

ACBA 4022

FUNDAMENTALS OF CONSTRUCTION

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INTRODUCTION

This report looks at the construction details of three different build systems used for two-storey domestic housing: Timber Twin Frame, SIPS, and Traditional Brick and Block. It focuses on the ground floor detail, window detail, and roof and eaves detail for each system. Each section describes how the systems are built, how they deal with insulation, airtightness, moisture, and structural support, and compares how they meet current building standards. By exploring these details, the report aims to highlight the differences in how each method is constructed and performs in practice, helping to understand the advantages and potential limitations of each system in residential construction.

OFFSITE CONSTRUCTION

Offsite construction is where part of building is not made on site it is manufactured elsewhere and brought to the site when required. This approach offers numerous benefits including improved build quality, reduced site labour, shortened construction times and less disruption to the surrounding area. There are 4 different types of offsite construction.

1. Panelised systems: This is when the Walls, floors and roofs are fabricated in a factory.
2. Volumetric/modular: When whole rooms are built offsite and delivered when required.
3. Sub-assemblies and components: for example prefabricated staircases and MEP systems.
4. Pre-Engineered solutions: Steel frames and precast concrete.

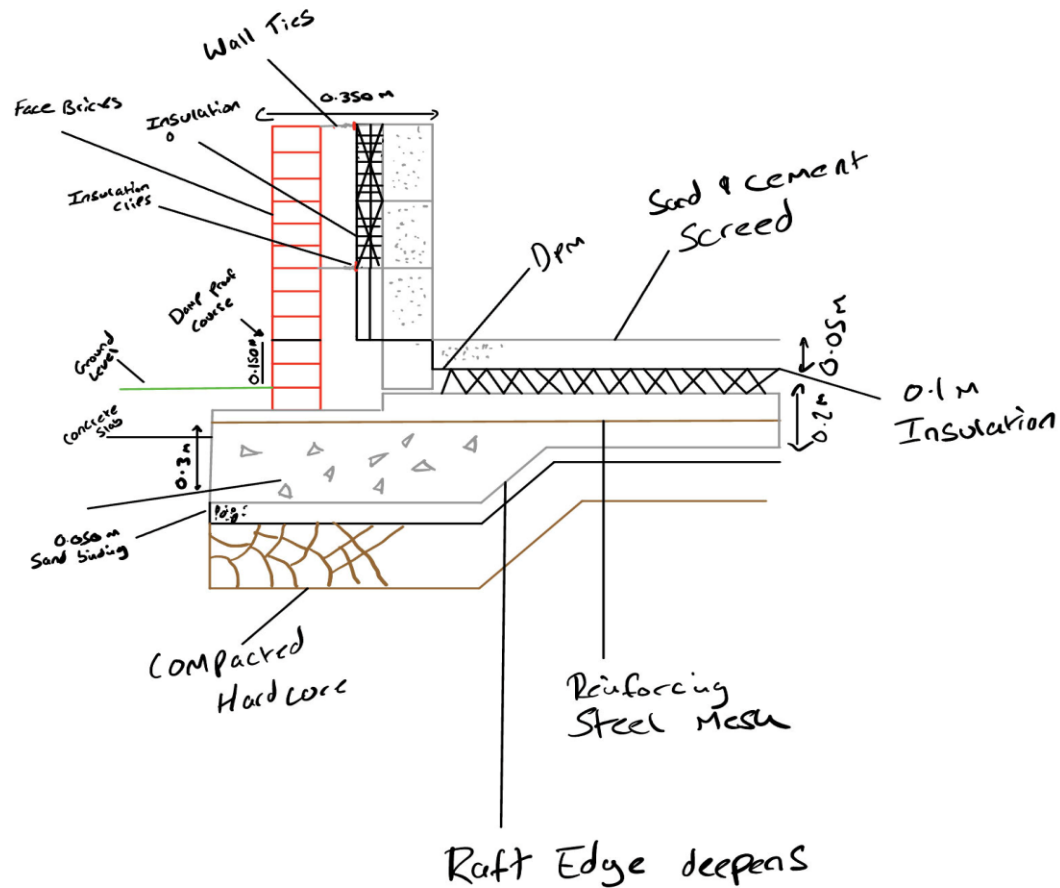
Panelised systems will work the best for the structure if the client selects a timber frame and also sub-assemblies for the stairs, kitchens etc.

