

BIM Theory Assignment



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Subject : BIM Delivery Strategy for Ysgol Y Twyn - UPRN 5016

Dear Caerphilly Council Project Team,

Introduction

Caerphilly Council and the Welsh Government are delivering Ysgol Y Twyn, a new infant school and community facility funded under the Sustainable Communities for Learning Programme (Welsh Government, 2021). Dean-Design-Consultants LTD, acting as Lead Appointed Party, has constructed a framework in line with ISO 19650 standards (ISO 19650-1:2018; ISO 19650-2:2018), the UK BIM Framework and the Welsh Government Digital Delivery Policy. The strategy for this project will focus on transparency of cost and compliance, whole life value through CAFM, predictive maintenance and digital handover, and future readiness positioning the Council for Level 3 maturity, digital twin adoption and circular economy practices.

This strategy will provide high quality designs and better life performance through architecture, engineering and digital coordination. This report appraises the BIM strategy for Ysgol Y Twyn, aligning with BIM maturity requirements ranging from Levels 0 to 4 (United-BIM, 2019). It examines the strategic BIM framework, compliance with key standards and shows demonstrating how whole life monitoring through CAFM improves sustainability and operational efficiency. Aligning BIM maturity, CAFM integration, proportionate modelling and collaborative structuring with SCfL criteria delivers value that can be measured and assessed over its lifetime to propose data for future projects. This supports BREEAM standards on energy, material performance, acoustic and indoor comfort.

Through combining federated modelling, 4D/5D integration and structured asset information, the approach lowers design risk, improves cost certainty and supports long term sustainability (Digital Built Britain, 2018), showing how BIM is a governance mechanism delivering measurable social, financial and environmental value.

Strategic BIM Framework

Throughout this project Dean-Design-Consultants will apply a BIM strategy that integrates design, cost and long term asset information into one coordinated digital workflow for Ysgol Y Twyn. This approach places BIM as a decision making tool instead of purely a modelling process, this allows early design choices to be tested against both construction budget and operational expenditure (Morin, 2024), this is important for Welsh Government funding justification (Welsh Government, 2021). Through linking real project data and performance targets, this project team is able to show how the school aligns Sustainability Communities for Learning objectives during design and throughout operation.

The project will follow ISO 19650 principles in order to achieve BIM Level 2, with future progression towards Level 3 in the future as the CAFM integration increases organisational capability.(ISO 19650-3:2020). This avoids outdated 2D information exchange which provides limited information and auditability, being unsuitable for meeting Net Zero or whole life sustainability requirements (Digital Built Britain, 2018).

The Welsh Government and Caerphilly Council act as Appointing Parties to define specific requirements such as asset tagging and safeguarding layouts. The design disciplines are coordinated using MPDT and MIDP, whilst weekly Navisworks federations identify clashes in constrained difficult to monitor areas such as the nursery ceiling voids (United-BIM, 2020). The pre-contract BEP sets naming rules, LOIN and interoperability expectations, whilst higher risk assets within the project are developed to Stage 4 in order for supporting future maintenance, and general building elements can remain at Stage 3 (ISO 19650-2:2018). Although the BEP sets a clear structure, ISO guidance allows interpretation, meaning BEPs could turn too complex unless aligned with the project's context.

Information will be managed using Autodesk BIM 360 using a controlled WIP-Shared-Published workflow, with weekly reviews combining model changes with 5D cost information (Autodesk, 2025). CESM dashboards allow the council to monitor social value, safeguarding performance and sustainability, this helps the school justify a wider public benefit. Examples from recent Welsh school projects include Ysgol Gymraeg Bro Morgannwg and Ysgol Bae Baglan show that this structured approach can lower design errors, demonstrating the practical value of a maturing BIM environment.

Overall this BIM framework strategy strengthens the design coordination, reduces risk and can provide a long-term approach to cost certainty and sustainability (Enginero, 2024), this helps the project demonstrate public value throughout the lifecycle of the building.

