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Construction Technology 2

CONSTRUCTION TECHNOLOGY 2 (ACBA5019)
CHLOE WATKINS 2407375

Table of Contents

Introduction.....	2
Site Location and Context.....	2
Site Description	2
Environmental Conditions	3
Ground Conditions and Site Investigation.....	4
Anticipated Ground Conditions	4
Borehole Investigation	5
Structural Frame Selection	6
Proposed Structural System	6
Justification of Reinforced Concrete Frame.....	8
Foundation Design	9
Proposed Foundation Type.....	9
Justification	9
Building Envelope Design.....	10
External Wall System	10
Cladding Material Selection	10
Roof Design.....	11
Windows and Glazing	11
Conclusion	13
Appendices	Error! Bookmark not defined.
References	15

Introduction

This report has been prepared in response to a client brief for the proposed construction of a new medium to high-rise hotel development in Swansea, South Wales. The client has limited experience in construction technology and has requested professional advice regarding suitable structural systems, construction materials, and construction methods appropriate for the selected site. The report aims to provide a clear technical justification for each major design and material choice while considering structural performance, fire safety, durability, sustainability, aesthetics, and environmental impact.

The proposed development site is located close to Singleton Hospital and Swansea University, near Swansea Bay. This coastal location presents specific environmental challenges, including high wind exposure, heavy rainfall, and salt-laden air, all of which influence material selection and structural design. In addition, anticipated ground conditions and the proximity of sensitive neighbouring buildings require careful consideration when selecting foundation systems and construction methods.

The report focuses on three key areas: the selection of an appropriate structural frame and foundation solution based on anticipated ground conditions, the design and material specification of the building envelope, and an evaluation of prefabrication versus traditional on-site construction. The recommendations provided are informed by recognised industry guidance, British Standards, and current UK Building Regulations.

Site Location and Context

Site Description

The proposed development site is situated on an undeveloped grassed field located directly in front of the Swansea Harriers athletics running track, to the south of Singleton Hospital. The surrounding context includes sports facilities, university buildings, residential neighbourhoods, and key transport routes connecting Swansea city centre to the wider region. The site benefits from good accessibility and proximity to major institutions, making it a suitable location for a hotel development serving hospital visitors, university users, and tourists.

As the site is currently undeveloped, the project is not constrained by existing structures, allowing flexibility in layout and construction sequencing. However, the close proximity to an operational hospital introduces constraints relating to noise, vibration, dust, and construction traffic, all of which must be carefully managed through appropriate construction techniques and site planning.



Figure 1 - Site location (Google Maps)

Environmental Conditions

Swansea is located on the south-west coast of Wales and experiences a temperate maritime climate. Key environmental characteristics include high annual rainfall, frequent strong winds predominantly from the south-west, and exposure to salt-laden air due to the site's proximity to Swansea Bay. Seasonal temperature variation is relatively moderate, though persistent moisture and wind-driven rain present challenges for building envelope performance.

Below is a flood map of the proposed site:

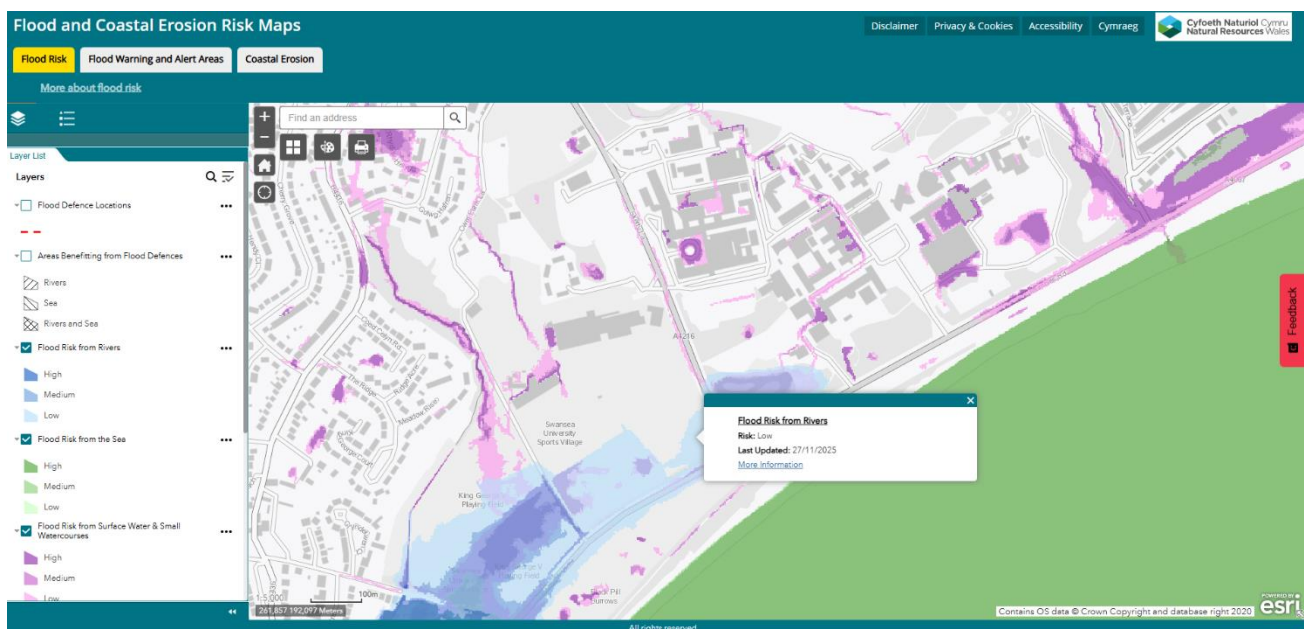


Figure 2 - Flood map of proposed site, dated 27/11/2025. (NRW)

For a medium to high-rise building, wind loading is a significant design consideration and will influence both structural stability and façade detailing. Additionally, the coastal environment increases the risk of corrosion, requiring the use of durable materials with appropriate

protective finishes. These environmental conditions strongly influence the selection of structural materials, cladding systems, and detailing strategies.

Table of average wind and rainfall can be seen below for reference:

Average tables

Average graphs

Location comparison

Average maps

Climate period:

1991-2020

Station: Mumbles Head

Month	Maximum temperature (°C)	Minimum temperature (°C)	Days of air frost (days)	Sunshine (hours)	Rainfall (mm)	Days of rainfall ≥1 mm (days)	Monthly mean wind speed at 10 m (knots)
January	8.26	4.33	2.13	–	102.48	15.63	14.93
February	8.33	4.10	1.93	–	73.68	12.13	14.22
March	9.84	5.08	0.70	–	69.94	12.80	13.30
April	12.36	6.86	0.07	–	59.88	10.57	12.08
May	15.24	9.49	0.00	–	64.53	10.43	12.25
June	17.83	12.17	0.00	–	68.61	10.33	11.78
July	19.55	14.07	0.00	–	73.63	10.50	11.85
August	19.67	14.20	0.00	–	87.72	11.95	12.04
September	17.97	12.67	0.00	–	76.37	11.37	12.63
October	14.70	10.14	0.00	–	112.76	14.90	14.97
November	11.49	7.25	0.23	–	117.86	16.03	14.45
December	9.09	5.10	1.80	–	114.13	15.87	15.21
Annual	13.72	8.81	6.86	–	1021.59	152.51	13.31

Figure 3 - Table of average wind and rainfall from 1991-2020 in Wales. (Met Office)

Ground Conditions and Site Investigation

Anticipated Ground Conditions

The geological profile of Swansea and its coastal plain typically comprises made ground and topsoil overlying alluvial deposits of sand, silt, and clay. These deposits are often underlain by glacial till and, at greater depth, mudstone bedrock. Due to the site's proximity to the coast and nearby watercourses, groundwater levels may be relatively high.

Such ground conditions can result in variable bearing capacity and an increased risk of differential settlement, particularly under the loads imposed by a medium to high-rise structure. Clay-rich strata may also be susceptible to volume change due to moisture variation.

As a result, shallow foundations are unlikely to be appropriate for this development without extensive ground improvement. *BGS (n.d.).*

Borehole Investigation

A comprehensive ground investigation is essential prior to finalising the foundation design. This would typically involve the drilling of several boreholes across the site to provide detailed information on soil stratification and ground conditions. Borehole investigations allow engineers to determine soil type, layer thickness, groundwater levels, and the depth to competent bearing strata.