Construction Detail In The Ground

Foundation type

The foundations recommended are sitting on a raft foundation. The edges are insulated to provide a thermal break at the wall junctions and will reduce heat loss at the perimeter. A damp proof membrane (DPM) is installed above the raft to prevent moisture rising into the structure. The insulation around the slab also helps improve overall energy performance and avoids cold bridging. The raft provides a solid, level base for the superstructure and is suitable for a range of ground conditions, helping to distribute loads evenly and reduce the risk of settlement.

Traditional Build



The Traditional build is using Face brick on the outer skin and blockwork on the inside. The cavity width is 0.35m this allows for 100mm of insulation with a 50mm air gap to ventilate the cavity. The skins are tied together with 300mm stainless steel wall ties with red clips holding the insulation. The depth of the concrete slab is 300mm on the raft edge and 200mm in the middle with steel reinforcing to help the tension in the slab. The floor is insulated with under floor heating under the 100mm of screed, the insulation is protected by the DPM to avoid moisture corroding the insulation and creating a damp proof barrier from the slab to the screed.

Dpc is placed on both skins at the height of the screed and bottom of the door level which is called DPC level, the DPC height as to be a minimum of 150mm above ground level to avoid any rising damp. There is also a radon barrier which I forgot to add to the diagram placed at the on the DPC course with weep vents installed every 450mm to allow water to weep out of the cavity.

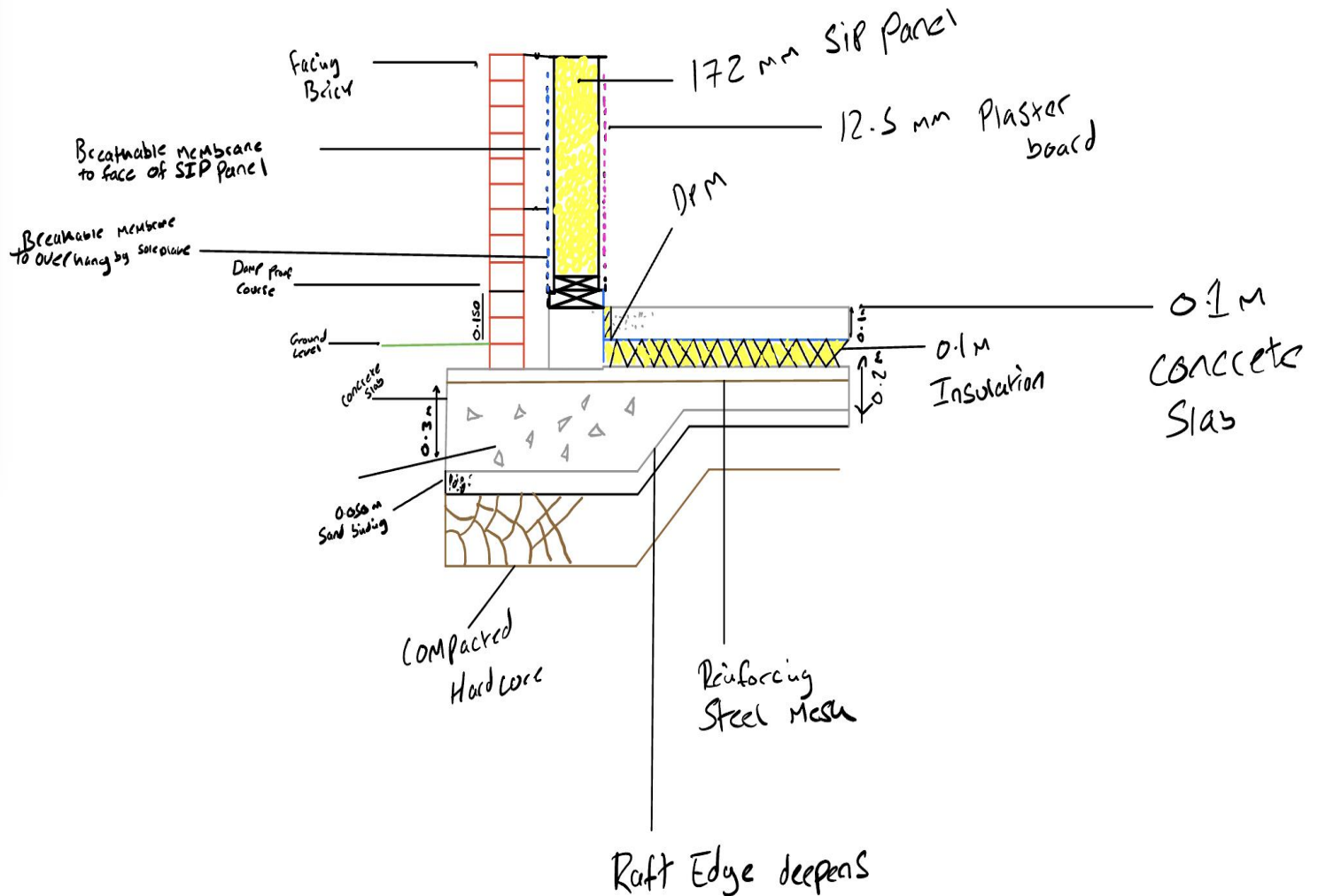
The Advantages Of Using Traditional Build

- It is more commonly used in the UK
- It has a high durability unlike the timber frame bricks and blocks do not warp and move in different climates.
- Can start the build earlier due to not a lot of offsite construction compared to the other builds.

