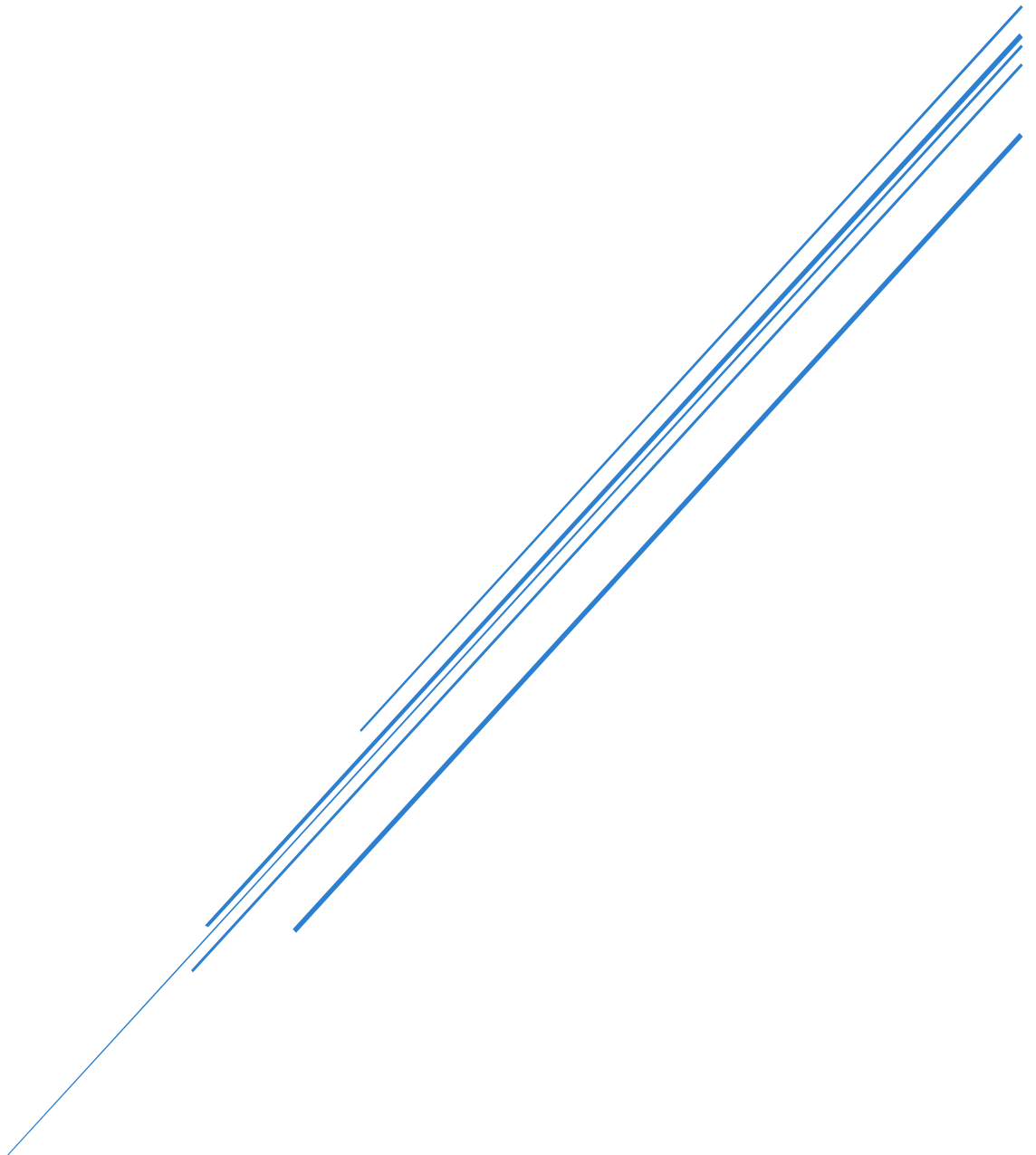


FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY

Semester 2



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1. Offsite Construction

- i. Offsite construction means building parts of a structure like walls or entire sections in a factory instead of at the actual site. These parts are then delivered and assembled at the location. It's a quicker, cleaner, and more efficient way to build, kind of like putting together large pre-made pieces. There are 4 main techniques of offsite construction:
 - A) 'Panelised offsite construction' is where parts of the building like walls, floors and roofs are made in a factory as a flat panel. These panels are measured to the millimetre, which boosts the accuracy of building when assembled on site. This is a very time and cost-effective way of building.
 - B) 'Modular offsite construction' is where whole sections of the building are collated and made up offsite, these include rooms inclusive of all walls, floors and ceilings and can come pre stage fixed in some instances.
 - C) 'Hybrid offsite construction' is the method combining both Panelised and Modular offsite techniques. Where prefabricated modular rooms are dropped onto panelised floors, or between panelised walls.
 - D) 'Component offsite construction' is where different parts of the buildings structure like beams and columns are created offsite and assembled and bolted together onsite. Creating the buildings envelope.

2. What are the building regulations?

When constructing a new build house or building, you must comply with the building regulations. Currently in Wales there are 18 applicable, namely part A to Part S. The building regulations are designed and put in place to ensure that any new buildings / dwellings that are constructed are going to be safe, healthy and high performing.

Text 1 (LABC, 2025)

3. External Wall to Ground Floor Junction.

When looking at the external wall and ground floor junction detail, Part E of the building regulations must be compliant 'Resistance to the passage of sound'.

Also, stated in Part L of the building regulations, a new-build external wall must meet or exceed a U-Value of 1.18

When comparing the three external wall constructions, there are many considerations that need to take place. In the first instance, the walls thermal performance:

- 3.1. SIP Panels have extremely low U-Value ratings, and with the addition of extra insulation can be improved further. They are also extremely airtight, due to being manufactured offsite and delivered in panels. There is minimal thermal bridging also, however, only if the panels are fitted correctly. SIP Panels are easily constructed too. However, a MVHR Panel is often required to ventilate.

SIP Panels comply with building regulation Part E due to the plaster board on the internal skin of the structure. And the dense foam core which is usually either Polystyrene or Polyurethane. The foam between both SIP Panels is so dense, it ensures the SIP Panels are effective against both Airbourne and Impact noises.

Another advantage and additional compliance for the TTF system is it's compliance with a robust detail, which means the structure has been tested prior to its use on site.

Text 2 (Kim, 2025)

- 3.2. The Traditional brick and block method of external wall construction is the most commonly used construction method throughout the UK. Using this method, the U-Value is higher than the SIPS Panel, but can be bettered with a thicker insulation. A brick and block wall aren't very airtight in comparison to the other two methods that have been proposed. And has a longer construction period.

In order to comply with building regulations Part E, a brick and block external has poor sound absorption and therefore the wall will require a thick cavity insulation layer and additional sound absorption materials, such as sound grade plasterboard.

Text 3 (Mann, NHBC Good Craftsmanship Guide to Brickwork and Blockwork in New Build Homes, 2024)

- 3.3. Twin Timber Frame (TTF) external wall construction can achieve the lowest U-Value out of the three methods. It has an extremely high air tightness as a structure, however not so much when detailing with a floor. TTF commonly takes longer to construct in comparison to both SIPs and brick and block construction, however, have an excellent thermal and sound performance.

Due to being predesigned and prefabricated, TTF construction will comply with building regulations Part E as the insulation that is incorporated between the two timber panels is of high value and specification and has extremely good sound and thermal resistance.

