



PRIFYSGOL CYMRU
Y Drindod Dewi Sant
UNIVERSITY OF WALES
Trinity Saint David
SWANSEA - ABERTAWE

RESULT

MASTER'S DEGREE ASSIGNMENT SPECIFICATION

Student name:	Alex Haddow	Student P number:	2006950
Programme:	<u>MSc Property and Facilities Management</u>		
Module:	Building Maintenance and Asset Management	Module Level:	7
Module code:	ACBA7000	Contribution to Overall Module Assessment (%):	70% of the assessment 30% for a presentation
Lecturer:	Ka Leung, LOK (Lawrence)	Internal Verifier:	Chris House
Assignment Title:	Building Maintenance and Asset Management	Assignment No (x of x):	1 of 1
Hand Out Date:	20 April 2022	Submission deadline:	20 June 2022

Referencing:	In the main body of your submission, you must give credit to authors on whose research your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have read or quoted in order to complete this assignment (e.g. for books: surname of author and initials, year of publication, <u>title of book</u> , edition, publisher: place of publication).		
Disclosure:	I declare that this assignment is all my own work and that I have acknowledged all materials used from the published or unpublished works of other people. All references have been duly cited.		
Student's Signature:	<i>Assignments will not be accepted without a signature here</i> 	Date:	17/06/2022
Turnitin: Lecturer to tick to indicate if an electronic version of the assignment must be submitted to Turnitin. Note: The Turnitin version is the primary submission and acts as a receipt for the student. Both electronic and paper versions MUST be submitted by the same deadline. No marks will be released until both submissions are received. Late submission of either the electronic or paper version will result in a late penalty mark. Penalties for late submission: Up to ONE week late, maximum mark of 50%. Over four weeks late, Refer.	YES	X	
	NO		

Table of Contents

1.0.	Executive Summary	3
1.1.	Case Study Building.....	3
2.0.	Application of Building Pathology	3
2.1.	Knowledge of the Building	4
2.2.	Fundamentals of Building Pathology	4
2.2.1.	Identification	5
2.2.2.	Investigation.....	6
2.2.3.	Course of Action	7
2.3.	Building Regulations.....	7
2.4.	Critical Success Factors	8
2.5.	Recommendations	8
3.0.	Construction Defects in the New Gwent Police HQ Building	9
3.1.	Introduction to the report	9
3.2.	Defect Liability Period.....	9
3.3.	Building Inspection & Surveys	10
3.4.	Asset Management and BIM.....	13
3.5.	Recommendations.....	13
3.6.	Defect Monitoring.....	14
4.0.	Maintenance and Facilities Strategy Audit	15
4.1.	The Importance of Maintenance Planning	15
4.2.	Maintenance Planning.....	15
4.3.	Identifying Maintenance works and Repairs.....	16
4.4.	Managing the Works	16
4.5.	Health and Safety	17
4.6.	Accessibility and Inclusiveness.....	19
4.7.	Environmental Considerations	19
4.8.	Recommendations – Use of Maintenance Priority Tools.....	20
5.0.	References	21
6.0.	Appendix 1 – Building Regulations (Wales).....	25
6.0.	Appendix 2 – Spectrum of Building Conditions.....	26
6.0.	Appendix 3 – Risk Based Tool Example	27

1.0. Executive Summary

The below report will investigate how building pathology is applied and understood within the built environment. Drawing on current research and in practice knowledge to critically analysing how various principles are delivered.

Secondly the report will investigate the case study building and apply the various building pathology principles to correctly identify building defects, whilst also providing an integrated approach to rectification.

Lastly the report will provide a full maintenance and facilities audit using the various techniques described within the report to propose potential future building maintenance strategies.

1.1. Case Study Building

The case study building chosen is the new Gwent Police headquarters building. The building is circa 6000m² and houses senior members of staff and officers. The building was constructed to an exceedingly high specification to reflect this and was completed and occupied by the end of 2021. The building also houses the force control room and was built with a security first mindset. This was to ensure the safety of staff and officers.

The building is constructed on a part pad part pile foundation due to existing ground conditions. The façade is a mixture of high-performance glass with brick slips. The roof is a flat roof housing much of the building plant and energy regeneration equipment.

2.0. Application of Building Pathology

The Royal Institute of Chartered Surveyors (RICS) (2021) describes building pathology as the discipline of understanding Construction technology and environmental services, Design and specification, Inspection, and Legal/regulatory compliance.

The CITB (2021) suggests that problems (defects) in buildings are sometimes misdiagnosed. This can in turn lead to the remedial action suggested causing

more damage than good. It is essential to arrive at the correct diagnosis when solving the problem.

The CITB (2021) suggests that building pathology is the forensic approach of identifying defects. As stated above by the RICS, applying sound building pathology principles relies upon a sound understanding of construction technology. This is where building pathology can breakdown, whereby persons without the sound construction technology background fail to correctly apply building pathology principles to a building defect.

