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Table of Contents

1. Introduction
2. Site Analysis
 - Location and Context
 - Ground Conditions
3. Design Proposal
 - General Design Proposal
 - Structural Frame and Foundations
 - Building Envelope: Materials and Method Choices
 - Prefabrication vs. On-Site Construction
4. Design Considerations (Expanded)
 - Environmental Impact and Sustainability
 - Structural Strength and Stability
 - Fire Safety
 - Aesthetics
5. Additional Facilities
6. Building Description
7. Conclusion
8. References
9. Appendices

Introduction

This report outlines the design and rationale for a medium to high-rise student accommodation building in the SA1 Swansea area, situated near the University of Wales Trinity Saint David (UWTSD) and the coastal dock area. The development seeks to meet the rising demand for modern, conveniently located student housing while supporting the regeneration of Swansea's waterfront.

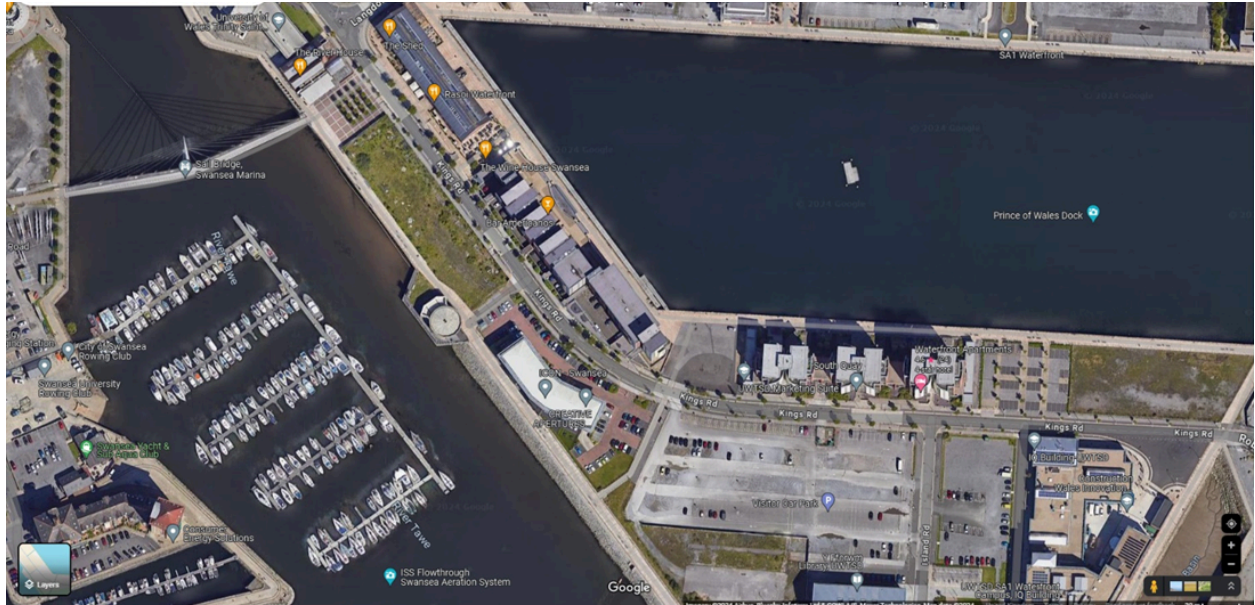
The proposed building will provide sustainable, functional, and visually appealing living spaces, designed to meet the academic and social needs of students. It will address the challenges of the coastal environment, including wind, salt corrosion, and flooding, ensuring resilience and energy efficiency. Furthermore, the design integrates seamlessly with the surrounding urban context, offering easy access to transportation, retail, and leisure facilities.

In essence, this project aims to enhance the student experience and contribute positively to the ongoing growth and revitalization of the area.

Site Analysis

Location and Context

The site is located in SA1 Swansea, a vibrant waterfront area with a mix of residential, educational, and commercial developments. The proximity to UWTSD makes it ideal for student accommodation. The coastal location provides unique opportunities for integrating natural views of the dock and sea while requiring solutions to address wind loads, salt corrosion, and potential flooding.



The aerial image above highlights the site's strategic location near the Prince of Wales Dock and key amenities such as Swansea Marina, restaurants, and public transport. The area's accessibility enhances its suitability for student housing, with ample potential for creating a vibrant, connected community.

Swansea's coastal climate includes high humidity and occasional storms, necessitating robust material and structural choices. The location also offers access to local amenities and transport links, enhancing its appeal for students.

