

Construction Tech 2 – Assignment 2

CONSTRUCTION TECH 2 (ACBA5019)
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Introduction

This report builds upon the previously developed construction technology proposal for a medium- to high-rise hotel development in Swansea, South Wales. Assignment 1 established an appropriate structural system, foundation solution and building envelope in response to coastal environmental conditions, variable ground conditions and the functional requirements of a hotel located adjacent to a hospital and university campus.

This assignment evaluates the buildability and sustainability of the proposed design, considering whether the selected construction methods and materials allow the building to be delivered efficiently while minimising environmental impact. The coastal location presents challenges including high wind exposure, heavy rainfall and restricted site access, all of which influence construction planning and long-term building performance.

The report examines the environmental impact of building orientation, lifecycle performance and aesthetic integration within the surrounding context. Sustainable design measures, including façade greening and Sustainable Urban Drainage Systems (SUDS), are also assessed in response to local climate and flood risk. Finally, the buildability of the design is analysed through construction methods, site logistics and sequencing to demonstrate that the proposal is both sustainable and realistically achievable.

Environmental Impact

Building Orientation

Building orientation is a key factor in reducing environmental impact through improved daylighting, ventilation, and energy efficiency. For the proposed hotel development in Swansea, the building orientation has been designed in response to the coastal climate, which is characterised by high wind exposure, frequent rainfall, and moderate solar availability (Chudley and Greeno, 2020).

The primary façades are oriented to maximise natural daylight, particularly from the south and south-east, where solar gains are more consistent throughout the day. This improves daylight penetration into hotel rooms and communal spaces, reducing reliance on artificial lighting and lowering operational energy use, while also enhancing occupant comfort (CIBSE, 2019).

Glazing has been carefully limited on elevations exposed to prevailing south-westerly winds from Swansea Bay. Reducing large glazed areas on these façades helps minimise heat loss and wind-driven rain ingress, which are common issues in coastal locations. High-performance glazing and a well-insulated building envelope further support thermal efficiency without compromising internal daylight levels (HM Government, 2022).

The reinforced concrete frame selected in Assignment 1 also contributes to environmental performance through thermal mass. Concrete absorbs heat during the day and releases it slowly as temperatures fall, helping to regulate internal conditions and reduce heating and cooling demand when combined with appropriate orientation (The Concrete Centre, 2021). In addition, locating the building core and service areas on exposed elevations provides a buffer against wind, improving air-tightness and long-term energy efficiency. Overall, the building orientation supports reduced operational energy use while responding effectively to the challenging coastal conditions of the Swansea site.

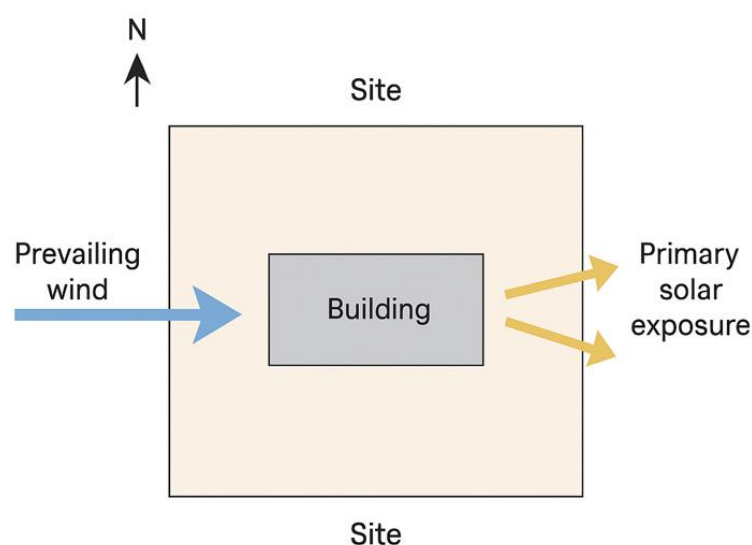


Figure 1: Indicative building orientation showing prevailing wind direction and primary solar exposure.

Life Cycle and Material Durability

The environmental impact of the proposed hotel development has been assessed using a whole-life approach, which considers both embodied carbon and long-term operational performance. Material selection and structural design have been chosen to reduce environmental impact through durability, energy efficiency, and reduced maintenance over the building's lifespan (UK Green Building Council, 2020).

The reinforced concrete structural frame provides significant lifecycle benefits for a medium- to high-rise building. Although concrete has a higher embodied carbon than some alternative materials, it offers high durability and a long service life, frequently exceeding 60 years when appropriately detailed. In Swansea's coastal environment, reinforced concrete performs well due to its resistance to moisture, wind exposure, and fire, reducing the risk of premature repair or replacement (Chudley and Greeno, 2020).