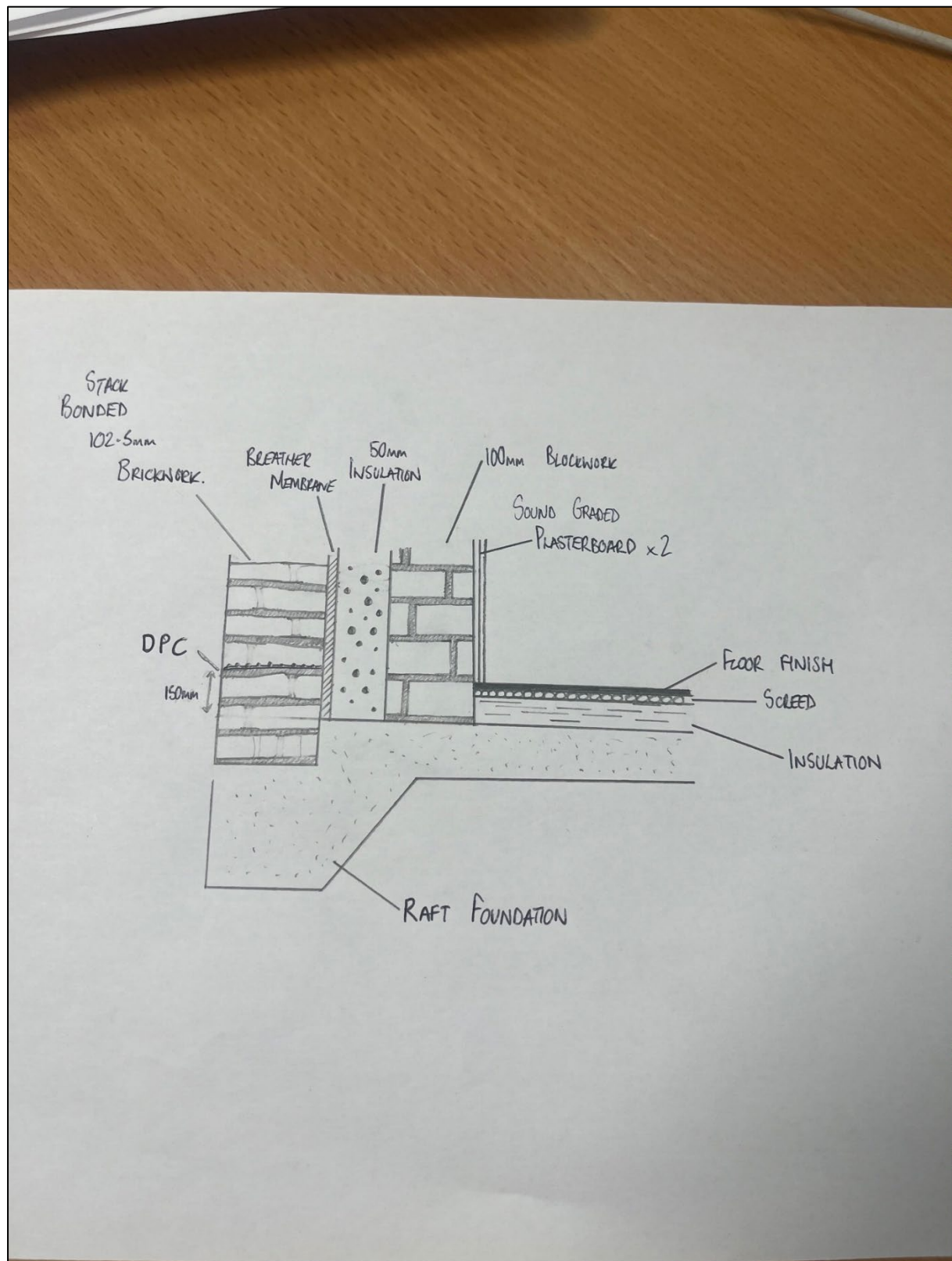
Another advantage and additional compliance for the TTF system is its compliance with a robust detail, which means the structure has been tested prior to its use on site.

Text 4 (Mann, NHBC Standards Chapter 6.2 – External Timber Framed Walls, 2025)