The Disadvantages Of Using Traditional build:

- Weather permitted bricks and blocks cannot be laid in heavy rain due to the bricks weighing more causing the bricks to sink
- Time, Traditional builds are a slower build due to the labour intensity.
- More thermal bridging risk at junctions unless carefully detailed.

Sip Ground Detail



The SIP Ground Detail is using a similar design to the traditional, replacing the blockwork with a 172mm SIP panel which sits on a treated timber soleplate. The SIP panel consists of two layers of OSB with rigid insulation in between, providing both structure and thermal performance. Bricks are tied to the SIP using stainless steel wall ties fixed through the outer OSB layer. A cavity is maintained between the SIP and brickwork for moisture control, and a DPC is installed at the base to prevent rising damp.

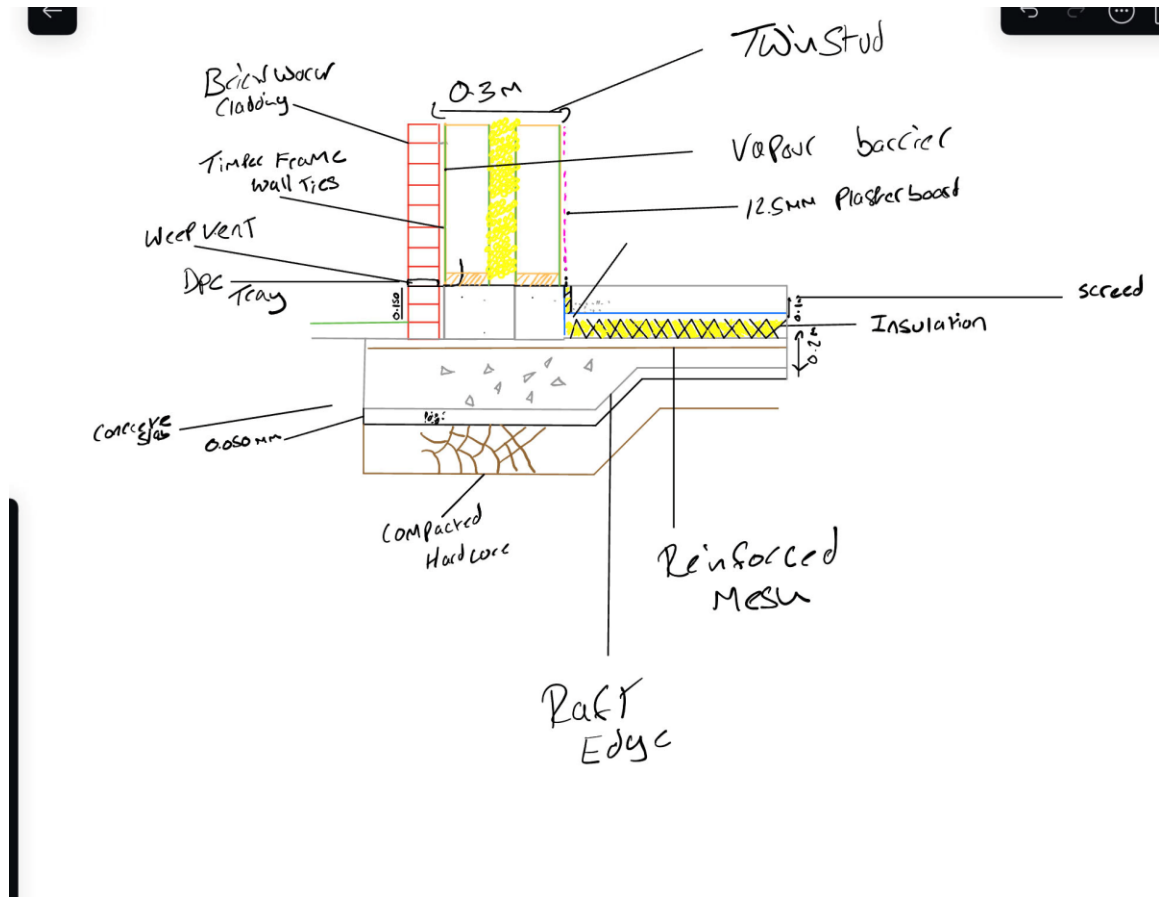
Advantages Of Using SIP

- Fast installation, as the SIPs are built offsite this allows for faster assembly.
- Excellent thermal performance due to the continuous insulation core.
- Not as weather permitted as the Traditional