Ground Conditions

The site's soil composition primarily consists of alluvial deposits, including sand, clay, and silt, which have been deposited by water or tidal movements. These materials can be highly variable across the site, influencing their load-bearing capacities. In addition, the area near the dock has been developed on reclaimed land, which typically involves the filling of soft soils with dredged materials or construction waste. As a result, reclaimed land can be less stable and more prone to settlement due to uneven compaction.

To ensure stability and prevent differential settlement, a robust foundation system is required. Pile foundations are the most appropriate solution for this site. Precast concrete piles will be used to penetrate the weaker upper layers and anchor the building to the more stable strata below. This method provides a reliable, long-term solution to support the building's load and address the challenges posed by the variable ground conditions.

Geotechnical investigations will be essential to determine the precise depth and placement of the piles. This foundation system will comply with industry standards, including BS 8004:2015 and Eurocode 7, ensuring the building's safety and stability in these challenging ground conditions.

British Standards Institution, **Eurocode 7: Geotechnical Design (EN 1997-1)**, BSI, <https://www.bsigroup.com/> [written 2004, accessed 16 January 2025].

Design Proposal

Structural Frame and Foundations

Structural Frame: A reinforced concrete frame is proposed due to its:

- **Advantages:**
 - High durability against coastal conditions, including resistance to salt corrosion.
 - Excellent fire resistance compared to steel.
 - Ability to support medium to high-rise structures with flexibility in design.
- **Disadvantages:**
 - Heavier than steel, which may increase foundation loads.
 - Longer curing time for concrete, potentially extending construction timelines.

What is a Reinforced Concrete Steel Frame?

A reinforced concrete steel frame is a hybrid structural system that combines reinforced concrete with steel elements. The concrete provides compressive strength, while the steel offers tensile strength and flexibility. Steel reinforcement bars (rebar) are embedded in concrete to resist tension forces, and steel columns or beams are used alongside concrete elements to enhance the frame's overall stability and strength. This combination is particularly effective for high-rise buildings, as it ensures strength, fire resistance, and the ability to withstand various loads and stresses.

Alternative Considerations:

- **Steel Frame:** Steel offers faster construction time and lighter weight, but due to the site's proximity to the coast, steel would require extensive treatment for corrosion resistance.

This could increase maintenance costs and reduce the lifespan of the building compared to reinforced concrete.

- **Timber Frame:** While environmentally sustainable and lightweight, timber is not suitable for medium to high-rise buildings due to limitations in structural strength and fire safety concerns at higher elevations.

Why Chosen: Reinforced concrete is the optimal choice due to its superior resistance to coastal environmental factors such as salt corrosion and high humidity. It also offers enhanced fire resistance, making it ideal for student accommodation.

Foundations: Given the variable ground conditions of alluvial deposits and reclaimed land near the dock, pile foundations are the most suitable. These foundations will ensure the building remains stable, with a deeper reach into the stable strata of the site. Precast Concrete Piles will be used to ensure the foundations are installed quickly and to a high standard. These piles are advantageous for the project due to their suitability for soft or unpredictable soils, with the ability to carry substantial load-bearing capacities.

Regulation Reference: The pile foundation system complies with BS 8004:2015 (Code of Practice for Foundations) and Eurocode 7 (EN 1997-1) for geotechnical design.

- BS 8004:2015 - Code of Practice for Foundations:
<https://shop.bsigroup.com/ProductDetail/?pid=000000000030249611>
- Eurocode 7 - Geotechnical Design: <https://www.bsigroup.com/>
- **Product/System:** Precast concrete piles by Balfour Beatty Ground Engineering meet these standards.

Building Envelope: Materials and Method Choices

Materials:

Aluminum Composite Panels (ACP):

- **Advantages:** Lightweight, durable, and resistant to weather and corrosion, making it ideal for the coastal location.
- **Disadvantages:** Higher initial cost and potential environmental concerns with production.
- **Regulation Compliance:** Meets BS EN 13501-1 (Class A2) for limited combustibility.
Link: [BS EN 13501-1 - Fire classification of construction products and building elements](#)
Reference: British Standards Institution. (2018). BS EN 13501-1:2018 Fire classification of construction products and building elements. BSI Standards Limited.
- **Product/System:** Alucobond Plus panels, which provide high durability and are available in a variety of finishes.