Information obtained from borehole logs is used to assess soil bearing capacity, settlement potential, and the suitability of different foundation solutions. Borehole data may also identify the presence of made ground, contaminants, or weak compressible layers that could affect foundation performance. In coastal areas such as Swansea, boreholes are particularly important for identifying groundwater conditions, which can influence excavation methods and foundation construction.

The interpretation of borehole logs allows engineers to assess settlement risk, determine suitable pile depths, and identify potential construction challenges such as artesian water pressures or weak compressible layers. For the purposes of this report, it is assumed that borehole results will confirm weak to moderate strength soils at shallow depth, with more competent strata located at greater depth, consistent with regional ground conditions. The final foundation design would be fully informed by the actual borehole data obtained. *BGS (n.d.).*

Please see below Borehole results from proposed site:

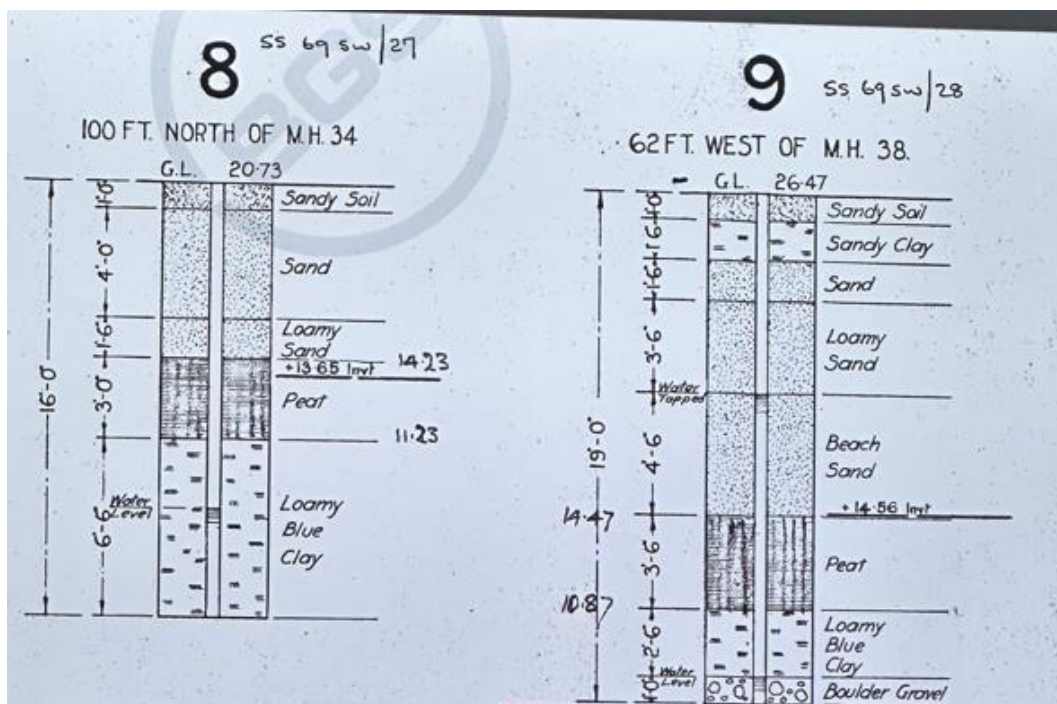


Figure 4 - Borehole results from proposed site (British Geological Survey)

The borehole investigation undertaken for the proposed hotel site provides important information regarding the subsurface conditions and confirms that the ground is generally weak and variable at shallow depth. The two boreholes (SS69SW27 and SS69SW28) indicate a sequence of sandy soils, organic peat, and clay, underlain at greater depth by denser granular material. Groundwater was encountered within the soil profile in both boreholes, which is consistent with the site's coastal location in Swansea.

