further questions touched on considerations and

challenges the team currently face on implementing modern software. Large portfolios of estates can have complex buildings with their own set of challenges. In this case, the Dylan Thomas Centre is a historic building, listed and currently under shared use between UWSTD and Swansea Council. Some systems are in place to update and modify the FM regime as listed in the completed forms. The systems consist of a mixture of historic hard copy plans, CAD drawings and CAFM. However, there is opportunity to improve the management of the Dylan Thomas Centre to the next level.

Opportunities

Numerous opportunities were found in the results from the form. For this report, the main opportunities discussed will be around software not currently in use by FM as well as missed opportunities to introduce BIM for future maintenance and performance of the building. Both participants acknowledged that there is no current use of 3D modelling or point cloud laser scanning in place for the Dylan Thomas Centre. In addition to this, a large majority of the facilities management and maintenance is conducted on a CAFM system that is excel based and not fully integrated across the entire estate.

The Dylan Thomas Centre is part of a much larger portfolio of buildings. This ranges from listed buildings to newly finished buildings. This suggests there is just as large of a range of information available on these buildings. For example, anything completed as 2023 is likely to have a 3D model associated to the building. Meaning access to this model is available, and it is feasible to suggest this model was created in a suite of software such as Autodesk. Providing the FM team with access to this package of software would allow this data rich model to be used in their daily maintenance of newer buildings. Thus, providing an opportunity to implement new BIM technology to their current regime. Conducting this step would follow suit of the project at UWE. Where the means were available. Recent technology was used in data collection and building up this database. This would also allow a lesson learnt process to take place. Where attempts to implement BIM technology can be continuously reviewed and assessed, taken forward on all successful projects and implementing further into the portfolio.

Throughout the form it is reiterated that the estate is not currently equipped to be fully BIM integrated. This is due to some of the challenges faced below.

Challenges

All responses to the form acknowledged the same theme of challenged faced when managing the Dylan Thomas Centre. Firstly, there is consideration that the building is not solely used or owned by UWTSD. The Dylan Thomas Centre is leased with Swansea council, having a direct impact on the ability to make executive decisions on the building. Secondly, the building has been subject to various changes internally and left the general condition of the building poor. There is not mention in the responses of updated record drawings or a digital twin in place. Dunbar, Mullan (2025) notes how this directly impacts the FM ability to accurately locate items, plan maintenance and effectively deal with issues. This, along with the age of building is a hurdle for the FM team as management of the building becomes more complex as there are more unknowns.

Summary

BIM technology continues to excel, with newer forms of data collection aligning with better performing collaborative software's. The continuous development has proven, as seen in the UWE case study, how beneficial these technologies can be when implemented correctly to existing building stock. Efficient use and proper collection can create a data rich model and information package on buildings allowing easier information transfer and smoother maintenance management. As discussed, not all technology possesses the ability to fully collate all available information currently, many forms of the technology rely on others to paint the entire picture. The possibility of data rich packages for existing buildings is fully feasible and with appropriate user proficiency it can encourage far more efficient building and facility management.

Part B

Co-ordination of New and Historical Data of The Dylan Thomas Centre

Introduction

Here in the report, the historic data of The Dylan Thomas Centre has been co-ordinated with new data using BIM Technologies. A Point Cloud scan conducted by The University of Wales Trinity St David as well as AutoCAD drawings from an architect plan of the existing building have been combined and collaborated within Revit and Revizto 5. This has allowed a thorough examination of the historic data alongside the newer sourced information using various forms of BIM technology. It is possible to identify any and all accuracies and discrepancies between the two forms of collected data with additional modelling conducted to examine the main differences. As not all information on the existing building was accessible, some information has been assumed. These assumptions are listed below. The technical demonstrator who provided the scans and scanned the building giving 1mm to 3mm allowance for error. Therefore, the information provided from the scan should be as accurate as possible of the building in its current condition. A common data point was decided on the building where all 2D plans were aligned to in Revit and the same common point was used when publishing the Revit model to Revizto. This allowed for one point of all data sets to have a communal area to ensure the information would align to its best ability where possible in a federated model.

Floor heights have been assumed to be between 3m to 4m per floor level. This assumption was made based on the modelling of the historic plans. Various floor heights were evaluated, however only from 3m to 4m did the levels begin to align between 2D plans and 3D scanned data. However, it is important to note that although this assumption has been made and modelled accordingly, this is due to missing information between floor levels. Typically, there is an allocation of space above all ceiling levels for building services and equipment. Neither the available historic plans or the 3D scan has captured this data therefore it is not possible to confirm its existence or space allocation. For this exercise, the floor-to-floor level assumption is based purely on alignment of models on the data that is accessible.