Shelbourne (2004) suggests that employers within the field are employing graduates with not only the technical knowledge but the practical experience of surveying buildings. This is a valid point and suggest that for building pathology principles to be applied they must first be understood and then applied within a real-life application.

2.1. Knowledge of the Building

A building is fundamentally used as a box or envelop that protects people from external elements. Watt (2007) suggests that this is widely understood as to how buildings work for people with buildings acting as a skin which surrounds its occupants and modifies the environment to suit its occupants.

The Gwent Police (GP) new headquarters building uses high specification building materials to provide enhanced level office space for senior officers and staff. With this in mind understanding how the building operates for both hard and soft facilities management is key to ensuring staff and officers are comfortable and happy within their working environment.

2.2. Fundamentals of Building Pathology

Building pathology is a core principle of the RICS assessment of professional competency. The RICS (2018) pathway guide suggests it is essential that all candidates understand defects analysis, and the likely resultant defects from failures in building fabric. Candidates are expected to have an in-depth

knowledge of a range of defects found in typical buildings coupled with a sound construction technology background.

In order for individuals to correctly diagnose defects, a systematic process applied to the defect will assist with the correct diagnosis. The below section will investigate the three phases and how they assist with defect identification, investigation and ultimately the course of action.

2.2.1. Identification

Within the United Kingdom there are several condition surveys that are available all with varying degree of complexity and output for the end users. Building managers may wish to firstly inspect the overall condition of a building to first ascertain the reasons for commissioning a survey Douglas (2011). A spectrum of building condition has been provided in appendix 2.

Douglas (2011) suggests that there are three main stages to an on-site condition survey. Firstly the exterior overview which investigates the elements of the façade and roof. Usually a top-down process covering the roof, then walls from the upper floor down to ground level. The interior inspection is completed room by room and identifies any defects to floors, walls, ceilings and fittings. Any external defects causing internal issue must be recorded. Lastly the review of the exterior and surrounding site investigates any defects on the property grounds including boundary walls.

The RICS provide several building surveys for both residential and commercial properties. According to localbuildingsurveyor (2020) the RICS provide three basic levels of condition surveying.

Level 1 – This is the standard condition survey. The survey is a visual non-intrusive investigation and is the basic level report.

Level 2 – This survey is completed on a standard RICS document. The detail of the report is more complex and can include a valuation on request. The

report does not detail every aspect of the property, and only focuses on urgent matters needing attention.

Level 3 – The level 3 report is the most complex and includes a full building survey covering minor and major defects. This report also provides recommendations and potential cost implications of each defect.

As can be seen above Douglass and the RICS have a similar approach to property condition and identifying defects. The process has been a constant within the UK for several years. The RICS use formatted templates to undertake surveys. This can be risk as surveyors can become complacent when completing forms. Although the RICS surveys are tried and tested route to defect identification.

2.2.2. Investigation

The investigation of the building defect follows the initial identification. The process can be timely but requires a skilled process to ensure defects are correctly diagnosed.

Gibbons (2021) suggests that the diagnosis of a defect requires understanding of complex relationships between building components including their arrangement and the environmental factors to which they have been exposed. The process helps avoid seemingly obvious solutions and assist with root cause diagnoses.

With Australia a process known as forensic investigation of building defects has been suggest as another solution to help reduce misdiagnosis.

The process of forensic investigation of building defects firstly starts with the information gathering stage. Information includes architectural drawings, structural drawings, specifications, warranties and certificates. From this a site inspection is conducted to identify the defects. The survey concludes with a failure theory report which explores the possible defect cause. Donnan (2010).

The above process using the existing building information coupled with the experience of the surveyor to formulate an in-depth audit of each building defect and how the construction of the building may or may not have impacted.

One issue highlighted within the journal was that information such as specifications and drawings may not be available for older buildings.

2.2.3. Course of Action

Once the defects are understood the next course of action is rectification. This process can depend on the severity of the defect but also the policies of an individual organisation.

Listed building consent is used to make decisions that balance the sites historical significance against other issues such as repairs. Historic England (2015). This can be a lengthy process resulting in minor defects becoming worse quickly.

For new buildings, a defect liability period will be set within the construction contract. A defects liability period is usually a period of around six or 12 months, but it can vary depending on the contract used. Any defects or faults which arise during this must be put right by the contractor at its own expense Hugh James (2019).

2.3. Building Regulations

Building Regulations derived from the Building Act 1984 and are defined by English and Welsh governments. Regulations are used to ensure that new buildings are constructed to a certain level of specification. This ensures that buildings are habitable, safe and healthy of future occupants Local Authority Building Control (2018), Welsh Government (2021). There are 16 core regulations ranging from fire safety to conservation of fuel and power. A table has been provided in appendix 1 outlining the full regulation list.