The upper layers identified in both boreholes consist predominantly of sandy soil, sandy clay, and loamy sand. These soils typically exhibit low to moderate bearing capacity and are susceptible to settlement when subjected to sustained loading. While such materials may be acceptable for lightly loaded structures, they are unsuitable for supporting the loads imposed by a medium to high-rise hotel building, particularly where groundwater is present, as this reduces effective soil strength.

Both boreholes record the presence of peat at intermediate depths. Peat is a highly organic and compressible soil with very low shear strength and poor load-bearing characteristics. From an engineering perspective, peat is considered unsuitable for foundation support due to its tendency to undergo significant long-term settlement. The presence of this layer represents a major constraint for the development and effectively rules out the use of shallow foundation systems.

Below the peat, loamy blue clay is recorded. Although stronger than peat, clay soils are prone to consolidation settlement and potential volume change in response to moisture variation. As a result, this stratum alone is not considered sufficiently reliable to support the structural loads of a multi-storey hotel without the use of deep foundations. At greater depth, borehole SS69SW28 identifies boulder gravel, which represents a competent bearing stratum with high strength and low compressibility.

The identification of shallow groundwater further influences foundation selection, as it increases settlement risk and complicates excavation works. Taking these factors into account, shallow foundations are considered inappropriate for the proposed development. Instead, bored reinforced concrete pile foundations are recommended, as they allow structural loads to be transferred through weak and compressible soils into deeper, competent strata. This solution minimises differential settlement and is well suited to the proximity of Singleton Hospital due to its low vibration installation method. Overall, the borehole findings strongly support the proposed foundation and structural strategy for the hotel development.

Structural Frame Selection

Proposed Structural System

The recommended structural system for the proposed hotel development is a reinforced concrete frame incorporating shear walls and a central reinforced concrete core. This system is widely used in medium to high-rise hotel construction due to its strength, stiffness, durability, and inherent fire resistance.

The structure would consist of reinforced concrete columns supporting flat slab or beam-and-slab floor construction. A centrally located concrete core would house lift shafts, stairwells, and service risers, providing both vertical circulation and lateral stability. *Chudley & Greeno (2020), BS EN 1992 (2004), The Concrete Centre (2021).*

Examples of reinforced concrete frame structures:

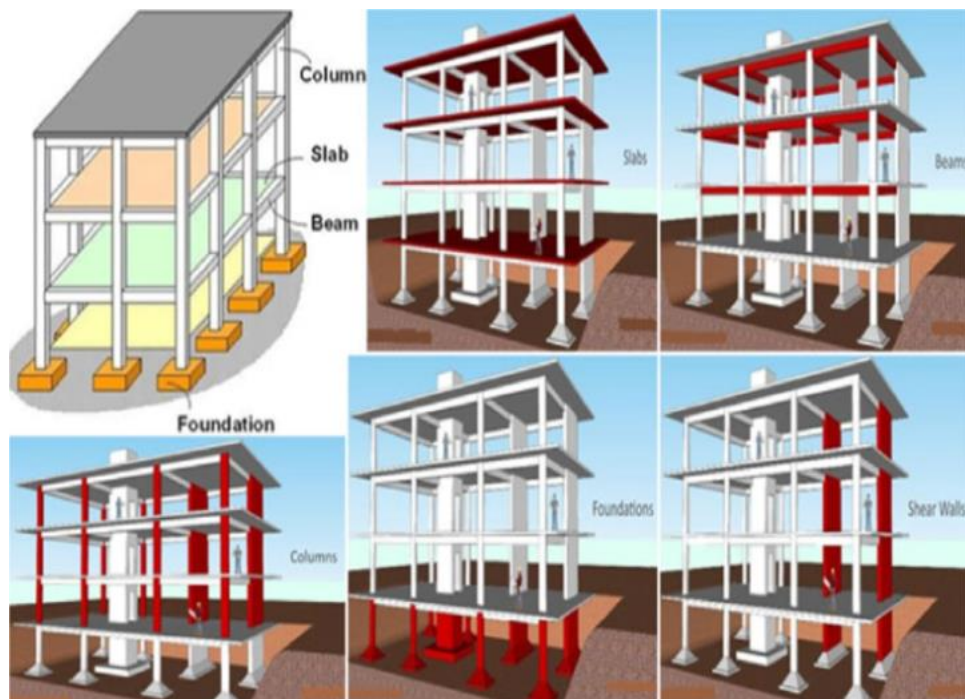


Figure 5 - Example of Reinforced Concrete Frame



Figure 6 - Visual example of a reinforced concrete frame

Justification of Reinforced Concrete Frame

Reinforced concrete has been selected for the following reasons:

- High compressive strength suitable for multi-storey buildings
- Excellent fire resistance without the need for additional fire protection
- Good acoustic performance, enhancing guest comfort
- Thermal mass benefits, improving energy efficiency
- Robustness and durability in a coastal environment

The rigidity of a reinforced concrete frame reduces lateral movement under wind loading, which is particularly important for occupant comfort in taller buildings.

Comparison with Alternative Structural Systems

An alternative structural option for a building of this scale would be a structural steel frame. While steel frames offer speed of erection and reduced self-weight, they are less suitable for this particular site and building type. Steel requires additional fire protection to achieve the necessary fire resistance, increasing cost and long-term maintenance. Furthermore, in a coastal environment, steel elements are more susceptible to corrosion if not adequately protected.

In contrast, reinforced concrete provides inherent fire resistance, greater mass for acoustic separation, and improved vibration performance, which is particularly beneficial in hotel accommodation. The increased stiffness of a concrete structure also reduces lateral movement under wind loading, improving occupant comfort in taller buildings. *Chudley &*

Greeno (2020), BS EN 1992 (2004), The Concrete Centre (2021).

Structural Performance and Stability

The reinforced concrete frame and core system provides a robust load path for both vertical and horizontal loads. Vertical loads from floors and roof levels are transferred through columns and walls into the foundation system, while lateral loads from wind action are resisted by the concrete core and shear walls. This arrangement ensures structural stability and compliance with Eurocode design requirements.

Foundation Design

Proposed Foundation Type

Based on the anticipated ground conditions and the scale of the proposed development, bored reinforced concrete pile foundations are recommended. Piles would extend through weaker near-surface soils and transfer structural loads to deeper, more competent strata identified through borehole investigations.

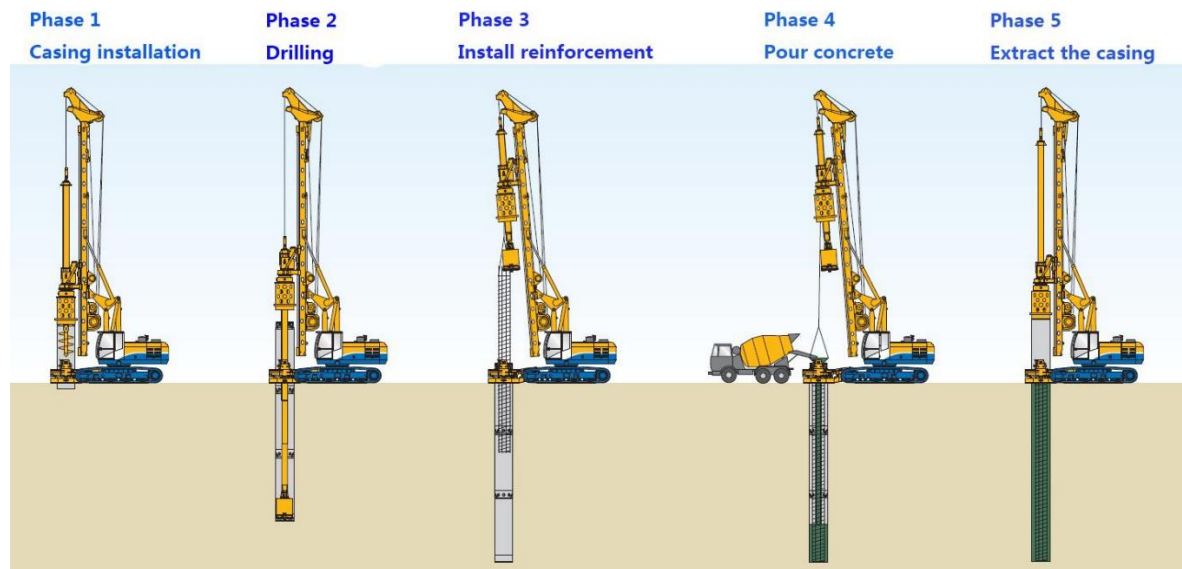


Figure 7 - Process of a pile foundation

Pile caps would be constructed to distribute column and wall loads into groups of piles, providing continuity between the superstructure and substructure. Ground beams may also be incorporated to support external walls and transfer loads between pile caps. *CIRIA (2015), BRE (2013), BS EN 1992 (2004)*.