It is important to note that these assumptions have been made for the report and that this missing data does impacts the facilities management ability to correctly manage the building in real life. Unknowns on key equipment and building services can lead to costly intrusive surveys and slow down the team's capability to deal with future problems (Tsay, Staub-French et al. 2023).

Accuracies

Doors

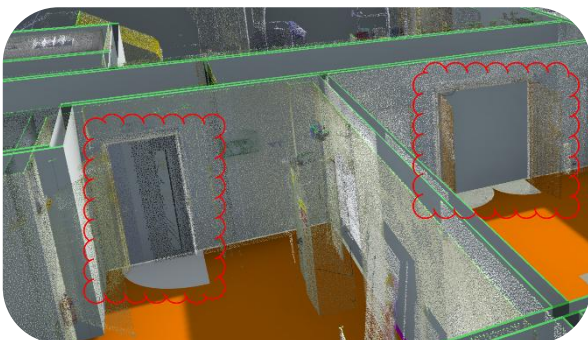


Figure 4: Doorways aligned from Point Cloud Scan and 2D Floor plans.

A common consistency between historic floor plans and the imported scan is doorways. Although the floor space is incorrect, the located doors on existing drawings align as well as with the scan as seen in figure 4. Correct placement of items and openings is important. For doorways and entry points it factors into other aspects of building management such a fire safety and escape routes. In addition to this, accurate and detailed layouts of items such as doors and windows, internal and external, can assist facility teams. Allowing for correct asset tagging and locating. When discussing a listed building, minor changes on these components become a larger issue.

Discrepancies

Walls



Figure 5: Scan showing wall with boxed in area.

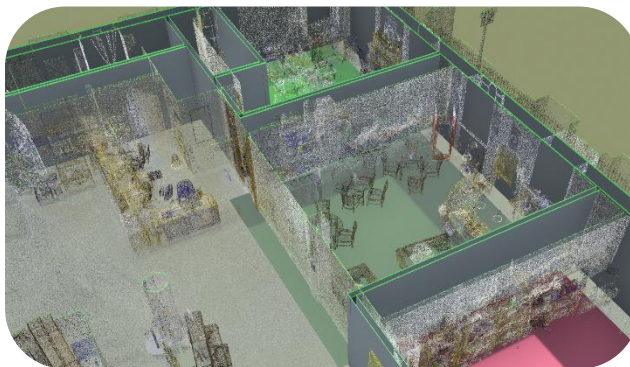


Figure 6: Scan showing wall separating an area which does not align with the greyed walls modelled from the 2D floorplan.

There are several areas throughout the building where walls do not align between the existing and new plans. As seen in figure 6 there is an entire wall missing from the historic drawings. In a building that has been subject to various change of uses and modification it is not uncommon to change internal walls. However, the need to update as built floorplans and drawings is extremely important to allow for management and facilities teams to conduct their jobs correctly. We can see in figure 5 that the missing walls indicates to a boxed in area. This can be a structural element to the building or an allocated area for building services. Both items integral to a well-functioning building and missing data on either could potentially lead to future problems and further unknowns. Incorrect placement of walls, or missing walls can also lead to discrepancies and issues with energy performance data. For example, the space where the wall is missing could be calculating a much higher heat loss on energy performance based on historic plans.

Externally

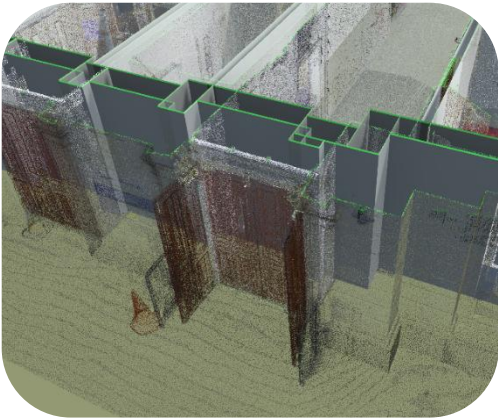


Figure 7: Discrepancy in external wall ends between scanned data and modelled data.

Throughout the combined model, the external façade does not align. The volume of the entire building does not align between both data streams. Figure 7 highlights the stark difference between the historic data external wall area and the current scanned data. As the wall thickness has been assumed for the modelling exercise it confirms the requirement for more accurate data and how this can be sourced by using new BIM technology to compare record drawings with large scale point cloud surveys.

Further inaccuracies were identified throughout the federated model. There were various misalignment of walls, windows, and external area as well as missing information on internal spaces. More examples of these issues have been reported using the Revit 5 software. This report can be found in appendix 1.