Glass Curtain Walls:

- **Advantages:** Maximizes natural light and allows for panoramic views of the waterfront and dock area.
- **Disadvantages:** Lower thermal insulation without advanced coatings, potentially leading to higher energy consumption.
- **Regulation Compliance:** Meets BS 6262-4 for safety and Part L of UK Building Regulations for thermal performance.
Link: [BS 6262-4 - Code of practice for glazing for buildings - Part 4: General principles](#)
Reference: British Standards Institution. (2018). BS 6262-4:2018 Code of practice for glazing for buildings - Part 4: General principles. BSI Standards Limited.
Link: [Part L - Conservation of Fuel and Power \(UK Building Regulations\)](#)
Reference: Ministry of Housing, Communities & Local Government. (2021). Building Regulations Part L: Conservation of Fuel and Power. UK Government.
- **Product/System:** Pilkington Solar Control Glass with low-emissivity coating to improve energy efficiency and maintain safety standards.

Mineral Wool Insulation:

- **Advantages:** Excellent thermal and acoustic performance, and non-combustible.
- **Disadvantages:** Higher initial cost compared to alternatives like fiberglass.
- **Regulation Compliance:** Meets BS EN 13501-1 (Class A1) for non-combustibility.
Link: [BS EN 13501-1 - Fire classification of construction products and building elements](#)
Reference: British Standards Institution. (2018). BS EN 13501-1:2018 Fire classification of construction products and building elements. BSI Standards Limited.
- **Product/System:** Rockwool Rainscreen Duo Slab which is specifically chosen for its durability in coastal environments.

Why Chosen: The combination of Alucobond Plus, Pilkington Solar Control Glass, and Rockwool insulation ensures a highly durable and energy-efficient envelope. These materials are ideal for the coastal environment, offering protection against salt corrosion and high humidity while providing aesthetic appeal and energy savings.

Prefabrication vs. On-Site Construction

Prefabrication:

- **Advantages:**
 - **Reduced Construction Time:** Modular components are manufactured in controlled factory environments, which ensures consistent quality and reduces on-site construction time.
 - **Minimized Material Waste:** With controlled production, there is less material wastage, leading to more efficient use of resources.
 - **Improved Safety:** Factory-based manufacturing offers safer working conditions compared to traditional on-site construction.

- **Disadvantages:**
 - **Higher Initial Setup Costs:** The cost of setting up factory operations for prefabrication may be higher, which can affect the overall project budget.
 - **Limited Flexibility:** Once the modules are produced, there is limited ability to make changes on-site, which may be a drawback if design adjustments are needed during construction.
- **Regulation Compliance:** Prefabricated components will adhere to BS EN 1090-1, which governs the execution of structural steel and aluminum components.
Link: [BS EN 1090-1 - Execution of steel structures and aluminum structures](#)
Reference: British Standards Institution. (2018). BS EN 1090-1:2018 Execution of steel structures and aluminum structures. BSI Standards Limited.
- **Product/System:** Vision Modular Systems will supply modular room units and bathroom pods, which will be pre-manufactured off-site and assembled on-site.

On-Site Construction:

- **Advantages:**
 - **Design Flexibility:** On-site construction allows for greater flexibility, enabling design adjustments and the integration of complex or unique structural elements as needed.
 - **Ability to Make Modifications:** Changes and modifications can be made on-site throughout the construction process, providing more adaptability.
- **Disadvantages:**
 - **Longer Construction Timeline:** On-site construction typically takes longer than prefabricated methods, which may extend project completion times.
 - **Higher Labor Costs:** The need for skilled labor on-site can result in increased labor costs.
 - **Material Waste and Potential Delays:** On-site construction may lead to greater material waste and unforeseen delays due to weather conditions or other challenges.

Why Chosen: A hybrid approach has been adopted for this project, utilizing prefabrication for repetitive elements such as room units and bathroom pods, while more complex structural components, including the reinforced concrete frame, will be built on-site. This combination balances the efficiency of prefabrication with the flexibility of traditional construction.

Design Considerations

Environmental Impact and Sustainability

Energy Efficiency:

To improve the building's energy efficiency, LG NeON R solar panels will be installed on the rooftop. These panels will harness renewable solar energy, reducing the building's dependency on conventional power supplies. In addition, Pilkington K Glass will be used for the windows to enhance thermal performance. This high-performance glazing helps to minimize heat loss during the winter and reduces unwanted heat gain in the summer, ensuring stable indoor temperatures and lowering overall energy usage throughout the year.

Water Management

A rainwater harvesting system will be integrated into the building design to capture and store rainwater for non-drinking purposes, including irrigation and toilet flushing, which will reduce reliance on the mains water supply. Additionally, permeable paving will be used throughout the site to enable rainwater to naturally infiltrate the ground, minimizing surface runoff and reducing the potential for flooding.