When applying building pathology principles to a building, one must consider the building regulations as the minimum standard used when constructing

the building. Alongside this any refurbishment or remedial works conducted to the building must also comply with building regulations.

2.4. Critical Success Factors

For clients wanting to correctly identify defects using building pathology principles a number of critical success factors have been identified above.

- 1) A sound understanding of construction technology is required.
- 2) Be mindful that misdiagnosis is a common mistake.
- 3) Use the three-phase process of identification, investigation and course of action.
- 4) Use all existing building information to assist with investigations.

2.5. Recommendations

Client without the relevant construction technology background may find the diagnosis of defects a challenging task. This can lead to misdiagnosis and ultimately making the defect worse.

It is suggested that inexperienced client employ a third-party surveyor via an institute such as the RICS to perform a level 3 building survey. This will provide the client with the relevant information to correctly diagnose and rectify any building defects.

3.0. Construction Defects in the New Gwent Police HQ Building

The below report will investigate the current building defects within the New Gwent Police HQ Building. Using the RICS (2010) condition report as a template document to ensure defects are identified, investigated whilst also providing the remedial action required.

3.1. Introduction to the report

The condition report aims to tell the reader:

- The construction and condition of the building
- Identification of all defects
- Further investigations required
- Health and Safety concerns

The survey will investigate the below areas providing a condition rating:

- Outside of the property
- Inside the property
- Services
- M&E Equipment
- Risk
- Legal Matters

3	Defects that are serious and/or need to be repaired, replaced or investigated urgently.
2	Defects that need repairing or replacing but are not considered to be either serious or urgent. The property must be maintained in the normal way.
1	No repair is currently needed. The property must be maintained in the normal way.
NI	Not inspected (see 'Important note' below).

3.2. Defect Liability Period

As described in section 2.2.3 defect liability periods (DLP) are usually a period of around six or 12 months, but it can vary depending on the contract used. The new Gwent Police HQ is currently within a defect liability period. As such

if determined to be within the scope of the DLP the contractor will be instructed to repair the defect.

3.3. Building Inspection & Surveys

Item	Defect Identification	Rating
External Fire Doors	During the initial inspection it was discovered that the existing fire doors fitted by the contractor were not compliant with building regulations.	3
	Investigation	
	According to Building Regulations UK (2018) as determined with reference to Commission Decision 2000/367/EC regards the classification of the resistance to fire performance of construction products, construction works and parts thereof. All fire doors should be classified in accordance with BS EN 13501-2:2003 Fire classification of construction products and building elements. The fire doors fitted within the new HQ building were not seen to be complaint with BS EN 13501-2:2003.	
	Course of Action	
	Contractor to remove fire doors and associated equipment and replace with BS EN 13501-2:2003 compliant doors.	

Item	Defect Identification	Rating
Thermal Movement Provisions	A number of windows identified throughout the building appear to be cracked at the corners. This is believed to be a result of thermal stress provisions.	3
	Investigation	
	Hinks (1997) suggest that glass exposed to solar energy can heat up resulting in thermal expansion. If there are no provisions in place to account for this expansion the glass will crack under stress. Preventative measures include using toughened or	

	solar protected glass or installing thermal edge protection to the glass.	
	Course of Action	
	It is suggested that due to the high specification of the new HQ building that both upgraded glass and thermal edge protection are fitted to all windows affected by thermal stress.	

Item	Defect Identification	Rating
Thermal Comfort	With use of internal temperature points it was deemed that the building suffered from overheating during times of hot weather.	2
	Investigation	
	According to the Health and Safety Executive (HSE) (2019) Thermal comfort is exceedingly difficult to define as you need to consider a range of environmental, work-related and personal factors when deciding what makes a comfortable workplace temperature. Although temperatures were deemed to be exceedingly high during times of hot weather. It was later discovered that there was an issue with the Building Management System (BMS). The system was not reading all internal temperatures and as an effect producing a higher over building temperature.	
	Course of Action	
	The BMS engineer was called, and the problem was rectified via the BMS desktop computer.	

Item	Defect Identification	Rating
Unsafe access to roof top plant	During the initial inspection of the roof space it was deemed that the access provided was unsafe for access and maintenance. A large profile aggregate was applied to the roof to assist with drainage.	2

	Roof top plant consist of 6 air handling unit and a chiller.	
	Investigation	
	Investigation into the contractors design risk assessments was commissioned with a foresight from the contractor for the access to roof top plant. Regulation 17, point 1b states that There must, as far as is reasonably practicable, be suitable and sufficient safe access and egress from every place construction work is being conducted to every other place to which workers have access within a construction site. HSE (2015)	
	Course of Action	
	A glass reinforced plastic (GRP) 35mm mesh safety flooring was installed. Linked together with spacers and brackets, the flooring solution provided a safe and secure solution for maintenance access.	

