

Construction Technology 2

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Ross Montanari | Construction
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1. Introduction

This report continues from the previous structural and envelope design strategy for a proposed medium to high rise hotel opposite Singleton Hospital in Swansea. The earlier report proposed a building of approximately nine storeys, using a reinforced concrete core, steel frame and composite concrete floor slabs. It also recommended piled raft foundations because of variable ground conditions and a non-combustible rainscreen cladding system fixed to a steel framing system backing wall (Montanari, 2026).

This report evaluates the buildability and sustainability of the proposed hotel, including orientation, life cycle, appearance, façade greening, SUDS, construction methods, logistics and practical challenges.

The site is close to Singleton Hospital, Singleton Park and Swansea Bay. The building must respond to Swansea coastal climate, including high rainfall, high humidity, wind driven rain and prevailing south westerly winds. Construction must also reduce disruption to hospital access, roads, patients, staff and visitors.

Hotels use large amounts of energy for heating, cooling, lighting, hot water and ventilation. The design should reduce energy demand, manage rainwater, use durable materials and allow for long term maintenance.

2. Environmental Impact

2.1 Building Orientation

The orientation of the proposed hotel has a major effect on daylight, solar gain, ventilation, heat loss and occupant comfort. Good orientation can reduce artificial lighting and lower operational energy use (Approved Document L, 2022).

As the site is close to the Swansea coastline, the building will be exposed to south westerly winds and wind driven rain. The design must balance daylight and ventilation benefits with protection from moisture, heat loss and overheating. South and southwest facing elevations are likely to receive the most sunlight. This can improve daylight in bedrooms, reception areas, restaurant spaces and circulation routes, while reducing lighting demand during the day.

However, large areas of glazing on south or west facing elevations could increase overheating, especially in hotel bedrooms. This can be controlled using solar control glazing, recessed windows, vertical fins, external shading and selected facade planting.

The north facing elevation will receive less direct sunlight and may have lower overheating risk. However, it may also have higher heat loss and lower daylight levels, so window sizes, insulation and airtightness should be carefully detailed.

Natural ventilation can help improve air quality, but openable windows may not always be suitable on a taller hotel because of wind pressure, noise, safety and weather exposure. Mechanical ventilation with heat recovery would provide controlled fresh air while reducing heat loss. Ventilation design should follow Approved Document F (Approved Document F, 2021).

2.2 Life Cycle and Material Durability

A hotel should be designed for a long service life. Early demolition or major replacement has a high environmental cost, so the structure and envelope should be durable and maintainable.

The reinforced concrete core provides lateral stability by resisting wind loads. It also houses stairs, lifts and service risers within a protected central zone, which is important for fire safety in a hotel. Concrete can provide strong fire resistance (The Concrete Centre, 2019). Its main disadvantage is embodied carbon. This can be reduced by using cement replacement materials such as ground granulated blast furnace slag or fly ash where suitable.

Steel also has life cycle benefits because it is recyclable and can contain recycled content. Steel beams and columns can be manufactured off site, improving accuracy and reducing waste. Coastal corrosion protection is essential. Protective coatings, careful detailing and planned maintenance are needed.

The rainscreen cladding system suits the local climate because the drained and ventilated cavity allows wind driven rain to drain and dry before it reaches the inner wall. Non-combustible cladding panels and mineral wool insulation support thermal performance and fire safety. Fire barriers should be installed at floor levels and around openings to reduce fire spread within the cavity (Approved Document B, 2020).

The roof also needs careful design because Swansea experiences frequent rainfall. A warm flat roof is suitable because the insulation sits above the structural deck, reducing condensation risk. The waterproofing layer should be durable, with outlets and overflows to prevent ponding.

Life cycle design should consider embodied and operational carbon. A sustainable hotel should reduce both through durable materials, good insulation, airtightness, efficient services and planned maintenance.

2.3 Aesthetic Value and Local Context

The hotel will be visually prominent because of its height and location near Singleton Hospital, Singleton Park and Swansea Bay. The design should respond to its setting rather than appear as an isolated block.

The proposed rainscreen cladding gives flexibility in colour, texture and panel size. A palette of brick inspired tones, soft stone colours and muted greys would allow the hotel to look modern while still relating to the surrounding urban and coastal context.