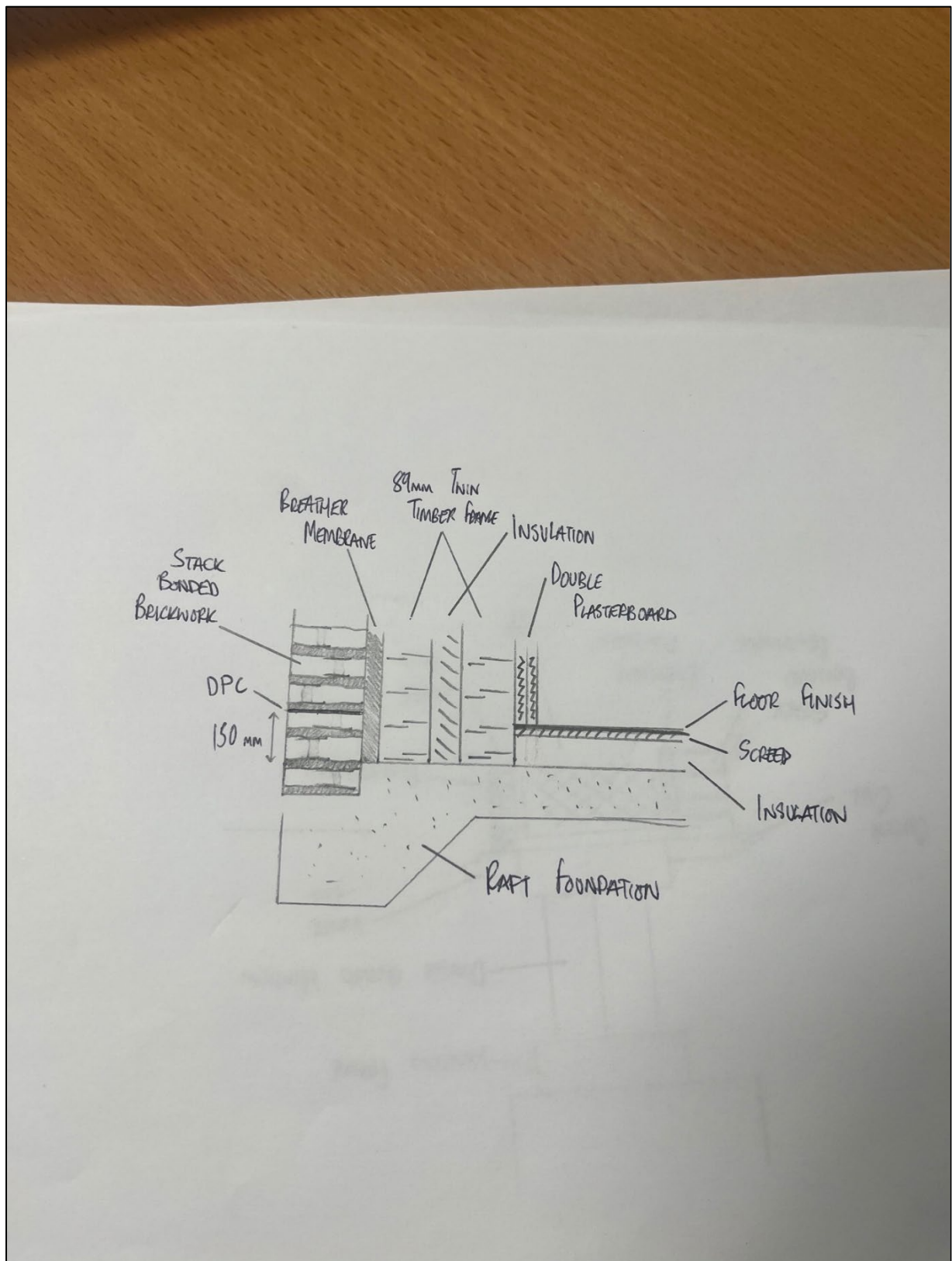
- 3.4. When comparing the junction between the external wall and ground floor, both SIP Panels and Twin Timber Frame systems present advantages and disadvantages in terms of connecting with ground floor construction and adhering to Part E (sound insulation). Because of its thick mass, brick and block construction performs well acoustically, making Part E compliance simple, particularly when detached, as is the case with this new build. SIPs and Twin Timber Frames, on the other hand, are lightweight and need extra acoustic details (such as double linings, acoustic insulation, and resilient bars) in order to meet regulations. SIPs need to be carefully detailed for ground floor junctions to guarantee airtightness and insulation continuity, especially at the raft edge.

Text 5 (Marmox, 2024)