Disadvantages Of Using SIP

- Limited cavity space for services unless battened internally.
- Higher upfront costs
- Limited flexibility on site
- Specialist installation required

Twin Timber Frame Ground Detail



The detailing in this drawing of the twin timber frame is similar to the two other designs but uses a different building as there is no cavity. The Twin timber frame uses 2 timber studs as the internal and external walls with insulation in between both studs. The brick work is used as a cladding in this build as the structures main component is timber. The timber frame uses a vapor barrier on the external skin as the rain and moisture travels through the brick. There is a DPC tray installed with weep vents at the dpc level to allow moisture and water to escape.

Advantages Of A Twin Timber Frame

- Good thermal performance and acoustics.
- Easy to install services in battened zone.
- Low Carbon Footprint
- Lightweight Structure

Disadvantages Of A Twin Timber Frame

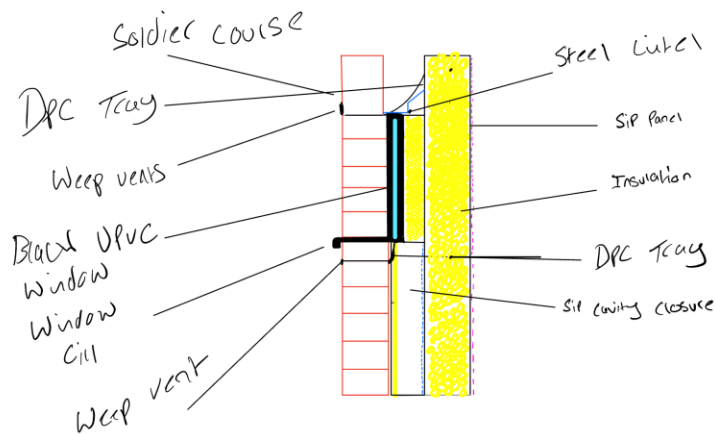
- Requires precision to avoid thermal bridging at soleplate.
- Warping, wood warps in different climates which can cause movement in the structure.
- Higher wall thickness due to the two timber frames
- Vulnerable to moisture during construction if not properly protected.