Building Research Establishment (2016). Rainwater Harvesting Systems. BRE

Sustainable Materials

The design will prioritize the use of sustainable and recyclable materials, such as Reynobond aluminum composite panels for the building's exterior cladding. These panels are weather-resistant, lightweight, and fully recyclable, making them an ideal choice for a coastal location. For glazing, Pilkington Solar Control Glass will be used to enhance thermal performance and minimize energy costs by reducing the need for heating and cooling.

References:

Reynobond (n.d.). Reynobond Aluminum Composite Panels. Reynobond

Pilkington (n.d.). Pilkington Solar Control Glass. Pilkington

Passive Design Strategies:

The building will incorporate natural ventilation by strategically placing windows and vents to facilitate passive cooling, reducing the need for mechanical systems. The design also includes large windows and glass curtain walls, allowing ample daylight to penetrate the building, which will decrease reliance on artificial lighting during the day.

For insulation, Rockwool Rainscreen Slab will be used, offering excellent thermal and acoustic properties. This will help regulate indoor temperatures, improving comfort while lowering the energy required for heating and cooling.

Additional Facilities

The proposed accommodation will include common areas such as communal lounges, study rooms, and retail spaces, all of which are designed to create a vibrant and connected student community. Furthermore, outdoor areas will be landscaped to enhance the building's environmental credentials, and there will be bike storage to promote sustainable transport options.

Building Description

The proposed student accommodation will be a medium to high-rise building, designed to offer modern, practical living spaces tailored to student needs, while embracing the coastal environment of SA1 Swansea. The design incorporates various amenities aimed at enhancing student life and well-being, all with a strong focus on sustainability.

Overall Structure and Height:

The building will rise to approximately 15 stories, including a ground floor and a rooftop garden. It will combine student accommodation with essential communal spaces, providing a balanced and comfortable living environment.

Accommodation:

- **Total Rooms:** The building will offer 250 student rooms, comprising both individual studios and shared apartment layouts.
- **Room Sizes and Layouts:** Each room will range from 20-25 square meters and will include modern finishes, a bed, study desk, storage, and en-suite bathroom. Shared apartments will house 4 to 6 students, with communal kitchen and living areas to foster social interaction.
- **Ceiling Heights:** Rooms will feature a minimum ceiling height of 2.6 meters, contributing to a sense of spaciousness and comfort.

Ground Floor and Communal Areas:

The ground floor will host retail spaces, such as cafes and shops, for student convenience. In addition, a large communal lounge and study rooms will encourage collaboration and social engagement.

Fitness and Well-being Facilities:

A fully-equipped gym will be located on the ground floor, offering students a dedicated space for physical activity and relaxation, with views over the waterfront.

Rooftop Garden:

The rooftop will feature a garden area with green spaces designed for study or relaxation. It will provide students with an opportunity to enjoy panoramic views of the coastline in a tranquil environment.

Sustainable Transport and Bike Storage:

To promote eco-friendly transport, secure bike storage will be provided on the ground floor. This initiative supports a healthier, more sustainable lifestyle for students.

Conclusion

In summary, the proposed student accommodation building is a thoughtfully designed structure that integrates sustainability, functionality, and aesthetics, making it a fitting addition to the SA1 Swansea waterfront. The building's use of durable materials and energy-efficient systems ensures that it will remain resilient to the challenges of its coastal location. By combining prefabrication with on-site construction, the project optimizes both efficiency and flexibility. Furthermore, the incorporation of sustainable features such as energy-saving technologies, high-performance glazing, and eco-friendly materials guarantees the long-term sustainability of the building while minimizing ongoing maintenance requirements. This design contributes not only to the student experience but also to the continued development and revitalization of Swansea's vibrant urban landscape.

References

British Standards Institution, *BS 8004:2015 Code of Practice for Foundations*, BSI, <https://shop.bsigroup.com/ProductDetail/?pid=000000000030249611> [accessed 16 January 2025].

British Standards Institution, *Eurocode 7: Geotechnical Design (EN 1997-1)*, BSI, <https://www.bsigroup.com/> [accessed 16 January 2025].

British Standards Institution, *BS EN 13501-1:2018 Fire Classification of Construction Products and Building Elements*, BSI Standards Limited, <https://shop.bsigroup.com/ProductDetail/?pid=000000000030257452> [accessed 16 January 2025].

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Pilkington, *Pilkington Solar Control Glass*, Pilkington, <https://www.pilkington.com> [accessed 16 January 2025].

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