Item	Defect Identification	Rating
Internal Finishes	Early on in the defect liability period a number of the internal walls were showing signs of hair line fractures. At the time, the main cause of the cracking was unknown and further investigation was required to develop a theory.	2
	Investigation	
	The National Housing Building Council (2022) suggested that Materials for plastering should be in accordance with BS 8481. After checking with the contractor it was deemed that the materials used were in accordance with the above regulations. Due to the high volume of glass within the façade of the building it was observed that the areas of high cracking density were situated in areas of intense sunlight. The Cement and Concrete Institute (2006) suggests that excessive early moisture loss due to the wall not being protected from the sun can lead to non-structural cracking.	
	Course of Action	

	As the moisture had left the wall and caused cracking it was deemed suitable for the cracks to be surfaced filled and monitored. The contractor was ordered to fill the cracks as part of the DLP.	
--	--	--

3.4. and disadvantages with outsourcing vs in-house operatives. Asset Management and BIM

Jones (2016) indicates that asset management is a mindset which sees physical assets not as inanimate and unchanging lumps of metal / plastic / concrete, but as objects and systems which respond to their environment, change and normally deteriorate with use, and progressively grow old then fail / stop working / die!

Building Information Modelling (BIM) asset management takes this a step further with utilisation of a 3D replica model allowing building owners to view building maintenance performance today but also how the building will operate in 20 years' time. The model can also manage maintenance schedules, repairs, renovations and costs Prokop (2018).

The system allows building owners to fully understand the building at the click of a mouse. Allowing for predicted elemental life expectancies of building parts to be investigated as and when the system indicates. This allows users to respond in a planned manner rather than reactive manner, thus reducing costs, time and resources.

3.5. Recommendations

It is recommended that Gwent Police commission a full RICS level 3 condition survey from the RICS to identify all defects present at a point in time. Surveys should be conducted Quinquennially. This will allow the maintenance team to identify defects and utilise resources to rectify critical defects at source.

3.6. Defect Monitoring

Although in some cases identified defects may not be rectified straight away. Constraints such as resources, budget and complexity of the project limit the building owner when considering maintenance.

This is when defect monitoring will be used to ensure defects are not worsening and can be rectified as and when budgets allow.

4.0. Maintenance and Facilities Strategy Audit

4.1. The Importance of Maintenance Planning

Maintenance of a building is important to ensure the safety and comfort of those occupying the building. To effectively ensure maintenance of a building is maintained adequate planning provision must be considered.

According to the Department for Education (2022) maintenance of a building or land is generally recognised as either planned preventative maintenance (PPM) or reactive maintenance. Alongside this a balance should be considered for both with PPM receiving a 70% ratio and reactive maintenance receiving 30%.

Reactive maintenance repairs generally cost more than planned maintenance. For larger organisations who have a multi building estate they may have team and resources in place to effectively plan maintenance. On the other side reactive maintenance include lower internal labour costs for less labour-intensive requirements Eco-Docs (2020).

For large organisations, a planned preventative maintenance strategy would be beneficial. For smaller organisations with smaller estates and smaller budgets a reactive option may well be the best course of action.

For the Gwent Police new headquarters building due to the age being almost new a PPM strategy would be advised. Coupled with a BIM asset model for monitoring a PPM strategy would provide reassurance to senior members of staff and officers that the building is effectively being managed.

4.2. Maintenance Planning

At present maintenance planning for the new HQ building is currently being developed. The building is currently in a defect liability period and the maintenance strategy will follow the completion of the DLP.

Future prioritisation is a key consideration for maintenance planning with the below areas being covered: Department for Education (2022)

- Overall estates maintenance management plan
- Day to day planned maintenance

Many asset management strategies follow a three to five year plan. Eastleigh Council (2020)

4.3. Identifying Maintenance works and Repairs

At present Gwent Police do not currently have a mechanism for identification of defects and continuous monitoring. The Department for Education (2020) suggests that building condition surveys are carried out every 5 years. This allows building managers to capture building elements and prepare a long-term maintenance programme. Potentially capturing future capital investment.

4.4. Managing the Works

Currently Gwent Police utilise a maintenance framework to undertake all its building, plant and servicing maintenance.

Framework providers such as National Framework Partnership (2021) provide easily accessible frameworks for building refurbishments and maintenance. This allows Gwent Police to access third party resources as and when needed. This can be costly with most works coming at a premium due to management cost, overheads and profits of the framework contractor provider.

One alternative to this form of contracting would be to employ in-house maintenance operatives. Davies (2017) suggests that when considering in-house operatives it is imperative to identify the skills required to undertake day to day repairs. Employing skilled operatives rather than outsourcing could be far most costly.