WINDOW DETAILS

SIP Window Detail

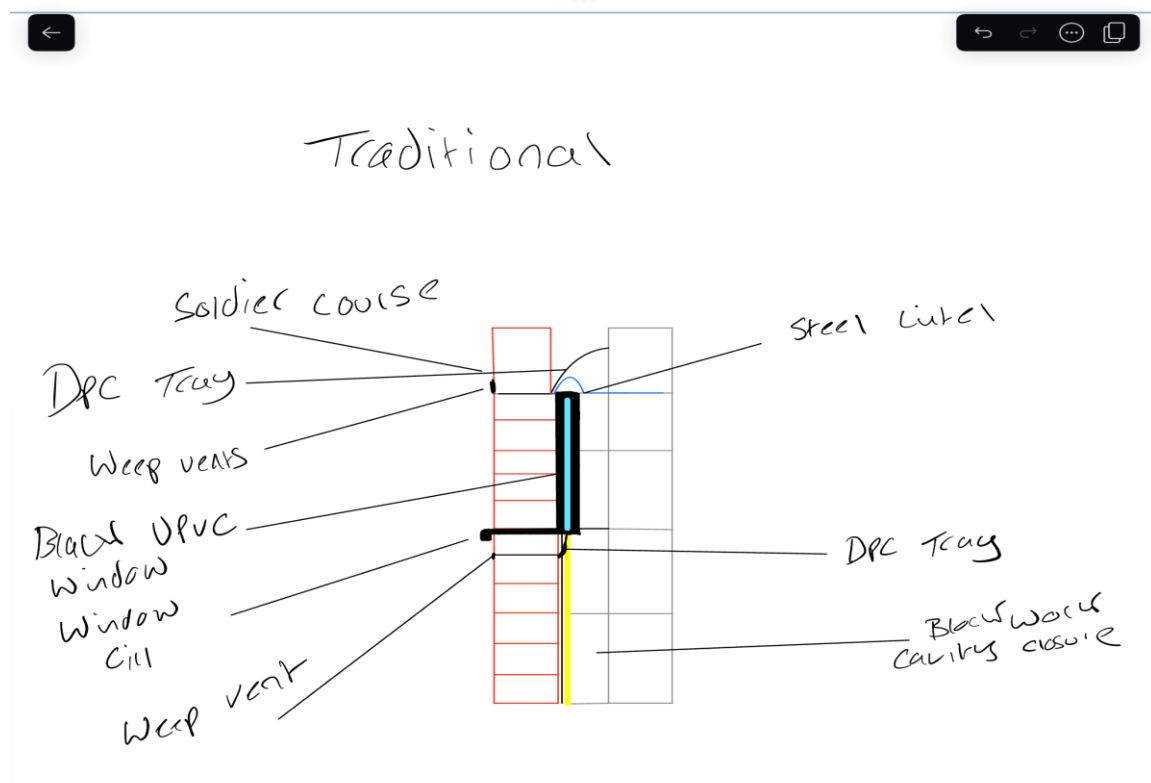


Window detail SIP



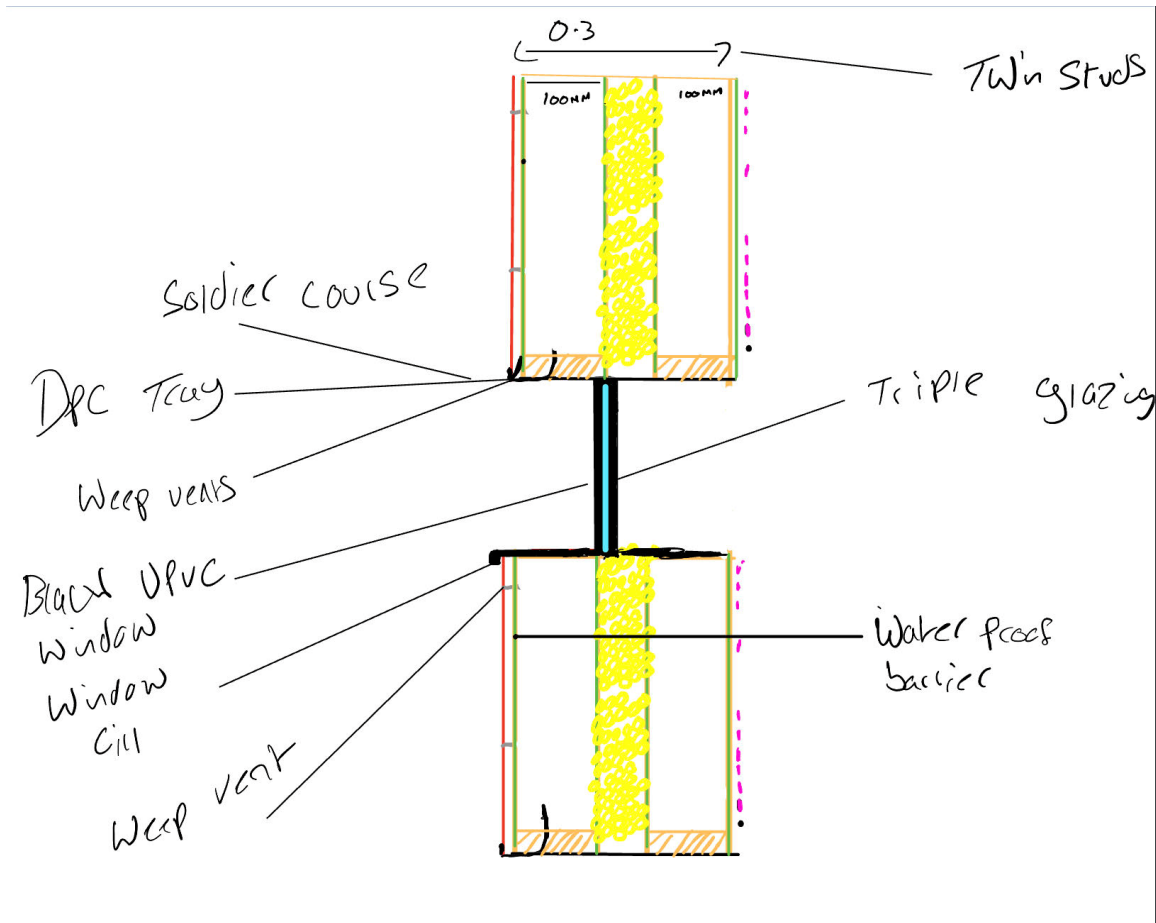
The Window details is using a black UPVC Window with Triple glazing. The Window reveals are cut into the panel and lined with insulation box liner. There is a lintel attached to the sip with cleets and a DPC tray over the lintels with weep vents every 450mm to release water there is also a tray underneath the window. The brick work has a soldier course as extra details. (GreenBuildingAdvisor, n.d.)