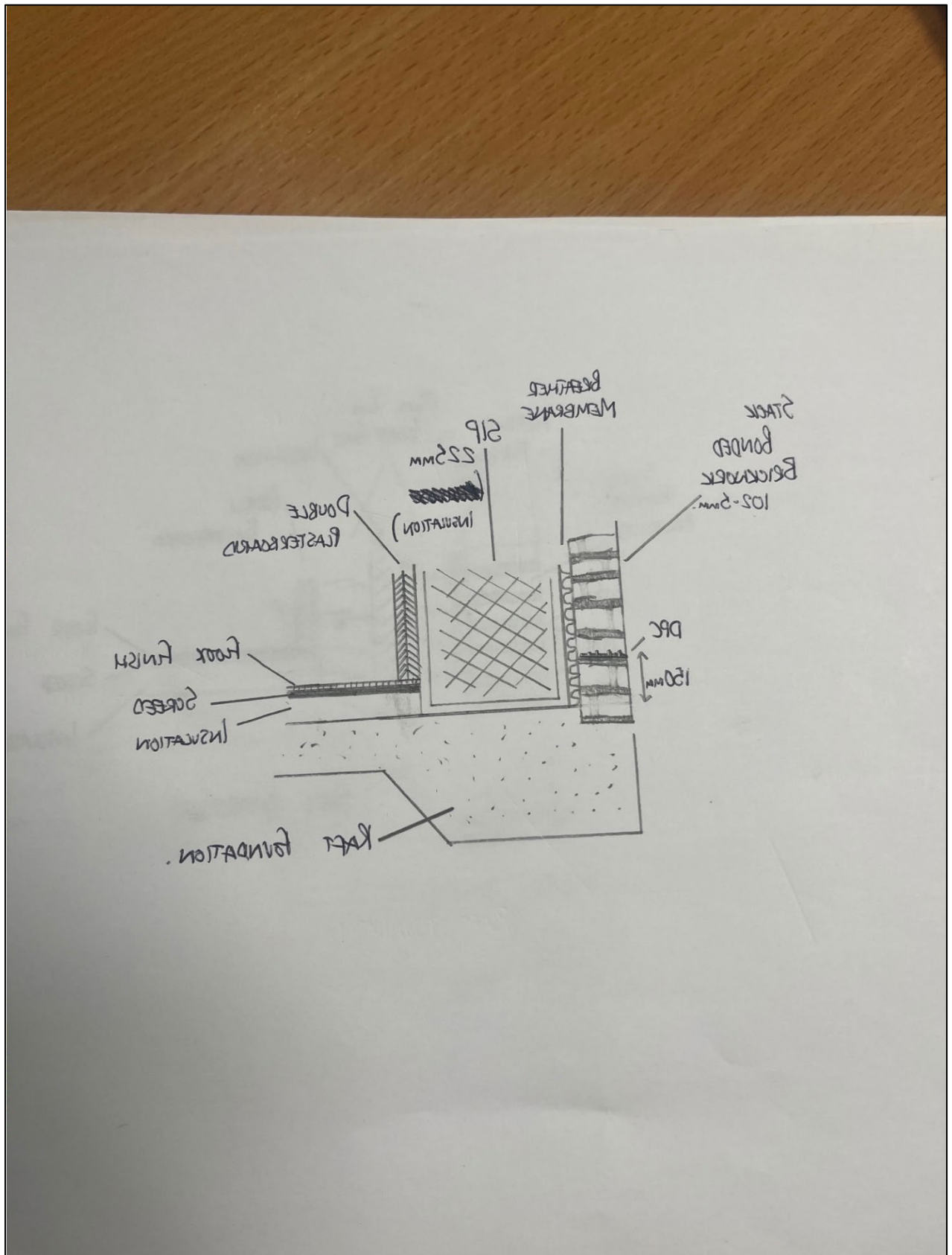
Sketch 1 – Brick & Block Ground Floor Detail



Sketch 2 – TTF Ground Floor Detail



Sketch 3 – SIP Panel Ground Floor Detail



4. Window Opening Section

Building Regulation Approved Document Q relates to the Building Security Regulation for new builds. The Security Building Regulations cover windows and doors in all materials, and the design must allow for provisions to prevent unauthorised access.

Text 6 (Dardalis, 2025)

- 4.1. Windows in SIP systems are usually tightly embedded into the insulated core, flush with the exterior face or mid-panel. Strong thermal continuity around the frame is made possible by this connection, which reduces cold bridging. The window is tightly encased in the SIP's insulation, which supports low frame and junction U-values.

Correct detailing reduces thermal bridging, and an airtight membrane system brings the window's overall thermal performance closer to its rated U-value (e.g., 0.8–1.2 W/m²K for triple glazing). Performance can be lowered by poor workmanship, such as gaps around the frame, however this danger is reduced under factory-controlled installation settings.