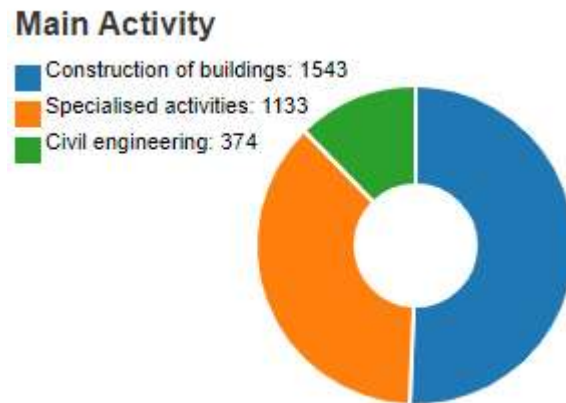
TPG Facilities Management (2020) indicates a number of advantages

In-house advantages	Outsourcing advantages
Control and influence of staff	Teams will be multi-skilled and fully qualified
Fixed staff cost	Access to office admin and 24-hour services
Able to appoint based on experience and personal attributes.	Outsourcing companies become liable for works
In-house dis-advantages	Outsourcing dis-advantages
Skilled works may be costly	Less control of operatives
Limited skills pool	Increased overall cost
Time consuming to appoint a team from nothing.	Security vetting of contractors

4.5. Health and Safety

Maintenance of a building can potentially expose people to various hazards. The HSE (2020) suggest that maintenance related accidents are a serious cause for concern. For example, analysis of data from recent years indicates that 25-30% of manufacturing industry fatalities in Great Britain were related to maintenance activity.

This is backed by the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations Statistics (2018) which indicated that construction of building activities holds the majority share of reportable accidents from 2011 to 2017.



Reporting of Injuries, Diseases and Dangerous Occurrences Regulations Statistics
(2018)

It is imperative that safe systems of work are implemented when maintenance activities are conducted. Within the construction industry risk assessments and method statements are used when conducting construction work.

Brit Safe (2020) Risk assessment is a straightforward and structured method of ensuring the risks to the health, safety and wellbeing of employees (and others) are suitably eliminated, reduced or controlled.

Minnett (2020) Method statements are hugely important when it comes to the health and safety of projects, particularly in the construction industry. These documents are used alongside risk assessments to make sure certain high-risk tasks and activities involved in a project are safe.

Health and Safety of construction and maintenance projects in the UK is covered by law within the Construction (design and Management) 2015 regulations.

4.6. Accessibility and Inclusiveness

When carrying out large maintenance and refurbishment projects areas of the building may be changed. It is again imperative to comply with the Equality Act 2010 when changing the use of buildings.

The act within buildings covers areas that create physical barriers. Alongside this making suitable adjustments in areas of access to services, spaces and minimising limitation within existing buildings Blundell (2017).

Again by law this must be incorporated into any asset management strategy and should be considered when making alterations within existing buildings.

4.7. Environmental Considerations

Since the Paris agreement and the climate change commitment of 197 countries in 2015 an emphasis on energy reduction has been high on organisation agendas throughout the world.

ISO 50001 is the global standard for energy management systems. Meeting the requirements of this standard and achieving ISO 50001-accredited status should be key objectives for environmentally conscious companies who wish to be as energy-efficient as possible NPT Consult (2019).

Benefits of ISO 50001 include: BSI (2021)

- Identify and manage the risks surrounding your future energy supply
- Measure and monitor energy use to identify where to improve efficiency
- Improve overall performance to cut energy consumption and bills
- Reduce carbon emissions and meet government reduction targets
- Demonstrate environmental credentials to increase tender opportunities

It is suggested that Gwent Police utilise the ISO 50001 standard. This will provide the team with a base line consumption of energy and a pathway to reduction and continuous monitoring for further reductions.

4.8. Recommendations – Use of Maintenance Priority Tools

The Department for Education (2020) utilise a tool to improve maintenance planning. The tool assists building owners to identify what additional factors may need to be considered when prioritising building maintenance works.

The first part of the tool requires a condition survey to be carried out for all estate buildings. From this information determines the maintenance priority based on budget.

Secondly the risk-based tool is based on an assessment of risk factors, their severity and the probability of failure.

Risk Factors

- health and safety and statutory compliance
- the impact on operation
- the potential financial or reputational implications
- the impact on the ongoing condition of the building or elements within it.

Probability of failure

The probability of failure in the tool is defined as:

- unlikely
- possible
- likely
- certain

Outcomes: By utilising the above matrix and methodology building owners are able to rank defects against each other ensuring that focus is on prioritising resources to minimise risk to the building.

5.0. References

Blundell, S. (2017). Understanding disability access in the built environment. [online] Planning, BIM & Construction Today. Available at: <https://www.pbctoday.co.uk/news/building-control-news/understanding-disability-access-in-the-built-environment/35090/#:~:text=Rather%2C%20duties%20under%20the%20Equality%20Act%202010%20include> [Accessed 16 Jun. 2022].

Brit Safe (2020). Risk Assessment and Management: A Complete Guide | British Safety Council. [online] www.britsafe.org. Available at: <https://www.britsafe.org/training-and-learning/find-the-right-course-for-you/informational-resources/risk-assessment/#:~:text=Risk%20assessment%20is%20a%20straightforward%20and%20structured%20method> [Accessed 16 Jun. 2022].