Hotel elevations can become repetitive because bedroom layouts usually create regular window patterns. This can be improved by using vertical and horizontal articulation, varied panel tones, recessed window bays and integrated shading. These details would reduce the perceived bulk of the building.

The lower floors are especially important because they are experienced at street level. A clear entrance, active frontage, planting and good landscaping would make the hotel more welcoming. Green walls planted areas and rain gardens would help connect the building with Singleton Park and support biodiversity.

3. Façade Greening and SUDS

3.1 Potential for Green Façades

A green façade could improve the environmental and visual performance of the hotel. Planting can provide shade, reduce surface temperatures and support biodiversity (CIRIA, 2015).

Because the building is around nine storeys high, it would not be practical to cover the whole façade with planting. Greening should be focused where it has the greatest benefit, such as the lower floors, main entrance, podium areas, sheltered courtyard elevations and selected south or west facing walls.

A suitable system would use climbing plants supported by a separate steel cable or trellis frame fixed independently from the rainscreen cladding. A clear air gap should be maintained so plants do not damage the cladding, block the ventilated cavity or trap moisture against the wall.

The benefits include improved biodiversity, reduced surface temperatures, seasonal shading and a stronger visual link with Singleton Park.

There are practical limitations. Plants require irrigation, pruning and occasional replacement. Maintenance access must be planned from the start. At higher levels, wind exposure may damage plants or support systems, so greening should mainly be used in

sheltered areas. Fire safety is also important. Planting must not obstruct escape routes, compromise cavity fire barriers or affect cladding performance (Approved Document B, 2020).

3.2 Sustainable Urban Drainage Systems

Swansea receives frequent rainfall, and the proposed hotel will create large roof and paved areas. Without a good drainage strategy, rainwater can enter the drainage network quickly, increasing flood risk and pressure on existing infrastructure.

SUDS manage rainfall close to where it falls by slowing, storing, filtering and, where suitable, infiltrating surface water (CIRIA, 2015). For this hotel, a combined strategy would be most suitable. It could include permeable paving, rain gardens, attenuation tanks, filter drains, tree pits, green roof areas and rainwater harvesting.

Permeable paving could be used in car parking areas, pedestrian routes and service yards. Water would pass through the paving into a granular subbase, where it can be stored before slow release. Rain gardens could be located near the entrance, along pedestrian routes or close to roof downpipes. They would collect and filter rainwater while improving appearance.

The ground conditions may limit infiltration. The earlier report identified variable superficial soils and possible high groundwater, so relying only on soakaways would be risky without further testing. A more reliable approach would be underground attenuation storage with controlled discharge to the drainage network (Montanari, 2026).

A simple calculation shows the likely scale of roof runoff. If the hotel roof area is 900 m² and the design rainfall event is 50 mm:

Runoff volume = Area × Rainfall depth

Runoff volume = 900 m² × 0.05 m

Runoff volume = 45 m³

This means around 45 m³ of water may need to be managed from the roof alone. The final design would need detailed rainfall data, ground investigation, infiltration testing and local authority approval. It should also comply with Approved Document H for rainwater drainage (Approved Document H, 2015).

4. Buildability

4.1 Practicality of the Construction Method

The proposed design is practical because it uses a hybrid structural system suited to a medium to high rise hotel. The reinforced concrete core provides stability, fire resistance and a fixed central zone for lifts, stairs and services. The steel frame allows fast erection and longer spans. Composite floor slabs provide efficient floor construction and reduce structural weight.

Taller buildings must resist vertical loads and lateral loads such as wind. Structural actions should be considered under Eurocode 1, while steel and composite elements should be designed to Eurocode 3 and Eurocode 4 (BS EN 1991, 2002; BS EN 1993, 2005; BS EN 1994, 2004).

The piled raft foundation is suitable because the site may have variable soils and groundwater issues. The piles transfer loads to stronger ground, while the raft spreads load and provides a stable base. Piling must be carefully managed to control noise, vibration and working hours.