Justification

Bored pile foundations are particularly suitable for this site for several reasons. The installation process generates minimal vibration compared to driven piles, reducing disturbance to the adjacent hospital and surrounding facilities. Bored piles are well suited to variable ground conditions and provide high load-bearing capacity, making them appropriate for medium to high-rise construction.

Additionally, pile foundations significantly reduce the risk of differential settlement, which is a key concern given the anticipated variability of the site's soil profile. The final pile design would be confirmed following analysis of borehole data and structural loading calculations.

Building Envelope Design

External Wall System

A rainscreen cladding system supported by the reinforced concrete frame is proposed for the external walls. A typical wall build-up would include an internal plasterboard finish, reinforced concrete structural wall, insulation layer, breather membrane, ventilated cavity, and non-combustible external cladding panels.

The ventilated cavity allows moisture to drain and evaporate, making the system highly effective in resisting wind-driven rain, which is common in coastal Wales. This approach also improves thermal performance and reduces the risk of condensation within the wall build-up.

Cladding Material Selection

Fibre cement or aluminium cladding panels with an A1 or A2 fire rating are recommended. These materials are durable, corrosion-resistant, and low maintenance, making them suitable for long-term use in a coastal environment. Their modern appearance is also appropriate for a contemporary hotel development.

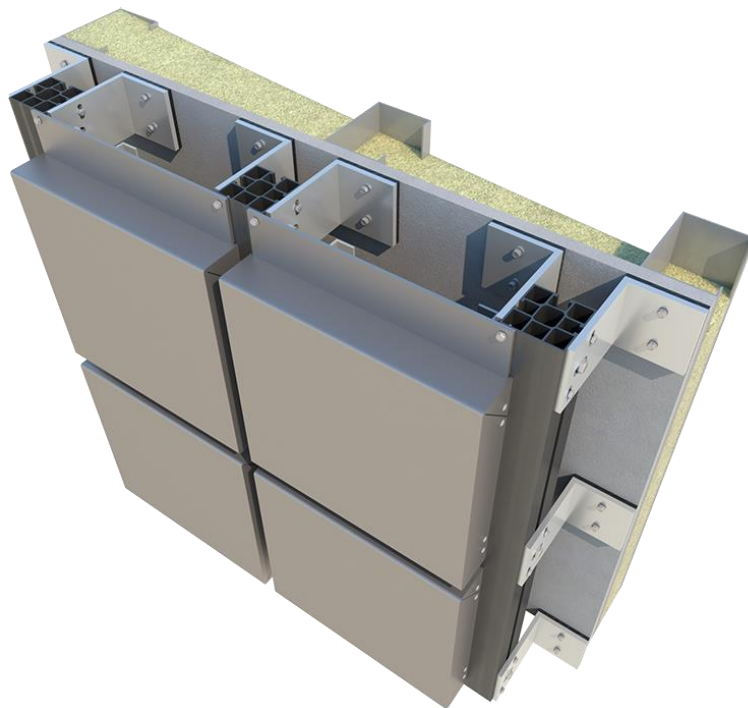
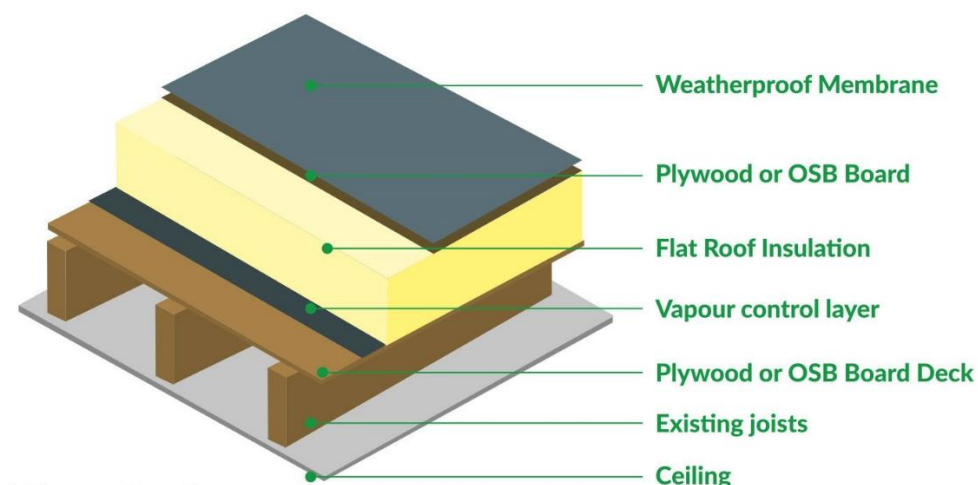