BSI (2021). Introduction to ISO 50001. [online] www.bsigroup.com. Available at: <https://www.bsigroup.com/en-GB/iso-50001-energy-management/Introduction-to-ISO-50001/> [Accessed 16 Jun. 2022].

Building Regulations UK (2018). Appendix B: Fire doors | The Building Regulations UK. [online] thebuildingregulations.org.uk. Available at: https://thebuildingregulations.org.uk/guides/Part_B_Vol__1/Appendix_B_Fire_doors/ [Accessed 11 Jun. 2022].

Cement and Concrete Institute (2006). Common Defects in Plaster. [online] Cement and Concrete Institute. Available at: file:///C:/Users/alex.haddow/Downloads/Common_defects_in_plaster.pdf [Accessed 13 Jun. 2022].

CITB (2021). Building Pathology - Online Classroom. [online] CIOB Academy. Available at: <https://www.ciobacademy.org/course/building-pathology-online-classroom/> [Accessed 9 Jun. 2022].

Davies, L. (2017). Maintenance: in-house or outsource? | Engineer Live. [online] www.engineerlive.com. Available at: <https://www.engineerlive.com/content/maintenance-house-or-outsource#:~:text=An%20in-house%20maintenance%20team%20usually%20has%20more%20years> [Accessed 14 Jun. 2022].

Department for Education (2020). How to prioritise maintenance - maintenance priority tools. [online] Department for Education. Available at: https://assets.publishing.service.gov.uk/media/5f84c9a68fa8f5044f333677/How_to_prioritise_maintenance.pdf [Accessed 16 Jun. 2022].

Department for Education (2022). Maintaining your estate - Good estate management for schools - Guidance - GOV.UK. [online] www.gov.uk. Available at: <https://www.gov.uk/guidance/good-estate-management-for-schools/maintaining-the-estate> [Accessed 14 Jun. 2022].

Department of Education (2020). Introduction to condition surveys. [online] Available at: https://assets.publishing.service.gov.uk/media/5f8480b58fa8f50455cd95d3/Introduction_to_condition_surveys.pdf [Accessed 14 Jun. 2022].

Donnan, D. (2010). Forensic Investigation of Building Envelope Defects. Australian Journal of Structural Engineering, [online] 11(1), pp.35–44. doi:10.1080/13287982.2010.11465054.

Douglas, J. and Noy, E.A. (2011). Building surveys and reports. 4th ed. Chichester: Wiley-Blackwell, pp.8-12.

Eastleigh Council (2020). Asset Management Strategy 2020 - 2025. [online] EastleighCouncil.gov. Available at: <https://www.eastleigh.gov.uk/media/7592/asset-management-strategy-2020-2025.pdf> [Accessed 14 Jun. 2022].

EcoDocs (2020). What Is Reactive Maintenance and How Does It Work. [online] EcoDocs. Available at: <https://www.ecodocspro.com/blog/reactive-maintenance/#:~:text=Reactive%20maintenance%20refers%20to%20the%20process%20of%20asset> [Accessed 14 Jun. 2022].

Gibbons, C. (2021). Building Defect Investigation. [online] TFT Consultants. Available at: <https://www.tftconsultants.com/services/building-defect-investigation/> [Accessed 11 Jun. 2022].

Health And Safety Executive (2015). Managing Health and Safety in Construction : Construction (Design and Management) Regulations 2015 : Guidance on regulations. Sudbury: HSE Books.

Health and Safety Executive (2018). Statistics - Non-fatal Injuries at Work in Great Britain. [online] Hse.gov.uk. Available at: <https://www.hse.gov.uk/statistics/causinj/index.htm> [Accessed 16 Jun. 2022].

Health and Safety Executive (2019). HSE - Thermal Comfort: Homepage. [online] Hse.gov.uk. Available at: <https://www.hse.gov.uk/temperature/thermal/> [Accessed 11 Jun. 2022].

Health and Safety Executive (2020). Safe Maintenance. [online] www.hse.gov.uk. Available at: <https://www.hse.gov.uk/safemaintenance/> [Accessed 16 Jun. 2022].

Hinks, J. and Cook, G.K. (1996). Technology of building defects. 1st ed. [online] London: E. And F. N. Spon. Available at: https://web-p-ebscobhost-com.ezproxy.uwtsd.ac.uk/ehost/ebookviewer/ebook/bmxlYmtfXzc2ODQzX19BTg2?s_id=cbf9b38d-3270-40fc-b1fe-1a6f570b53a0@redis&vid=0&format=EB&rid=1 [Accessed 11 Jun. 2022].

Historic England (2015). Listed Buildings | Historic England. [online] Historicengland.org.uk. Available at: <https://historicengland.org.uk/listing/what-is-designation/listed-buildings/> [Accessed 11 Jun. 2022].