Mitigation

One large form of mitigation would be to continue using modelling software to add in any missing information, such as walls and doors, following the mapped point cloud. This data will link directly into the 3D model and can be used to replace outdated and incorrect floorplans on file. This exercise can be conducted on each element of the building, floors, externals and furniture and fitting. Collating all of this data accurately can relate directly to better building management.

Secondly, technology such as thermal imaging could be carried out on the building. Sourcing where large and important building services can be identified. This not only supports more accurate data recording but contributes to more sufficient management of those systems. Being able to accurately identify services can lower costs on invasive works as well as allow for asset management and tagging to take place for future repairs and replacement work.

Thirdly, once all data on the build is collated it is important this is then stored and updated accordingly. Using BIM housing platforms such as Auto Desk packages or Revit 5 allows collaborative work between disciplines. Creating a workspace where professionals can access up to date building plans which will support the teams to make informed decisions on future works or repairs as required.

Summary

In summary, the current record information does not align well with the more recent document point cloud data. Vital information on walls, doors and overall external finish is inconstant and inaccurate. Not only does this make facilities management difficult on a listed building but can lead to further risks and issues on renovation or repair works. The unknowns of existing building stock are a large contributor to risks and cost when maintaining or conducting work. Having the capability to mitigate as many of these unknowns and correcting any discrepancies in data can support far more sustainable approaches to maintaining existing building stock. Data rich models and packages on existing building can allow the built environment to use the overwhelming number of existing buildings far more efficiently. This could be a direct contributor to a more sustainable construction industry and built environment.



Part C

Further Examination and Improvements – Energy Performance

Introduction

In the concluding section of this report, examination of the current process utilities and improvements to energy performance of The Dylan Thomas Centre will be covered. Energy performance of buildings, both new and existing, is a large topic within the built environment (Mosca 2024). The construction industry has a lack of capturing and monitoring build performance, with predicted and actual often misaligning (Jradi, Arendt et al. 2018). As seen in Figure 8, energy modelling from 2010 to 2013 alone reports more accurate data on building performance than ever before. This section of the report will discuss how energy modelling and BIM technology can assist the FM team in recreating this level of data capture for the Dylan Thomas Centre.

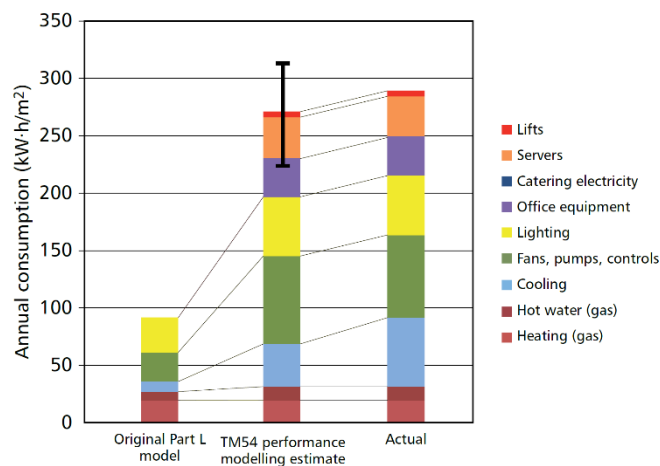


Figure 8: Results of applying the methodology to an office building: comparison between Part L 2010 compliance model, performance modelling estimate using TM54 (first edition; 2013), and actual energy use (Godefroy, Burman et al. 2022)

Current Regime for Energy Performance

Results from the form submitted to the FM team confirmed that the system in place currently to monitor the energy performance of the Dylan Thomas Centre is half-hourly metering. This form of monitoring collects detailed and accurate data every 30 minutes for billing purposes (Roberts 2025). This form of data capture can be linked to FM systems such as building energy management systems (BEMS) (Simply Switch 2025). It is not included in the responses whether this link has been made for the Dylan Thomas Centre or any other buildings within the portfolio. Alongside this, there is use of an AI backed modelling to assess trends of gas usage within the building. The systems being used is not named. It is suggested from the responses that these methods of monitoring and data collection are focussed on producing accurate billing. It is also noted in the question on what sources are currently being used that building sensors are being used to maintain the Dylan Thomas Centre. There is no confirmation on what exactly these sensors are reading and how that data is being used to maintain the building in terms of energy performance.

BIM Technologies for Energy Performance Monitoring

Various forms of BIM can be used to model, monitor, and enhance energy performance of a building. To begin, several software items such as Auto Desk modelling software and packages allow for accurate 2D, and 3D models of buildings can be created. Earlier involvement from BIM technology such as cloud scanning and thermal imaging equipment can be implemented into the building management, offering up to 30% savings in energy usage (Costa, Keane et al. 2013).