Text 7 (Kentishgreen, 2016)

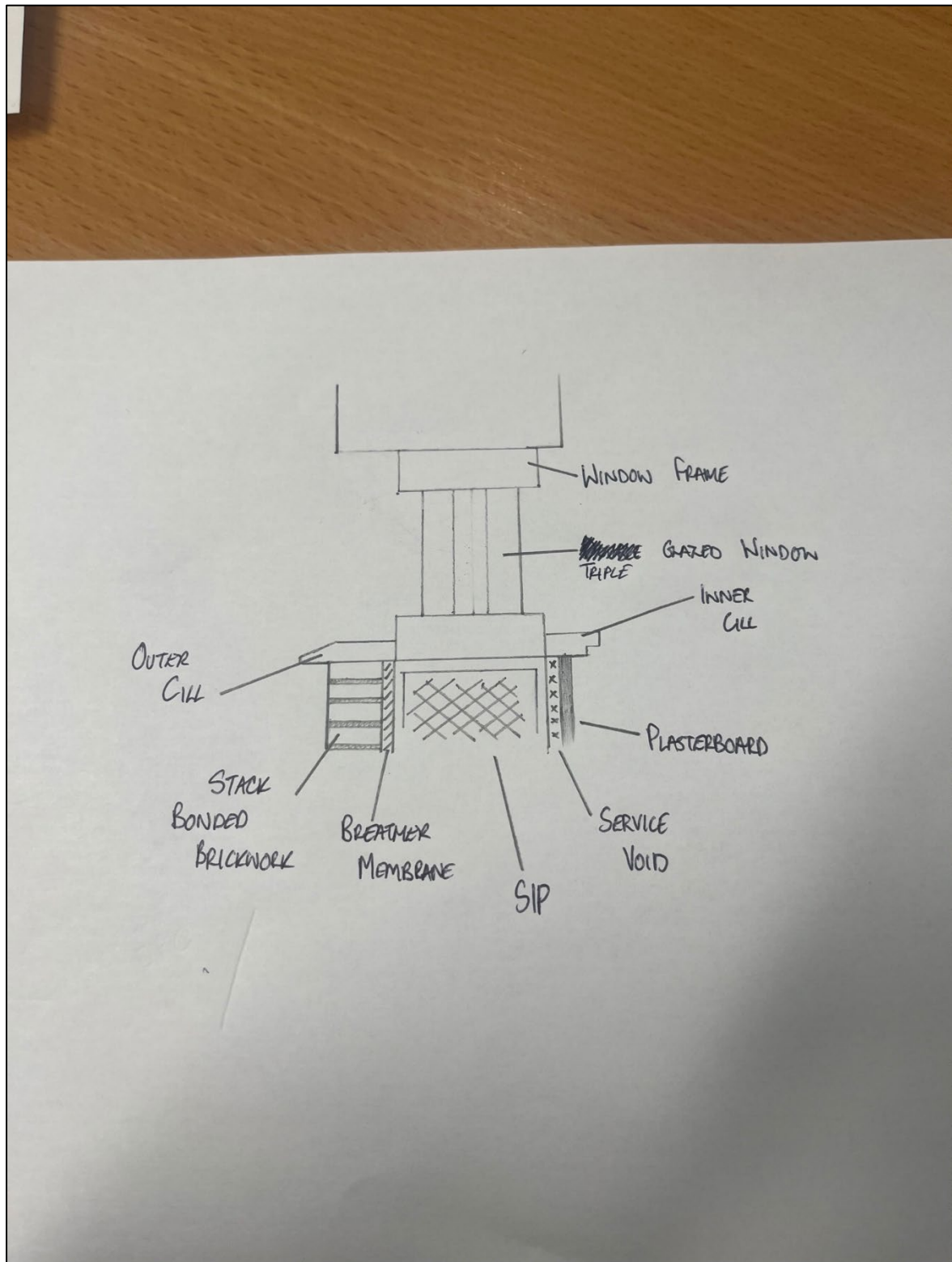
- 4.2. Windows are frequently positioned near the centre or outside edge of the cavity in brick and block walls. There are increased chances for thermal bridging because of the surrounding materials, which include block, insulation, and cavity closers. Heat leakage around the window's perimeter is more likely even with thermally broken lintels and insulated cavity closers. If insulation consistency at the reveals is not maintained, the layered aspect of the wall may result in cold areas.