Hugh James (2019). The 3-minute guide: defects liability periods. [online] Hugh James. Available at: <https://www.hughjames.com/blog/the-3-minute-guide-defects->

liability-

periods#:~:text=A%20defects%20liability%20period%20is%20usually%20a%20period [Accessed 11 Jun. 2022].

Jones, R. (2016). An Introduction to Asset Management. [online] Available at: https://www.i-fm.net/documents/Asset%20Mgt_Beginners_Guide_low_9.pdf [Accessed 13 Jun. 2022].

Local Authority Building Control (2018). What are the Building Regulations? |Building Control | LABC. [online] Labc.co.uk. Available at: <https://www.labc.co.uk/about-labc/what-are-building-regulations> [Accessed 5 Jun. 2022].

local building surveyor (2020). Which Home Survey Do I Need? RICS Homebuyer v Building Survey. [online] Local Building Surveyors. Available at: <https://www.localbuildingsurveyor.co.uk/which-home-survey-do-i-need.html#:~:text=The%20RICS%20has%20two%20main%20types%20of%20survey%3A> [Accessed 11 Jun. 2022].

Minnett, A. (2020). What Is A Method Statement? [online] CHAS. Available at: <https://www.chas.co.uk/blog/what-is-a-method-statement/> [Accessed 16 Jun. 2022].
National Framework Partnership (2021). Building Refurbishment & Maintenance Services - Framework. [online] National Framework Partnership. Available at: <https://www.nationalframeworkpartnership.co.uk/framework/building-refurbishment/> [Accessed 14 Jun. 2022].

National Housing Building Council (2022). 9.2.3 Plastering. [online] NHBC Standards 2022. Available at: <https://nhbc-standards.co.uk/9-finishes/9-2-wall-and-ceiling-finishes/9-2-3-plastering/#:~:text=Plastering%20shall%20provide%20an%20adequate%20substrate%20for%20the> [Accessed 13 Jun. 2022].

NPT Consult (2019). What is ISO 50001? [online] NPT Management Systems. Available at: <http://www.nptmanagementsystems.co.uk/management-systems/what-is-iso50001> [Accessed 16 Jun. 2022].

Prokop, K. (2018). The Use of BIM in Asset Management. [online] Microdesk. Available at: <https://www.microdesk.com/articles/the-use-of-bim-in-asset-management/> [Accessed 13 Jun. 2022].

RICS (2018). Pathway Guide: Building Surveying. [online] RICS, London: RICS, p.P9. Available at: <https://www.rics.org/globalassets/rics-website/media/qualify/pathway-guides/building-surveying-pathway-guide-chartered-rics.pdf> [Accessed 11 Jun. 2022].

Royal Institute of Chartered Surveyors (2010). Condition Survey. [online] RICS, London: RICS, full Report. Available at: <https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/building-surveying/condition-report-sample-report-rics.pdf> [Accessed 11 Jun. 2022].

Royal Institute of Chartered Surveyors. "Building Pathology Competency." *www.Rics.org*, RICS, 2021, [www.rics.org /uk/en/journals/built-environment-journal/building-pathology,competency.html](http://www.rics.org/uk/en/journals/built-environment-journal/building-pathology,competency.html). Accessed 2 June 2022

SHELBOURN, M., HOXLEY, M. and AOUAD, G., 2004. Learning building pathology using computers - evaluation of a prototype application. *Structural Survey*, 22(1), pp. 30-38.

Sub Surface (2021). Ground Investigation | Geotechnical & Environmental. [online] Sub Surface. Available at: <https://www.subsurface.co.uk/services/site-investigation/ground-investigation/> [Accessed 5 Jun. 2022].

TPG Facilities Management (2021). Outsourced facilities management - TPG Facilities Management. [online] TPG Building Consultancy & Facilities Management. Available at: <https://www.tpgbuildingfm.co.uk/blog/in-house-v-outsourced-facilities-management/> [Accessed 14 Jun. 2022].

Watt, D. (2007). *Building pathology: principles and practice*. [online] Oxford; Malden, Ma: Blackwell Pub, pp.9–11. Available at: https://books.google.co.uk/books?id=63HsCQAAQBAJ&pg=PA9&source=gbs_toc_r&cad=4#v=onepage&q&f=false [Accessed 5 Jun. 2022].

Welsh Government (2021). Quick Guide to the Building Regulations Quick Guide to the Building Regulations 2. Contents. [online] Available at: <https://gov.wales/sites/default/files/publications/2021-12/quick-guide-to-the-building-regulations.pdf> [Accessed 5 Jun. 2022].