TRADITIONAL WINDOW DETAIL



The Traditional window detail is using the same black uPVC window and triple glazing. The blockwork returns on the reveals to create a cavity closure which the window is fitted to. A steel lintel is installed on both skins with a DPC tray above to catch any water ingress. Weep vents are placed in the outer leaf to allow water to escape. Plasterboard is used internally to finish the reveal and provide a clean internal surface.

TWIN TIMBER FRAME WINDOW DETAIL



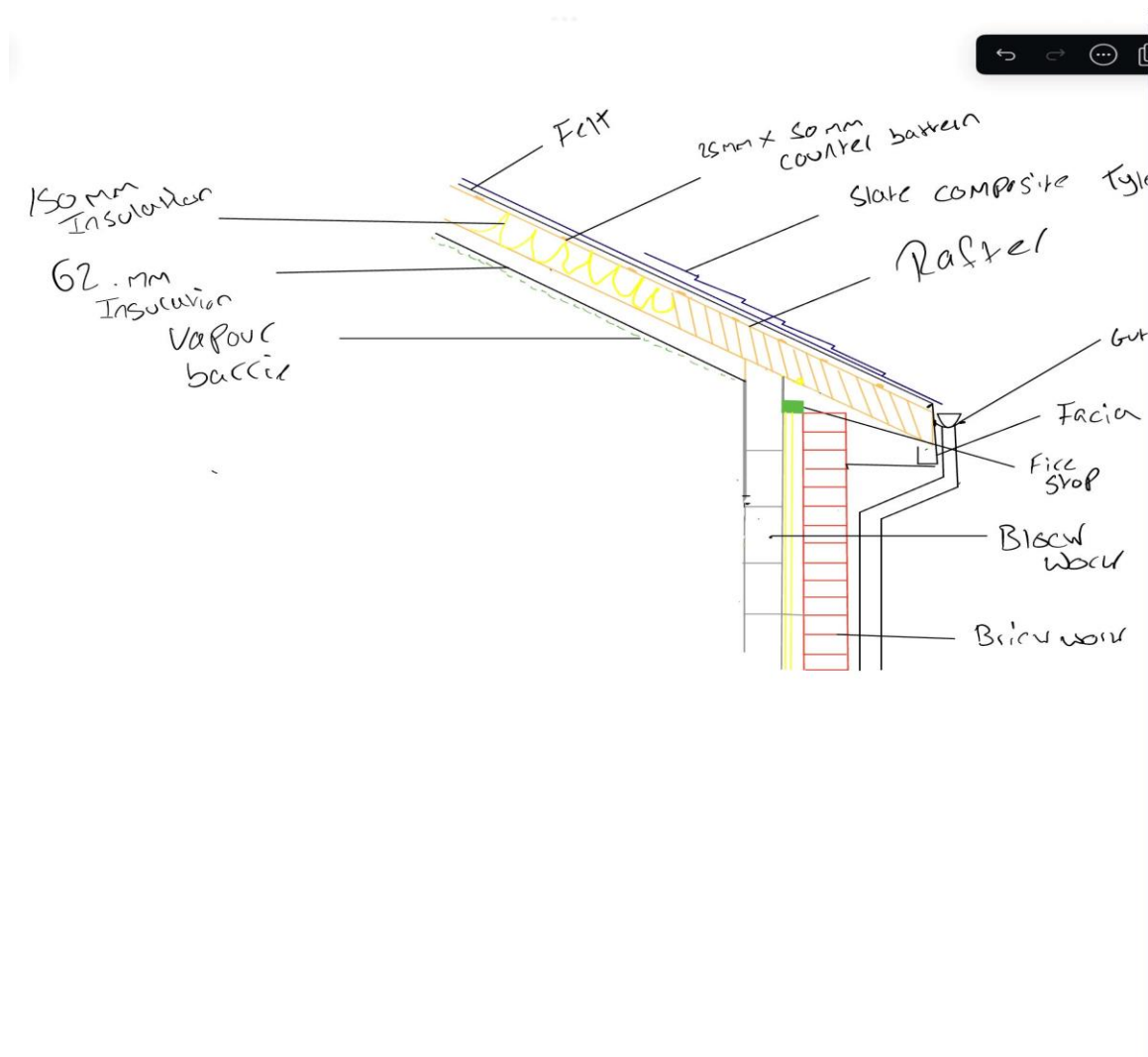
The structural opening is trimmed in treated timber and finished with a plywood box liner, creating a solid frame for the window installation. A triple-glazed black UPVC window is fixed securely into the timber frame. Cavity closers are installed around the perimeter to prevent cold bridging and provide a firm edge for fixing, while also helping with fire and moisture protection.