Figure 8 - Example of rainscreen cladding system

Roof Design

A warm flat roof construction is proposed, consisting of a reinforced concrete slab, vapour control layer, insulation, and waterproof membrane. This arrangement reduces the risk of condensation and provides good thermal performance.

The incorporation of green roof areas may be considered to enhance sustainability, improve rainwater attenuation, and contribute to biodiversity.



Warm Roof

The flat roof insulation is located above the joists

Figure 9 - Example of warm roof construction

Windows and Glazing

High-performance triple-glazed units with thermally broken aluminium frames are proposed. These units provide improved thermal efficiency, enhanced acoustic performance, and resistance to high wind pressures. Aluminium frames offer durability and minimal maintenance requirements in a coastal environment.

The strategic use of glazing will maximise natural daylight and views while maintaining occupant comfort and energy efficiency.

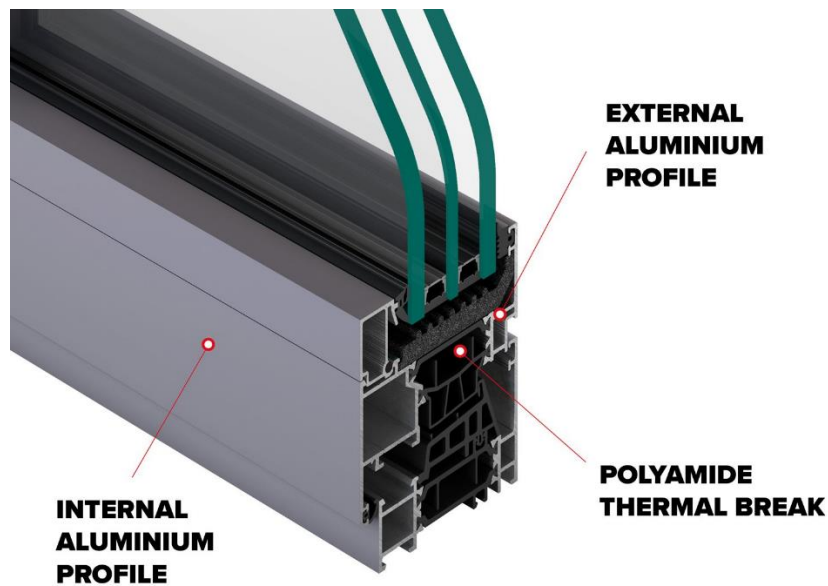


Figure 10 - Example of triple glaze windows with aluminium profile

Prefabrication and Construction Methods

Use of Prefabrication

A hybrid construction approach is recommended, combining traditional on-site construction with prefabricated elements. Prefabricated components may include bathroom pods, precast concrete floor slabs, stair units, and external cladding panels.

Prefabrication improves quality control through factory conditions, reduces construction time, minimises material waste, and enhances health and safety performance. It also reduces site disruption, which is particularly beneficial given the proximity of the hospital.

On-Site Construction Requirements

Certain elements must be constructed on site, including piled foundations, in-situ concrete cores, structural connections, and external works. This balanced approach allows flexibility while ensuring that site-specific conditions are adequately addressed.