6.0. Appendix 1 – Building Regulations (Wales)

Part A – Structure

Part B – Fire safety

Part C – Site Preparation and Resistance to Contaminants and Moisture

Part D – Toxic Substances

Part E – Resistance to the Passage of Sound

Part F – Means of Ventilation

Part G – Sanitation, Hot Water Safety and Water Efficiency

Part H – Drainage and Waste Disposal

Part J – Combustion Appliances and Fuel Storage Systems

Part K – Protection from Falling, Collision and Impact

Part L – Conservation of Fuel and Power

Part M – Access to and Use of Buildings

Part N – Glazing – Safety in Relation to Impact, Opening and Cleaning

Part P – Electrical Safety – Dwellings

Part Q – Security

Part R – Physical Infrastructure for High-Speed Electronic Communications
Networks

6.0. Appendix 2 – Spectrum of Building Conditions

Table 1.3 The spectrum of building condition ratings (based on Douglas, 2006 and Department of Health ESTATECODE, 1989)

General condition rating	Excellent	Good	Poor	Bad	Very bad
Condition category	Optimal	Near optimal (wind and watertight)	Partially/potentially dilapidated	Dilapidated	Ruinous
Overall effect	Excellent state of repair and performance	Reasonable state of repair. No major defects. Satisfies most user requirements	Showing signs of wear and tear. Neglected and approaching being run down	Extensive defects to the structure and fabric. Crumbling fabric nearing dereliction and redundancy	Only some walls left. Little or no roof structure remaining. Windows and doors missing
Non-domestic buildings: NHS Estates/DfEE Coding NB: A and B ratings = 'validated condition' (i.e. the desirable condition levels)	A The element is as new and can be expected to perform adequately to its full normal life	B The element is sound, operationally safe and exhibits only minor deterioration	C The element is operational but major repair or replacement will be needed soon, i.e. within 3 years for building and 1 year for engineering elements	D The element runs a serious risk of imminent breakdown	X A rating added to C or D to indicate that it is impossible to improve without replacement
Domestic buildings: Home Condition Report/Single Survey	1* No repairs needed. Normal maintenance should still be undertaken	1 No repair is presently required. Normal maintenance must be undertaken	2 Non-urgent repairs. Repairs are required but the Home Inspector does not consider these to be either serious or urgent	3 Urgent repairs. Defects of a serious nature or defects requiring urgent repair	3X This rating indicates that the element is impossible to improve without replacement
Typical risks	Superficial defects Redundancy Vandalism Fire Flooding	Minor dampness, timber decay and movement Redundancy Vandalism Fire Flooding	Accessibility problems Dilapidation Redundancy Obsolescence Deleterious materials Vandalism Fire Flooding Dampness, timber decay and movement	Near ruination Squatters Redundancy Obsolescence Vandalism Unsafe parts Deleterious materials Flooding/fire Significant defects	Instability Partial/full collapse Infestation by vermin and vegetation Squatters Redundancy Obsolescence Unsafe areas Flooding
Adaptation response	Maintenance and minor improvements Minor alterations? Extension	Maintenance Modernisation? Refurbishment? Rehabilitation? Alteration? Extension	Demolition? Renovation? Conversion to same or modified use?	Demolition? Restoration? Conservation? Conversion to other use?	Demolish and redevelop site

6.0. Appendix 3 – Risk Based Tool Example

RISK BASED TOOL		Risk Area				Probability of failure			
Severity of consequences	Severity	Health and safety /statutory compliance	Operational/ service interruption	Maintenance budget /business/ financial	Building or elemental condition/ deterioration	1 - Unlikely Operationally sound. Normal wear and tear. Estimated to fail in 5 to 10 years.	2 - Possible Minor deterioration/ damage. Estimated to fail in up to 5 years.	3 - Likely Significant deterioration and damage. Estimated to fail within a year.	4 - Certain Failure imminent or has already occurred.
	1 Insignificant	No risk of injury or breach of procedures	Minimal or no impact on school operation	Minimal or no impact on reactive maintenance budget or reputation	Work can be delayed without affecting condition of building or services	1	2	3	4
	2 Minor	Minor injury, trivial breach of procedures or minimal breach of legal requirements	Localised impact, little disruption or impact on school operation	Possible impact on reactive maintenance budget, complaint or impact on reputation	Could develop into minor deterioration of building or services if delayed	2	4	6	8
	3 Moderate	Injury or illness resulting in absence, significant breach of procedures or legal requirements	Impact on large part of school, disruption to normal school operation	Significant impact on reactive maintenance budget, reputational impact, financial penalty	Will result in significant deterioration of building fabric or services if delayed	3	6	9	12
	4 Major	Major injury, notifiable breach of legal requirements or procedures, litigation likely	Major impact and disruption to whole school operation	Major impact on reactive maintenance budget, loss of reputation, financial penalty	Serious deterioration of building and services and drop in overall condition category if delayed	4	8	12	16
	5 Catastrophic	Fatality, prosecution from legal breach	Failure results in closure of whole school operation	Extensive impact on maintenance or capital budgets, reputational impact, significant financial penalties	Will result in complete building failure, unsuitable for occupation if delayed	5	10	15	20