An airtight membrane is carefully lapped and taped around the window reveals, linking to the internal airtightness layer to maintain the building envelope's integrity. The window is positioned in line with the main insulation layer, reducing thermal bridging and improving overall thermal performance. Expanding foam or insulated tape is used in the fitting gap to seal the frame and further enhance airtightness and insulation.

Externally, the window sits neatly behind the outer brick skin, which is finished with a clean mastic sealant bead to prevent water ingress. Internally, the reveals are finished with plasterboard or timber linings, ensuring a neat aesthetic and compliance with thermal and airtightness. (Typical Detail -Passive Twin Stud Wall -Window Fixing, n.d.)

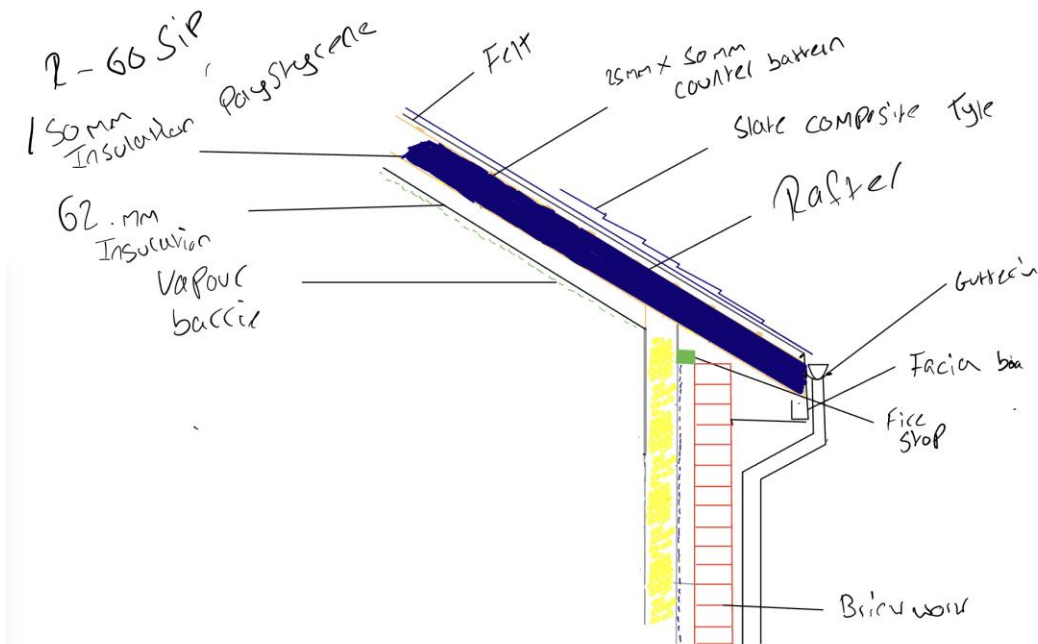
ROOF AND EAVES DETAILING

Traditional Roof Detail



In this detail, the trusses are fixed onto a wall plate, which is securely bedded onto the internal skin of blockwork. Insulation is terminated at wall plate height, with additional insulation placed between the rafters to maintain thermal continuity. A fascia is installed, incorporating a vented soffit detail to allow roof space ventilation and prevent condensation. Black UPVC guttering and downpipes are fixed to the external skin of the facing brickwork, ensuring effective rainwater drainage. The roof finish consists of slate composite tiles, offering a durable and low-maintenance solution. A felt membrane beneath the tiles adds weather protection, ensuring compliance with current Building Regulations.