Fire Safety Considerations

Fire safety is a critical aspect of hotel design due to high occupancy levels and sleeping accommodation. The reinforced concrete frame provides inherent fire resistance, typically

exceeding two hours without the need for additional fire protection. The concrete core offers protected escape routes for occupants.

Additional fire safety measures include compartmentation between hotel rooms, automatic fire detection and alarm systems, sprinkler installation throughout the building, and the use of non-combustible external wall materials. These measures ensure compliance with Approved Document B of the Building Regulations and enhance overall occupant safety. *UK Government (2022), RICS (2014)*

Sustainability and Environmental Impact

Material Selection and Lifecycle Performance

The selection of durable materials with long service lives reduces the need for replacement and maintenance, thereby lowering lifecycle environmental impact. The use of locally sourced aggregates and recyclable materials, such as aluminium, contributes to sustainable construction practices. *UKGBC (2020), The Concrete Centre (2021)*.

Energy Efficiency and Building Performance

Energy efficiency is enhanced through high levels of insulation, airtight construction, energy-efficient glazing, and the incorporation of mechanical ventilation with heat recovery (MVHR). The thermal mass of the reinforced concrete structure helps regulate internal temperatures, reducing heating and cooling demand.

Construction Environmental Impact

Prefabrication reduces construction waste, site traffic, and overall construction duration. This minimises noise, dust, and disruption to neighbouring buildings, particularly the adjacent hospital and residential areas.

Conclusion

This report has demonstrated that a reinforced concrete frame with bored pile foundations represents a robust, safe, and appropriate construction solution for the proposed medium to high-rise hotel development in Swansea. The selected materials and construction methods respond effectively to local ground conditions, coastal environmental exposure, and regulatory requirements.

By integrating durable materials, prefabricated components, and sustainable design principles, the proposed approach delivers a high-quality development that meets the client's objectives while minimising environmental impact and construction risk.

References

British Geological Survey (BGS) (n.d.) Borehole records and subsurface data for Swansea area.
Available at: <https://www.bgs.ac.uk>

(Accessed: 06/01/2026).

RICS (2014) Measured Surveys of Land, Buildings and Utilities (3rd edition). Royal Institution of Chartered Surveyors.

Available at: <https://www.rics.org/profession-standards/rics-standards-and-guidance/>

(Accessed: 06/01/2026).

The Concrete Centre (2021) Concrete and sustainability.

Available at: <https://www.concretecentre.com>

(Accessed: 06/01/2026).

UK Green Building Council (UKGBC) (2020) Embodied carbon: developing a client brief.

Available at: <https://www.ukgbc.org>

(Accessed: 06/01/2026).

Chudley, R. & Greeno, R. (2020) Building Construction Handbook. Routledge.

Available at: <https://www.routledge.com/Building-Construction-Handbook/Chudley-Greeno/p/book/9780367332992>

(Accessed: 06/01/2026).

BRE (2013) Digest 365: Soakaway Design. Building Research Establishment.

Available at: <https://www.brebookshop.com/products/digest-365-soakaway-design>

(Accessed: 06/01/2026).

BS EN 1992 (2004) Eurocode 2: Design of Concrete Structures. British Standards Institution.

Available at: <https://shop.bsigroup.com/products/eurocode-2-design-of-concrete-structures>

(Accessed: 06/01/2026).

CIRIA (2015) Pile Foundation Design and Construction Practice. Construction Industry Research and Information Association.

Available at: https://www.ciria.org/Resources/Free_publications.aspx

(Accessed: 06/01/2026).

UK Government (2022) Building Regulations – Approved Documents.

Available at: <https://www.gov.uk/government/collections/approved-documents>

(Accessed: 06/01/2026).

National Resources Wales - Check your flood risk on a map (Flood Risk Assessment Wales Map) (updated 11/12/2025)

<https://flood-risk-maps.naturalresources.wales/?locale=en>

(Accessed 12/01/2026)

Met Office - Location-specific long-term averages. (1991-2020)

<https://www.metoffice.gov.uk/research/climate/maps-and-data/location-specific-long-term-averages/gcjjm7j5g>

(Accessed 12/01/2026)

