

ACBA4017

DIGITAL SURVEYING AND HIGHWAY DESIGN

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Introduction

Building surveys are key factor to help with the maintenance, preservation and adaptive reuse of the built environment. (RICS, 2021) They provide important information about the condition, structure and functionality of buildings, forming the basis for decision making in areas such as refurbishment, conservation, and redevelopment. In the context of heritage buildings, surveys are even more crucial, as they must balance the need for a detailed investigation with the imperative to preserve and protect historically significant fabric. The Dylan Thomas Centre in Swansea, a Grade II listed neoclassical building is the kind of structure where careful and detailed surveys are important to protect cultural heritage for future generations. Historically, building surveys relied heavily on manual techniques such as hand measurements, sketches and photographic records. While effective to a degree, these methods were often time consuming, labour intensive and prone to human error. They also posed challenges in accessing difficult to reach areas and capturing the complex geometries typical of historic architecture (Historic England, 2018).

In recent decades, digital technology has revolutionised building survey practices. Tools such as drones, laser scanning (LiDAR), photogrammetry, Building Information Modelling (BIM) and thermal imaging have allowed surveyors to collect vast amounts of high quality data quickly and accurately (Murphy et al., 2009). These technologies enhance safety by reducing the need for direct physical access to hazardous areas, improve the reliability of survey outputs and support integrated digital workflows that benefit all stakeholders.

The aim of this assignment is to plan a comprehensive digital survey of the Dylan Thomas Centre, demonstrating the application of contemporary digital tools and techniques to a real world heritage scenario. The proposed survey will highlight the advantages of digital technologies in capturing, analysing and managing building data, ensuring that the Centre's structural and aesthetic integrity is maintained for years to come.

Survey Objectives and Scope

The primary objective of the proposed building survey is to create a detailed and accurate record of the Dylan Thomas Centre's current condition, identifying any structural issues, material degradation or environmental impacts that could compromise its integrity. This record will form the foundation for maintenance and conservation planning, ensuring that interventions are both timely and sensitive to the building's historical value.

Secondary objectives of the survey include documenting the architectural features and decorative details of the Dylan Thomas Centre to contribute to the heritage records, making sure that these elements are accurately recorded for future reference (ClfA, 2019). The survey will also assess the impact of environmental factors such as weathering from the coastal exposure and dampness, which may affect the building's structural integrity and aesthetic condition over time. Another key objective is to create a comprehensive digital model of the building, which can be used to facilitate ongoing monitoring, maintenance planning and informed management decisions. Finally, the survey aims to support stakeholder engagement by producing clear, visually rich and easily interpretable outputs that communicate the building's condition and needs effectively to a wide audience including non technical stakeholders.

The scope of the survey includes both the exterior and interior of the building. Externally, the focus will be on the roof, façades, windows and decorative elements, especially at higher elevations where traditional inspection is challenging. Internally, the survey will assess walls, floors, ceilings, structural members and ornamental details. The survey will also consider building services, where accessible, and note any signs of moisture ingress, thermal inefficiency or material fatigue.

Located in Swansea's Maritime Quarter, the Dylan Thomas Centre is prone to coastal environmental conditions, including salt-laden air, wind-driven rain and high humidity. These factors will inform the survey's emphasis on weatherproofing, corrosion and masonry condition. Because it's a Grade II listed building, any work must be gentle and not damage its historic features, while still giving useful information (English Heritage, 2015)

Selection of Digital Tools and Technologies

To meet the objectives above, the survey will employ three principal digital tools: 3D laser scanning, drone imaging, and Building Information Modelling (BIM). Together, these technologies deliver a well rounded approach that meets the specific demands of a heritage building survey.

3D Laser Scanning (LiDAR)

Laser scanning is a terrestrial technique that uses a rotating laser to measure millions of points on visible surfaces, creating a dense point cloud that represents the geometry of the building with millimetric accuracy. This technology is particularly valuable in historic settings, as it can capture complex architectural details such as cornices, columns and decorative stonework that are difficult to measure manually.

The advantages of laser scanning include its high speed of data acquisition, enabling large areas to be surveyed in just a few hours, with minimal disruption to the building's occupants and visitors. It also offers extremely high accuracy and repeatability, and the resulting point cloud data can be used to generate detailed 2D drawings and 3D models. Laser scanning will be used throughout the interior and accessible exterior areas of the Dylan Thomas Centre, providing a complete and accurate geometrical record. (RICS, 2021)

Drone Imaging

Unmanned aerial vehicles (UAVs), commonly known as drones, have become indispensable for surveying building exteriors, particularly roofs and upper façades. Equipped with high resolution cameras, drones can capture still photos, videos and even thermal data from angles that would otherwise require scaffolding or cherry pickers, which can be costly and time consuming.