Because of junction losses, the window's effective U-value within this wall type is frequently lower than its rated U-value. Nevertheless, performance can be greatly enhanced by thoughtful design, such as extending insulation all the way to the window frame.

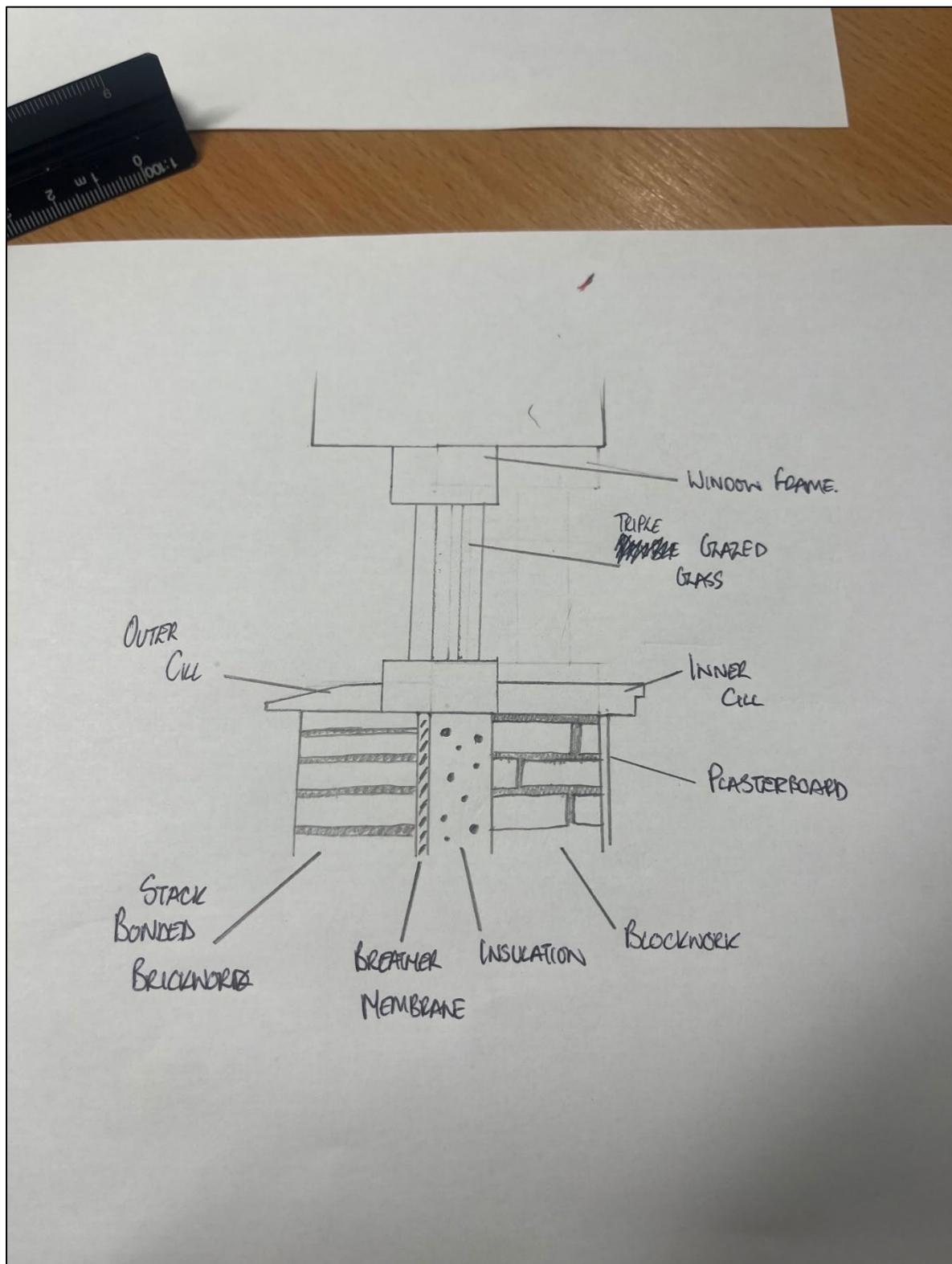
Text 8 (Technical Study: Window Details, n.d.)