The thermal mass of the concrete frame also improves lifecycle performance by stabilising internal temperatures, reducing heating and cooling demand, and lowering operational carbon emissions over time (The Concrete Centre, 2021). Durable envelope materials, including aluminium or fibre cement rainscreen cladding and high-performance triple glazing, further contribute to sustainability by extending replacement cycles and reducing maintenance requirements. Aluminium's recyclability at the end of its service life additionally supports circular construction principles (BRE, 2018).

Overall, the selected materials and structural system balance initial embodied carbon with long-term durability and improved operational efficiency, ensuring the building's environmental impact is minimised throughout its lifecycle rather than solely at the construction stage.

Building Element	Key Material	Durability Benefit	Sustainability Impact
Structural frame	Reinforced concrete	60+ year lifespan	Reduced replacement
External façade	Aluminium / fibre cement	Corrosion resistant	Recyclable materials
Windows	Triple glazing	Long service life	Reduced energy demand

Aesthetics and Context

The aesthetic design of a building contributes to both environmental and social sustainability, particularly within urban contexts where new developments must respond sensitively to their surroundings. For the proposed hotel development in Swansea, the building's scale, form, and material choices have been designed to integrate appropriately within the local environment while maintaining a contemporary appearance suitable for its function (Chudley and Greeno, 2020).

The site is located near Swansea University, Singleton Hospital, and nearby residential and recreational facilities, placing the development within a mixed-use setting. The use of a reinforced concrete structural frame enables a regular façade arrangement and simple building form that reflects the scale and character of neighbouring institutional buildings. This approach

helps prevent the structure from appearing visually dominant and supports contextual compatibility within the surrounding urban fabric (HM Government, 2022).

Material selection further supports aesthetic integration and long-term performance. The proposed rainscreen cladding system using fibre cement or aluminium panels provides a durable and modern appearance suited to the coastal environment. Muted façade colours help reduce visual impact while maintaining a high-quality finish appropriate for a hotel development (UK Green Building Council, 2021).

The inclusion of sustainable features such as limited façade greening and green roof elements enhances visual quality while also providing environmental benefits. These elements help soften the building's appearance, reduce perceived mass, and improve its relationship with surrounding open spaces, supporting broader sustainability and urban biodiversity objectives (CIRIA, 2015). Overall, the aesthetic strategy balances functional, environmental, and contextual considerations, contributing positively to the local environment.

Façade Greening

Façade greening can contribute to the environmental performance and visual quality of the proposed hotel development by enhancing biodiversity and softening the appearance of large urban buildings. In a coastal city such as Swansea, however, the suitability of green façade systems must be carefully considered due to exposure to wind, driving rain, and long-term maintenance requirements (CIRIA, 2015).

For this development, façade greening is most appropriate at lower levels and on sheltered elevations rather than across the full building height. Full-height living walls are unlikely to be practical on a medium- to high-rise structure in a coastal environment, as wind exposure can affect plant viability and increase maintenance demands. Instead, climbing plant systems or modular green panels could be incorporated at podium level, entrance areas, or courtyard façades, where environmental conditions are more favourable (UK Green Building Council, 2021).

Green façades can provide modest environmental benefits by offering shading, improving air quality, and contributing to improved visual amenity, particularly on south-facing elevations (BRE, 2018). Selecting hardy, low-maintenance plant species compatible with the rainscreen cladding system would minimise water use and long-term upkeep. Overall, a limited and carefully positioned façade greening strategy offers a realistic and sustainable enhancement without compromising durability or buildability.



Figure 2: façade greening at lower building levels

Sustainable Urban Drainage Systems (SUDS)

The integration of Sustainable Urban Drainage Systems (SUDS) is important for the proposed hotel development due to Swansea's high rainfall levels and coastal location. Conventional drainage systems can increase pressure on local sewers during heavy rainfall, whereas SUDS provide a more sustainable approach by reducing and controlling surface water runoff (CIRIA, 2015).

A green roof is considered one of the most effective SUDS measures for this development. Green roofs attenuate rainfall by retaining water within the growing medium and releasing it gradually, reducing peak runoff and lowering surface water flood risk. Additional benefits include improved thermal performance and increased biodiversity (BRE, 2013; DEFRA, 2020).

At ground level, permeable paving could be incorporated in pedestrian and service areas to allow rainwater to infiltrate through the surface, reducing direct discharge into drainage networks. However, borehole investigations indicate shallow groundwater levels, limiting the suitability of infiltration-based systems such as soakaways. As a result, underground attenuation tanks or geocellular storage systems provide a practical alternative by temporarily storing excess water before controlled discharge (CIRIA, 2015).