BIM Maturity and Standards Compliance

The progression of digital technology has moved away from basic CAD into coordinated lifecycle driven information management (Eastman et al., 2018). In terms of Ysgol Y Twyn, BIM Level 2 is the required foundation which lies on the Bew-Richards maturity wedge . To complete this level it requires all the project information to be brought together, shared in an organised way and kept into a controlled online system, this then makes the information reliable and easy to check through ISO19650-2 (ISO 19650-2:2018). It also prevents information from becoming disorganised, reduces RFIs and improves confidence in whole life performance. The BIM maturity measure also helps teams progress to advanced BIM.

Dean-Design-Consultants strategy for this project aligns with the UK BIM Framework and ISO 19650 to allow strong information governance (UK BIM Framework, 2020). The shift from PAS 1192 to ISO 19650 in 2019 replaces domestic guidance with a nationally aligned, progress driven approach. ISO standards help determine required detail, ensure information is reviewed before sharing and ensure final asset information is in line with Archibus CAFM (ISO 19650-3:2020). Documents such as the BEP, MIDP and TIDPs turn the clients requirements into clear tasks. Through using the LOIN approach, high risk assets such as plant equipment, safety systems and BB101 ventilation are developed into Stage 4, while lower risk items stay at Stage 3 .

Appendix A shows a LOIN matrix defining the required levels of geometric (G), data (D) and alphanumeric/attribute (A) information for each asset at Stage 3 and Stage 4, with higher G, D and A values applied only where increased detail is needed to manage construction, compliance or long-term operational risk. It also shows that not every object in the building needs the same level of detail, and it sets out the information needed and detail for individual asset lines with the EIR and AIR. This assists in making sure that important items contain enough data for handover into CAFM and future maintenance, whilst less important items stay simpler and avoid unnecessary modelling (UK BIM Framework, 2021).

Coordination and Collaboration Strategy

Since ISO/CD 19650-2 addressing the managing of information during the delivery phase of built assets and had replaced the earlier PAS standards in 2019 BS EN ISO 19650-2:2018, Dean-Design-Consultants have followed this approach to digital coordination, this ensures information is created, checked and authorised through the correct procedures which provides evidence of compliance with Welsh Government digital policy (ISO 19650-2:2018; Welsh Government, 2021). This also creates a transparent audit trail rather than relying on information document exchange.

Architecture, structure and MEP models are originally made in Revit and federated weekly in Navisworks, with clash detection and 4D sequencing used in resolving issues before construction. This proved to be important in the nursery ceiling void where clashes between acoustic panels and ductwork were identified at Stage 3, preventing rework and supporting BB93 compliance.

The CDE contains structured naming rules, revision control and automated checks using Solibri before information moves to Shared, this then gives traceability and safeguarding assurance (Solibri, 2025). Although the effectiveness of a CDE relies on continued adherence by all parties involved, this means the standard alone can not guarantee model clarity without strong governance.

Through using Primavera and Cost X, it supports sequencing and cost review, where 4D analysis identified piling resequencing requirements linked to town-centre access, and 5D comparison supported foundation design choices. However the accuracy on these outputs relies on mostly early design data and SME capability, this means benefits are limited by supply chain maturity. A strategy to streamline this is through the use of AI synch as Primavera 6 to change the way projects are planned, through the use of software it is possible for contract managers to prevent risks in real time and improve resource management as well as automising repetitive time consuming tasks.(Projex Consult, 2024).

Another collaboration strategy that has been increasingly used is the Matterport 3D scanning, it is used to capture site conditions quickly, this allows for point-cloud data to be uploaded into the BIM environment and a QR code to be made and placed on site for all data in one place. This allows for everyone involved in the project to be certain of what the job entails

and speeds up coordination in the project and further reduces manual surveying time (Matterport, 2025).

This strategy will reflect the best practice from the Aberdeenshire Schools PPP programme, this strong 5D processes reduce design delays. For the project Ysgol Y Twyn it improves data quality, lowers programme risk and supports predictable cost outcomes in line with SCfL priorities.

Limitations of 2D and Manual Alternatives

There are limitations to 2D drawings however , they are unable to detect clashes, create audit trails or coordinate safeguarding routes, M&E, 4D sequencing or 5D costs. Manual checks increase risk of not finding issues, especially in tight voids where they are not checked as well, leading to costly rework (Digital Built Britain, 2018). This means an ISO 19650-compliant BIM workflow is required (ISO 19650-2:2018).