In the case of the Dylan Thomas Centre, drones will be used to inspect the roof coverings, gutters, pine ends and chimneys, as well as to document inaccessible façades and higher level architectural features. The use of drones allows the capture of contextual aerial views of the building within the Maritime Quarter and enhances safety by removing the need for surveyors to work at height.

Building Information Modelling (BIM)

Building Information Modelling (BIM) is a digital process that brings together all building information in a single, intelligent 3D model. For heritage buildings, this approach is called Heritage BIM (HBIM) (Murphy et al., 2009)

. HBIM records not only the shape and size of the building but also extra data about each part, such as the materials used, its condition, and its maintenance history.

For the Dylan Thomas Centre, BIM will serve as a central repository for all survey data, enabling easy visualisation of the building for stakeholders. It will also support future maintenance planning by tracking deterioration over time and help

ensure compliance with relevant standards and regulations. with conservation requirements by clearly identifying historic fabric.

The integration of laser scanning and drone data into the BIM platform ensures a comprehensive and cohesive survey output. (Murphy et al., 2009)

Survey Planning

The survey will be carried out in three phases: preparation, data collection and data processing and reporting.

In the preparation phase, permissions and access agreements will be obtained from Swansea City Council and relevant heritage bodies. Historical records, previous surveys and existing drawings will be reviewed to inform the planning process. A site visit will be conducted to assess safety, access and logistical considerations. Finally, survey control points will be established using GPS or total stations to ensure accurate georeferencing of the collected data. Health and safety risk assessments will also be carried out, particularly in relation to drone flights and the use of laser equipment in occupied spaces. (RICS, 2021)

The data collection phase will involve setting up laser scanners at strategic locations both inside and outside the building to capture a complete point cloud. Drones will be deployed to carry out aerial photography and videography, covering all elevations and roof surfaces. This will be supplemented with high-resolution still photography and, if required, thermal imaging to identify moisture ingress or heat loss. Observational notes and photographs of areas of concern will also be recorded for later annotation within the BIM model. Throughout the process, care will be taken to minimise disruption to building users and the surrounding area.

Data Processing and Reporting

After data collection, the point cloud data will be processed to remove noise, align individual scans, and create a unified 3D model. Drone imagery will be georeferenced and integrated into the 3D dataset. The BIM model will then be populated with geometry, metadata, and annotations. From this, outputs such as 2D plans, elevations, sections, and a detailed condition report will be generated. Finally, the findings will be presented to stakeholders in a clear and accessible format, including interactive 3D visualisations. (Autodesk, 2020)

Challenges and Solutions

While digital technologies bring many benefits, they also present challenges that must be addressed through careful planning and mitigation.

Access Restrictions

Certain areas may remain inaccessible even with drones and scanning, for example due to fragile structures or internal obstructions. To avoid this small handheld scanners or endoscopic cameras can be employed in tight spaces and assumptions can be clearly documented where data cannot be collected.

Weather Conditions

Drone flights and exterior laser scanning are highly weather-dependent. Rain, strong winds, and low visibility can compromise data quality or pose safety risks. To address this, surveys will be scheduled during favourable weather windows, and contingency days will be built into the programme. (Historic England, 2018)

Data Volume and Processing Time

Digital surveys generate vast quantities of data that require powerful computing resources and skilled technicians to process. Cloud based processing platforms and experienced survey teams will be engaged to manage this workload efficiently (Esri, 2022).

Stakeholder Communication

Stakeholders unfamiliar with digital survey outputs may find it challenging to interpret technical data. (Autodesk, 2020) This risk will be eliminated by providing user-friendly visualisations, explanatory notes and in person presentations.

Conclusion and Recommendations

This essay has outlined a comprehensive digital survey plan for the Dylan Thomas Centre in Swansea, demonstrating the application of contemporary digital tools to a heritage building context. The survey objectives include documenting the building's current condition, informing maintenance and conservation strategies, and creating a detailed digital record for ongoing management.

The proposed methodology combines 3D laser scanning, drone imaging and BIM to capture accurate, high quality data in a non invasive manner. A carefully structured survey plan ensures that logistical, environmental and safety considerations are addressed. Potential challenges have been identified and mitigated through appropriate strategies.

The use of digital technologies in building surveys offers significant benefits, including improved accuracy, efficiency, safety and stakeholder engagement. In the case of heritage buildings like the Dylan Thomas Centre, these tools enable sensitive yet thorough assessment, ensuring that cultural value is preserved while supporting practical maintenance needs. (ClfA, 2019)

It is recommended that heritage organisations and survey practitioners continue to invest in digital skills and technologies, and that regular updates to BIM models be incorporated into long term building management plans. Furthermore, integrating survey data with environmental monitoring systems could enhance the predictive maintenance of such valuable assets. (Autodesk, 2020).

By appreciating digital innovation, we can ensure that historic buildings are better understood, maintained and celebrated securing their place in the urban fabric for generations to come.

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