Where site layout permits, landscaped features such as swales may also be included to slow surface water flow and enhance visual quality. Overall, the proposed SUDS strategy provides an effective and buildable response to local environmental conditions, reducing flood risk while supporting sustainable water management in line with current best practice (DEFRA, 2020).

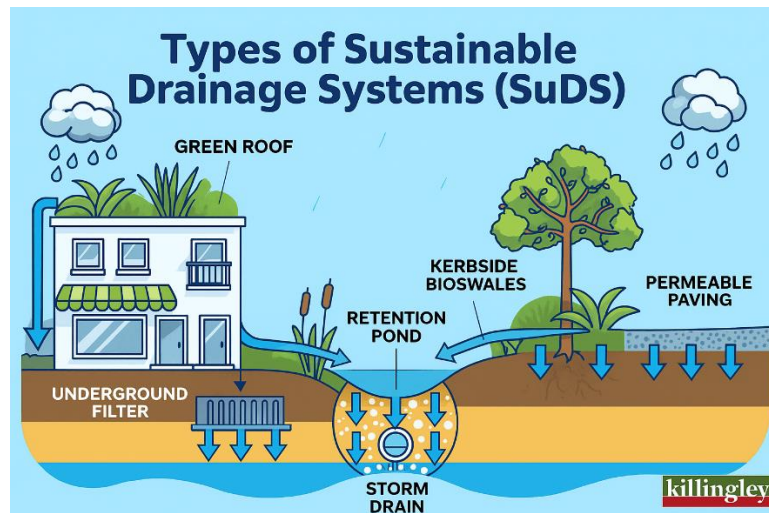


Figure 3: Indicative Sustainable Urban Drainage System (SUDS) strategy incorporating green roof, permeable paving and attenuation storage.

Buildability

Construction Methods

Buildability considers how efficiently and safely a building can be constructed in response to its structural system and site constraints. For the proposed hotel development in Swansea, the selected construction methods have been assessed to ensure practical delivery with minimal disruption to the surrounding environment (Chudley and Greeno, 2020).

The reinforced concrete structural frame offers clear buildability advantages for a medium- to high-rise hotel. Concrete frames are well suited to repetitive floor layouts, allowing a standardised construction process and efficient floor-by-floor progression. The inclusion of an in-situ reinforced concrete core provides early lateral stability, enabling safe and efficient construction as height increases (BS EN 1992-1-1, 2004).

Bored pile foundations have been selected due to variable ground conditions and the proximity of sensitive neighbouring buildings, including a hospital. Compared to driven piles, bored piles generate lower noise and vibration levels, reducing disruption and improving buildability in constrained urban environments (CIRIA, 2018).

Buildability is further enhanced through the use of prefabricated elements such as bathroom pods, precast stair units, and façade panels. Off-site manufacture improves quality control, reduces site labour requirements, and shortens overall programme duration by allowing parallel production and construction activities (BRE, 2018). Overall, the combination of reinforced concrete construction and targeted prefabrication provides a robust, efficient, and practical approach aligned with site and programme constraints.

Site Logistics, Material Availability, and Labour

Effective site logistics are essential to ensure safe and efficient construction, particularly on constrained sites. The proposed hotel development in Swansea is located adjacent to an operational hospital and university facilities, placing limitations on construction access, traffic movement, noise, and working hours. These constraints require careful planning to minimise disruption while maintaining project progress (Chudley and Greeno, 2020).

Although the site is currently undeveloped, available space for material storage and site compounds is limited due to nearby sensitive buildings. A just-in-time delivery strategy is therefore required to reduce congestion and improve safety, with deliveries scheduled to avoid peak hospital access periods (CIRIA, 2018).

Material availability has been considered to support programme reliability. Reinforced concrete is readily available across the UK, with regional batching plants able to supply the site efficiently, reducing the risk of delays and long-distance transport impacts. Similarly, commonly used prefabricated elements such as bathroom pods, precast units, and façade panels are widely available and suitable for procurement within typical construction timeframes (BRE, 2018).

Labour demands are reduced through the use of prefabrication, with a significant proportion of work completed off-site under controlled conditions. This approach improves quality, reduces on-site operatives, and lowers health and safety risks, particularly on a constrained urban site (CIRIA, 2018). In addition, low-vibration construction methods such as bored piling help minimise noise and disturbance, which is critical given the proximity of hospital facilities. Overall, the site logistics strategy demonstrates that the development can be delivered efficiently while respecting surrounding operational requirements.

Construction Sequence, Challenges, and Timeline Feasibility

A well-planned construction sequence is essential to ensure safe, efficient delivery of the proposed hotel development within a realistic timeframe. The sequence has been developed in response to the selected reinforced concrete structural system, site constraints, and the proximity of sensitive neighbouring buildings, including a hospital (Chudley and Greeno, 2020).