Prefabrication improves buildability. Steelwork, cladding panels, bathroom pods, stair units and service modules can be manufactured away from site. This reduces labour, improves quality and shortens the programme. Offsite construction can also reduce waste (BRE, 2020). Foundations, the raft slab and the concrete core are better constructed on site because they must respond to actual ground conditions.

4.2 Site Logistics, Materials and Labour

The site location near Singleton Hospital creates major logistical constraints. Construction traffic must not block emergency routes, hospital access, pedestrian routes or local roads. A traffic management plan would be needed, including delivery booking slots, designated unloading areas and separation between construction vehicles and the public.

Storage space may be limited, so just in time delivery should be used where possible. Steelwork, cladding panels and bathroom pods should arrive in planned sequences and be lifted directly into position.

A tower crane or mobile crane may be needed for steel erection, cladding installation and lifting prefabricated components. Crane location must be planned carefully. Lifting operations should use exclusion zones, trained banksmen and approved method statements.

Labour requirements would include groundworkers, piling contractors, steel erectors, concrete workers, cladding installers, roofers, mechanical and electrical contractors, dryliners and decorators. Coordination between trades is essential.

Dust, noise and vibration control are also important. Measures could include wheel washing, dust suppression, acoustic barriers, low vibration piling and communication with hospital management. Under the CDM Regulations, risks must be planned, managed and monitored throughout the project (HSE, 2015).

4.3 Construction Sequence and Timeline

The design is buildable if the structure remains regular and repetitive. A simple structural grid, stacked hotel bedrooms and repeated façade panels will improve speed, reduce waste and limit errors. Complex transfer structures, irregular floor plates or large cantilevers should be avoided because they increase cost and risk.

A logical sequence would be site setup, service checks, groundworks and piling, raft foundation, reinforced concrete core, steel frame erection, composite floor slabs, roof works, cladding and windows, bathroom pods and service modules, internal partitions, finishes, external works, SUDS, testing and handover.

The most critical stages are piling, core construction, frame erection, façade installation and commissioning. Early planning is needed to coordinate deliveries, crane use, trade access and inspection points.

4.4 Efficient, Safe and Sustainable Construction

The design supports efficient construction because it combines repetitive planning, prefabricated elements and durable materials. Offsite manufacturing reduces waste and improves quality control. It also reduces the number of workers needed on site, which is useful near a hospital.

Safety can be improved through early planning. The construction team should prepare method statements for piling, crane lifts, working at height, façade installation and temporary fire safety. Safe pedestrian routes, edge protection, scaffold systems and exclusion zones are essential. CDM Regulations require designers and contractors to eliminate, reduce or control foreseeable risks during construction and maintenance (HSE, 2015).

Sustainability during construction can be improved by reducing waste, separating recyclable materials, using local suppliers where possible and choosing low carbon materials. Deliveries should be consolidated to reduce vehicle movements.

The durable rainscreen cladding, high performance insulation, efficient ventilation and SUDS all support long term sustainability. Green façade elements and landscaping would also improve biodiversity and help the hotel relate better to Singleton Park.

5. Conclusion

Overall, the proposed medium to high rise hotel opposite Singleton Hospital can be made both sustainable and buildable through careful design and construction planning. The building orientation should maximise useful daylight while controlling overheating, wind exposure and heat loss. Durable materials, including a reinforced concrete core, steel frame, composite floors and non-combustible rainscreen cladding, support long term performance and reduce maintenance needs.

The environmental impact can be reduced by using low carbon concrete, recycled steel, efficient insulation, airtight detailing and mechanical ventilation with heat recovery. Green façade elements would improve biodiversity, appearance and shading, especially at lower levels and around the entrance. SUDS such as permeable paving, rain gardens and attenuation tanks would manage surface water runoff in response to Swansea rainfall.

From a buildability perspective, the hybrid frame, piled raft foundation and prefabricated elements provide a practical construction strategy. However, the site proximity to Singleton Hospital means logistics must be carefully controlled. Noise, vibration, traffic, deliveries, crane operations and public safety are key issues.

The design supports efficient, safe and sustainable construction by using familiar structural systems, off site manufacturing, durable envelope materials and a clear construction sequence. With proper planning, the project can balance environmental performance, visual quality, construction practicality and long-term durability.

Reference List

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