Operational Impact Example

Failing of important assets such as the kitchen's backup generator can cost £500–£1000 per day in external catering. BIM-enabled predictive maintenance links AIM data to IoT sensors and Archibus to give early warnings of underperformance, reducing emergency repairs and preventing disruption.

Whole-Life Asset Management & CAFM

Dean-Design-Consultants uses whole-life asset management by using BIM into the operational phase as well to be in line with ISO 19650-3 and BS8536-1 (**ISO 19650-3:2020**). When handed over, the project information model becomes a structured AIM that integrates with Caerphilly Councils Archibus CAFM system, replacing fragmented O&M manuals with a reliable Digital Handover Protocol.

COBie provides a structured way to capture maintenance records, warranty details and statutory testing requirements, while IFC delivers the geometric and spatial data needed for future digital-twin applications. When asset tags are applied consistently across the model and the Asset Information Model (AIM), it becomes far easier to carry out safeguarding checks, demonstrate statutory compliance and implement condition-based maintenance in high-use areas (**ISO 19650-3:2020**). Through keeping detailed AHU commissioning data within the AIM, facilities teams can find early signs of ventilation performance being not as effective, allowing for maintenance to be made before system deterioration leads to operational disruption.

The AIM forms the basis for a future digital twin by linking IoT data, occupancy, CO2 temperature and energy use to Welsh Net Zero Targets (**Welsh Government, 2021**). This consistent feedback improves cost forecasting. Poorly structured AIMS can cause missing tags and weak analytics, showing that quality information is needed. A strategy through this looks at automation through BIM which can bring quality, cost efficiency and time management through generated drawings and take offs automatically (**Arayici et al., 2012**).

This approach also aligns with The Gemini Principles, ensuring that future digital twin development for Ysgol Y Twyn is ethical, secure and focused on measurable public value (**Centre for Digital Built Britain, 2018**). Although the Gemini principles give a strong ethical foundation for future digital twins, they can offer limited technical guidance and cannot be applied without ISO19650 standards or similar. The emphasis placed on transparency and data sharing to the public can also conflict with cyber security requirements.

Works completed through the predictive maintenance strategy show value for how successful it works. An air handling unit failure can cost £1200-£1800 per day. Using AIM and monitoring reduces its downtime by up to 40% and can extend asset life by 5-7 years. Over 25 years this can save up to £55,000 in saved costs. Even though IoT investment has

upfront costs , All BIM , AIM and CAFM systems together can deliver measurable whole life value for Caerphilly Council and the Welsh Government

This demonstrates that BIM maturity is not achieved purely through standards, but through the Council's ongoing ability to maintain, update and interpret asset data within the CAFM system.

Challenges, Risks and Mitigation

Ysgol y Twyn faces risks that must be acknowledged. Interoperability issues are able to cause data loss and inconsistent classifications and bring file format problems that weaken coordination in the federated model (Eastman et al., 2018).

Data security is also a key factor in technical software and strategy. The CDE holds safeguarding layouts, access routes and IoT occupancy data, this means following ISO 19650-5 must be strictly followed (ISO 19650-5:2020). Smart systems support monitoring but increase cyber security risk.

Yet the effectiveness of a CDE in practice is restricted by how consistently parties follow naming rules and approval gates, meaning the standard alone cannot guarantee clarity without strong governance.

Further issues that may affect are the organisational barriers, this is due to the fact that many SMEs lack digital capability. Not fully understanding LOIN can cause overmodelling, and licence or training costs can cap numbers of participation

Mitigation requires a layered approach. Digital skills support and BIM champions improve capability. Proportionate LOIN keeps the model aligned with the EIR and AIR (UK BIM Framework, 2020). Regular model audits improve data quality, and secure permissions with full audit trails protect safeguarding information. Dean-Design-Consultants working with Caerphilly Council to improve the EIR and AIR requirements to stay clear and achievable.

Through governance, quality control and training the projects made through this strategy can overcome technical, cultural and ethical problems which ensures reliable information, safeguarding compliance and cost predictability for the Caerphilly Council and the Welsh Government

In practice, implementation remains challenged by varying digital capability, uneven model quality and differing interpretations of LOIN, especially across smaller suppliers.