Once collated, this data heavy model can be run through energy performance software. A popular system currently used in industry is Integrated Environmental Solutions (IES) (ArchToolbox 2025). Geometric data can be compiled efficiently when combining BIM technologies. Certain types of software become efficient tools in performance analysis and report running. IES is compatible with several other tools (IES 2021). Once created, tests on issues such as decarbonisation and energy conservation can be conducted on the buildings model (IES 2026). IES is Part L compliant and listed as a government approved software for building performance analysis (GOV 2025).

Opportunities

The consumption levels of the heating, ventilation and air conditioning of buildings is around 36% of the building's energy use (González-Torres, Pérez-Lombard et al. 2022). This highlights the importance of management and monitoring of this equipment. There is opportunity to create a digital twin of the Dylan Thomas Centre, linking this 3D model into IES where reports can evaluate the buildings heat loss and ventilation equipment. These reports can simulate changes or upgrades to the building services and run tests on how much more efficient this energy consumption could be. Reporting data back to the FM and stakeholders, allows them to make better informed decisions on the building's energy performance throughout its lifecycle (Hossain, Yeoh 2018).

Real life data can be collected by room sensors on the current room temperatures within the building. These forms of BIM technology can feed directly to the live digital twin, to produce accurate reports and statistics on the current performance. Sensors can additionally monitor building use. Historic England (2024) notes people, occupants, and use, as a factor in the building's energy performance. Energy wastage can be accumulated by overproducing comfort level for under used buildings, and vice versa. Monitoring this level of building use, reporting directly to a digital twin, can lower this risk of overconsumption. A study by (Valinejadshoubi, Moselhi et al. 2021) found that using BIM data collection built much better communication between the building's requirements and the FM team.

New BIM technology such as thermal imaging equipment and cloud point scans can also contribute to a better performing building. The buildings envelope is often a factor in a building energy performance (EBC 2014). Collecting accurate and detailed information on the building's fabric, by using both thermal imaging equipment and cross examining with point cloud scans, it is feasible to gather information on the building's fabric. Faults or defects within the building can be found using thermal imaging, often this technique is used to identify any thermal bridging in the building (Pearson 2011). Thermal bridging is a large contributor to poor performing buildings when considering energy consumption. Again, by inputting this data into a digital twin and linking to IES software, the quality of tests and reporting can be increased further.

All these opportunities allow for more efficient and sustainable management of the building. This can result in lower energy usage, earlier identification of defects and more initiative-taking FM work.

Summary

To conclude, the current regime in place for building performance for the Dylan Thomas Centre is outdated compared to the BIM technology that is available today. Software such as IES combined with sensors and monitors that can be placed within the building could provide rich data to the digital twin to run tests and reports on how to create a better performing building. Externally, technology such as thermal imaging and point cloud scans can gather detailed information on the buildings fabric and added to the digital twin. Allowing further exploration into the overall building performance, giving additional data to be assessed and analysed in IES. In short, there are many opportunities for BIM technology to be used throughout the building to offer general building performance monitoring and potentially contribute to lower energy consumption.

Conclusion

To summarise, the Dylan Thomas Centre is an exemplar building to discuss when comparing opportunities and challenges faced of implementing BIM to facilities management and building performance. As a listed building, with a vast history of use and physical modification over the years the FM noted how difficult these factors make general management. To include the joint lease of the building as well further supporting the requirement for BIM in day-to-day management. The current regime of management and monitoring includes elements of BIM, that from further investigation, can be developed on using new BIM technology. The collective benefits of newer more accurate data collection available in forms of laser scan, drones and thermal imaging allow for a data rich digital twin to be assigned to the building. As part of a larger portfolio, the Dylan Thomas Centre highlights the challenges faced when attempting to implement BIM technologies on older existing buildings. Issues around historic work and shared ownership add to the complexity of managing this building for the facilities team. This report focusses on these issues as opportunities to better the buildings operation and offer solutions to sustainably improve the current regime.



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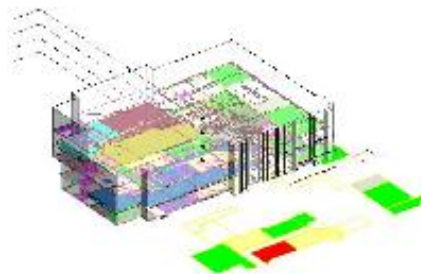
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Appendix 1

Stamped Errors Between 2D Plans & Scan

Report generated on: 14/Jan/2026
Data snapshot from: 14/Jan/2026



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