Construction would begin with site preparation works, followed by groundworks and the installation of bored pile foundations. Bored piling is appropriate for the site's ground conditions and generates low noise and vibration levels, reducing disruption to nearby facilities. Pile caps and ground beams would then be constructed to provide a stable base for the superstructure (CIRIA, 2018).

The reinforced concrete core would be constructed ahead of the main floor slabs to provide early lateral stability. Floor plates would then be built on a repetitive, floor-by-floor basis using standardised formwork systems, allowing efficient and predictable programme progression typical of hotel developments (BS EN 1992-1-1, 2004).

As the structure progresses, prefabricated façade panels would be installed to achieve early weather-tightness, allowing internal works such as prefabricated bathroom pods and services to proceed in parallel. This overlap of activities shortens the overall programme and reduces weather-related delays common in coastal locations (BRE, 2018).

Potential challenges include adverse weather conditions and restricted site access; however, these risks can be mitigated through flexible sequencing, temporary protection measures, just-in-time deliveries, and off-site prefabrication. Although reinforced concrete construction may be slower than steel in some cases, its inherent fire resistance and robustness reduce the need for additional protection measures, supporting programme certainty. Overall, the proposed sequence demonstrates that the building can be delivered safely and efficiently within a feasible timeframe.

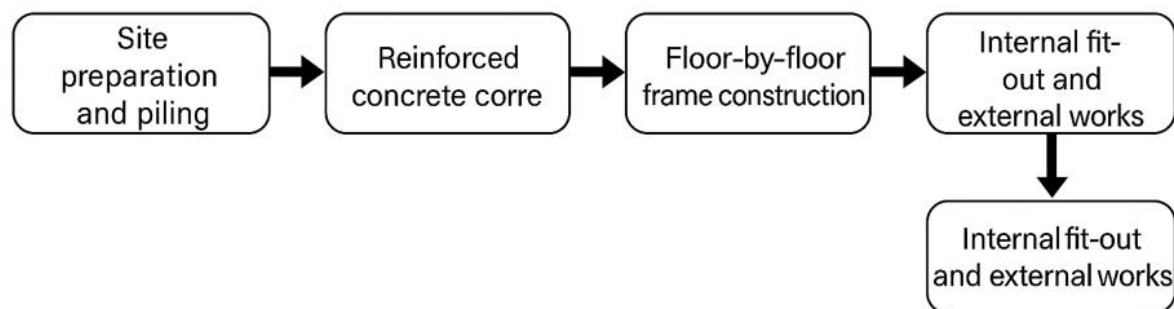


Figure 4: Simplified construction sequence for the proposed hotel development.

Conclusion

This report has evaluated the buildability and sustainability of the proposed medium- to high-rise hotel development in Swansea, building upon the structural and construction decisions established in Assignment 1. By assessing environmental impact, sustainable design measures, and practical construction considerations, the report demonstrates that the proposed scheme can be delivered efficiently while responding appropriately to site-specific constraints.

The environmental impact of the building has been addressed through careful consideration of orientation, material selection, and lifecycle performance. The orientation of the building supports improved daylighting, thermal performance, and occupant comfort while responding to Swansea's coastal climate and prevailing wind conditions. The use of durable materials such as reinforced concrete, high-performance glazing, and rainscreen cladding provides long-term benefits by reducing maintenance requirements and balancing initial embodied carbon with improved operational efficiency over the building's lifespan. In addition, the building's aesthetic approach allows it to integrate sensitively within its surrounding university and hospital context while maintaining a contemporary appearance.

Sustainable design features have been incorporated to further reduce environmental impact. Façade greening has been identified as a practical and targeted measure that enhances visual quality, supports biodiversity, and contributes to environmental performance without compromising durability or maintenance requirements. The proposed SUDS strategy responds effectively to high rainfall and potential flood risk by incorporating measures such as green roofs, permeable paving, and attenuation systems to manage surface water in a controlled and sustainable manner.

From a buildability perspective, the proposed design has been shown to be practical and well suited to the site constraints. The use of bored pile foundations, a reinforced concrete frame, and prefabricated elements supports efficient construction sequencing, improved safety, and reduced disruption to nearby sensitive facilities. Consideration of site logistics, material availability, and labour requirements further demonstrates that the project can be delivered within a realistic programme timeframe.

Overall, this report concludes that the proposed hotel development achieves a balanced approach to sustainability and buildability. The design not only meets structural and functional requirements but also supports efficient construction, long-term environmental performance, and responsible urban development within the Swansea context.

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