New Angle

A strategy that is not yet fully developed in Welsh Government BIM policy is using digital information in supporting circular economy outcomes in public buildings (Welsh Government, 2021). An example of this in Wales is the Cardiff Council Circular Economy Strategy which shows how material tracking and reuse can reduce waste (Digital Built Britain, 2018). Through applying this at Ysgol Y Twyn and using material passports which improves data transparency and tracking (UKGBC, 2024) , along with using digital twin links to allow components to be reused over all SCfL projects in the area.

This improves the project away from a “use and lose” model and improves sustainability to align with Net Zero Wales and national Circular Economy goals (Ellen MacArthur Foundation, 2025) with BIM datasets under ISO 19650-5 providing secure information for this (ISO 19650-5:2020).

However, the approach depends on consistent high-quality data and local capability, meaning maturity assumptions do not always match public sector readiness. This strategy also broadens the project’s ability to integrate cost, carbon and asset lifespan into one model to support better public-sector investment decisions. Examples of using these methods include reusing nursery furniture in neighbouring schools or repurposing community hall steelwork in future council projects, showing how smart BIM usage can improve economic and environmental value across Wales’s building industry. BIM makes it easier to identify components for reuse by creating a digital record of materials, quantities and locations within the building and when they need replacing ,as well as supporting circular economy strategies rather than demolition waste (Akanbi et al., 2018). Through accurate information models, BIM can help clients plan material recovery at end of life and reduce the embodied carbon associated with new product manufacturing.

Conclusion

Dean-Design-Consultants' BIM strategy for your project Ysgol Y Twyn shows strong collaboration, clear compliance and reliable whole-life value. Through applying ISO19650 into the project, the information is managed effectively and transparently, models are coordinated accurately and lifecycle data work together (ISO 19650-2:2018). The CDE being supported by CESM turns BIM into a governance tool that can give Caerphilly Council and the Welsh Government clear evidence of sustainability, efficiency and social value.

This approach helps support the Sustainable Communities for Learning programme by reducing design and operational risks, improves cost certainty and builds long term monitoring into the CAFM system to predict faults from the beginning (Welsh Government, 2021). Performance tracking and structured asset information can help with long term budget options and strengthen value for money reporting

Overall, this BIM framework can deliver more than a simple building of a school, its ability can create a digitally enabled, resilient public asset and prepares Ysgol Y Twyn for a future level 3 capability and digital twin development.

Any questions about this feel free to ask ,

Yours sincerely, Adam Dean

Lead Appointed Party – BIM Delivery

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Appendix A - Example of LOIN Matrix that could be used in Ysgol Y Twyn - Ensures proportional modelling, prevents over-detailing, and aligns each asset category with the EIR, AIR and Stage 3/4 deliverables.

Asset Category	Purpose of Information	Geometry (G)	Alphanumeric (A)	Documentation (D)	Required Stage	Justification (Project-Specific)
Nursery Furniture & Fittings	Spatial coordination, safeguarding supervision layouts	G3	A2	D2	Stage 3	High-wear, frequently replaced items; avoid unnecessary detail while ensuring safe circulation for supervised learning.
Mechanical Plant (AHUs, boilers, pumps)	Cost forecasting, maintainability, energy modelling	G4	A4	D4	Stage 4	Critical for BB101 ventilation compliance; supports predictive maintenance and CAFM integration.
Electrical Systems (lighting, CCTV, access control)	Safeguarding, security, energy monitoring	G3	A4	D4	Stage 3–4	Essential for safeguarding routes; structured data supports automated CAFM scheduling and privacy compliance.
Community Hall Structure (steel frame, slabs)	Coordination, loading, acoustics	G4	A2	D2	Stage 4	High footfall multi-use space; acoustics & load paths must be accurately modelled for community events.
Classroom Architectural Elements (walls, doors, windows)	Spatial coordination, energy and daylight modelling	G3	A3	D3	Stage 3	Supports thermal/lighting calculations for Net Zero targets; does not require fabrication-level detail.

Public (drainage, pipework)	Health	Clash avoidance, maintenance access, compliance	G3	A4	D3	Stage 4	Coordination required to avoid clashes in tight ceiling voids above nursery areas.
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