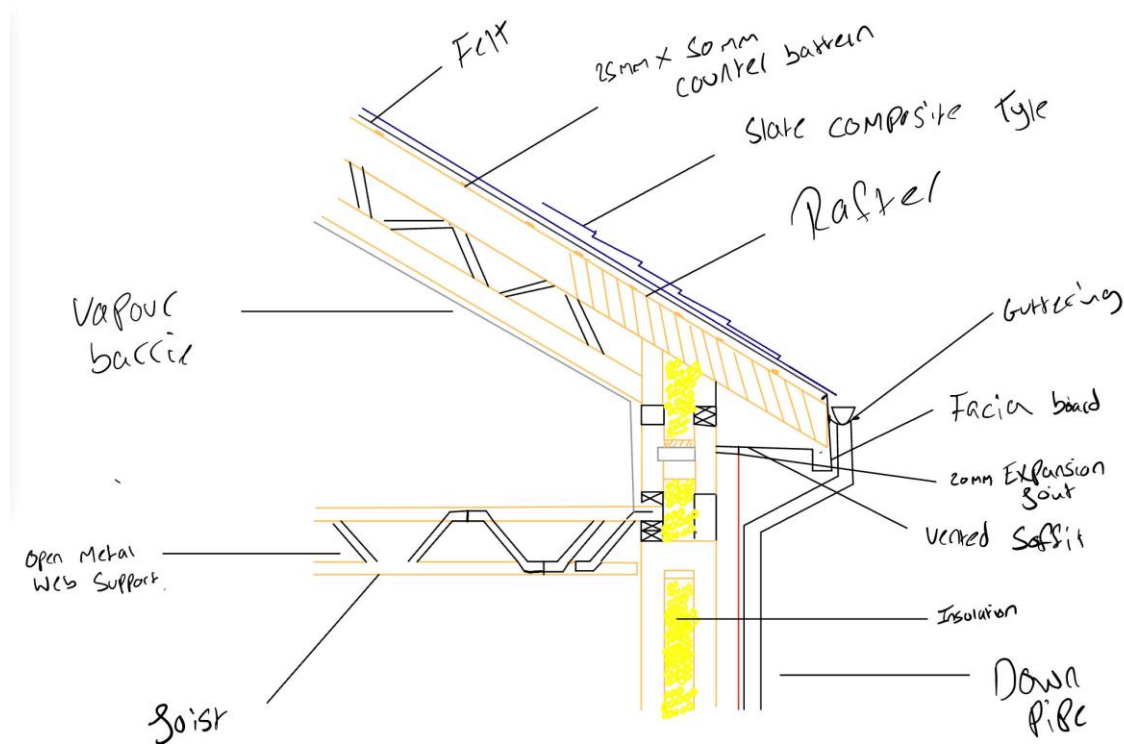
SIP ROOF DETAIL



The roof is using a sip roof pannel with osb sheathing with breathable membrane. R-60 SIP insulation is used behind the sip panels which is allowing for ventilation. The eaves overhang is minimal, creating a modern appearance. Ventilation is provided by fascia vents. Continuous insulation from wall to roof reduces thermal bridging. The system supports rapid installation, airtightness, and high energy efficiency in a compact roof design.

TWIN TIMBER FRAME ROOF DETAIL

Passive Roof



The Timber Twin Frame system uses raised tie trusses fixed to a continuous timber wall plate. These trusses support OSB roof sheathing topped with a breathable membrane, which allows moisture to escape while keeping water out.

Eaves are detailed with a ventilated soffit to maintain airflow through the roof void, helping prevent condensation and ensuring timber durability. A fascia supports the guttering, which directs rainwater safely away from the structure.

Thermal continuity is maintained by extending mineral wool or PIR insulation from the wall into the roof space, reducing thermal bridging. An internal airtightness membrane at the ceiling line controls air leakage and improves energy efficiency. All elements work together to provide a well-insulated, breathable, and airtight roof construction.

RECOMMENDED CHOICE OF BUILD

The Structural Insulated Panel System SIPS is recommended for the two-storey domestic building due to its high performance in several key areas: construction speed, thermal efficiency, accuracy, compatibility, and sustainability. SIPS allow for rapid construction, as the panels are pre-manufactured and can be assembled quickly on-site, significantly reducing construction time compared to traditional methods. The system's continuous insulation ensures high airtightness and excellent thermal performance, with low U-values and minimal heat loss, increasing energy efficiency. (Littlewood)

Manufactured offsite to precise measurements, SIPS reduce the risk of defects and ensure high-quality construction. Additionally, the system is highly compatible with external finishes, such as brickwork, and can integrate easily with internal service zones, meeting both aesthetic and functional design criteria.

In terms of sustainability, SIPS generate minimal waste during construction and contribute to long-term energy savings through improved insulation, reducing the building's environmental impact. Although the initial cost per square metre may be higher than conventional methods, the reduced construction time and ongoing energy savings offer significant value over the building's lifecycle. (Sanna)

Conclusion

All three systems Timber Twin Frame, SIPS, and a Traditional build can meet the planning and Building Regulations requirements of Miss A. Client's new home. However, SIPS offers the optimal balance of performance, efficiency, and adaptability for the specific site and project ambitions. Detailed planning and precision during the design and manufacturing phases will ensure the success of this offsite-led solute

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