- 4.3. It is usually preferable for windows in twin timber frame walls to be set behind a high layer of insulation. This arrangement reduces linear thermal bridging and increases thermal consistency. Thermal losses at the connection are kept to a minimum since insulation can wrap around the window frame on several sides. When built correctly, a window in this sort of wall can keep its rated U-value much more tightly, frequently within 0.1 W/m²K of the performance that was reported.

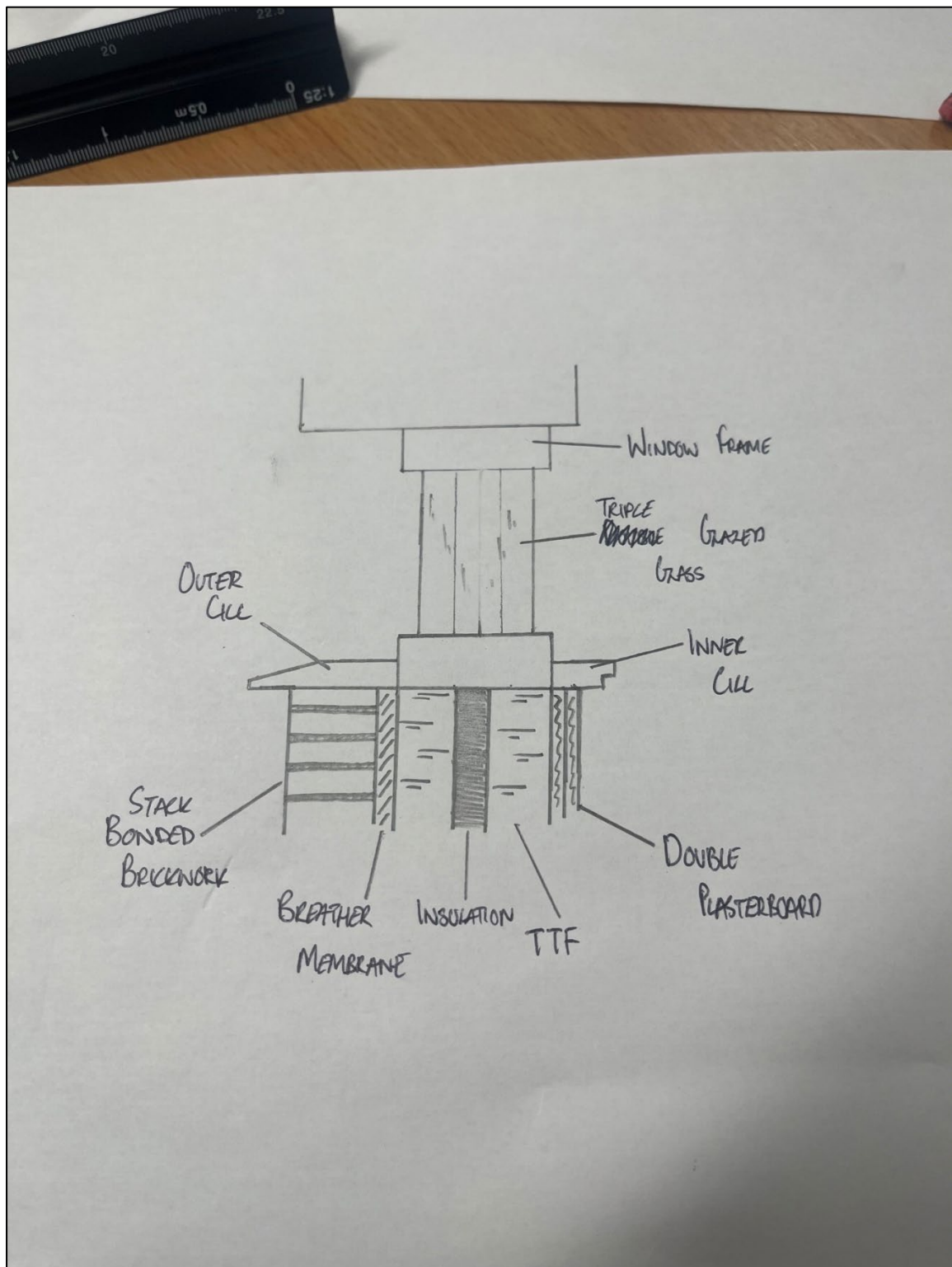
Sketch 4 – Window Detail SIPS



Sketch 5 – Window Detail Brick & Block



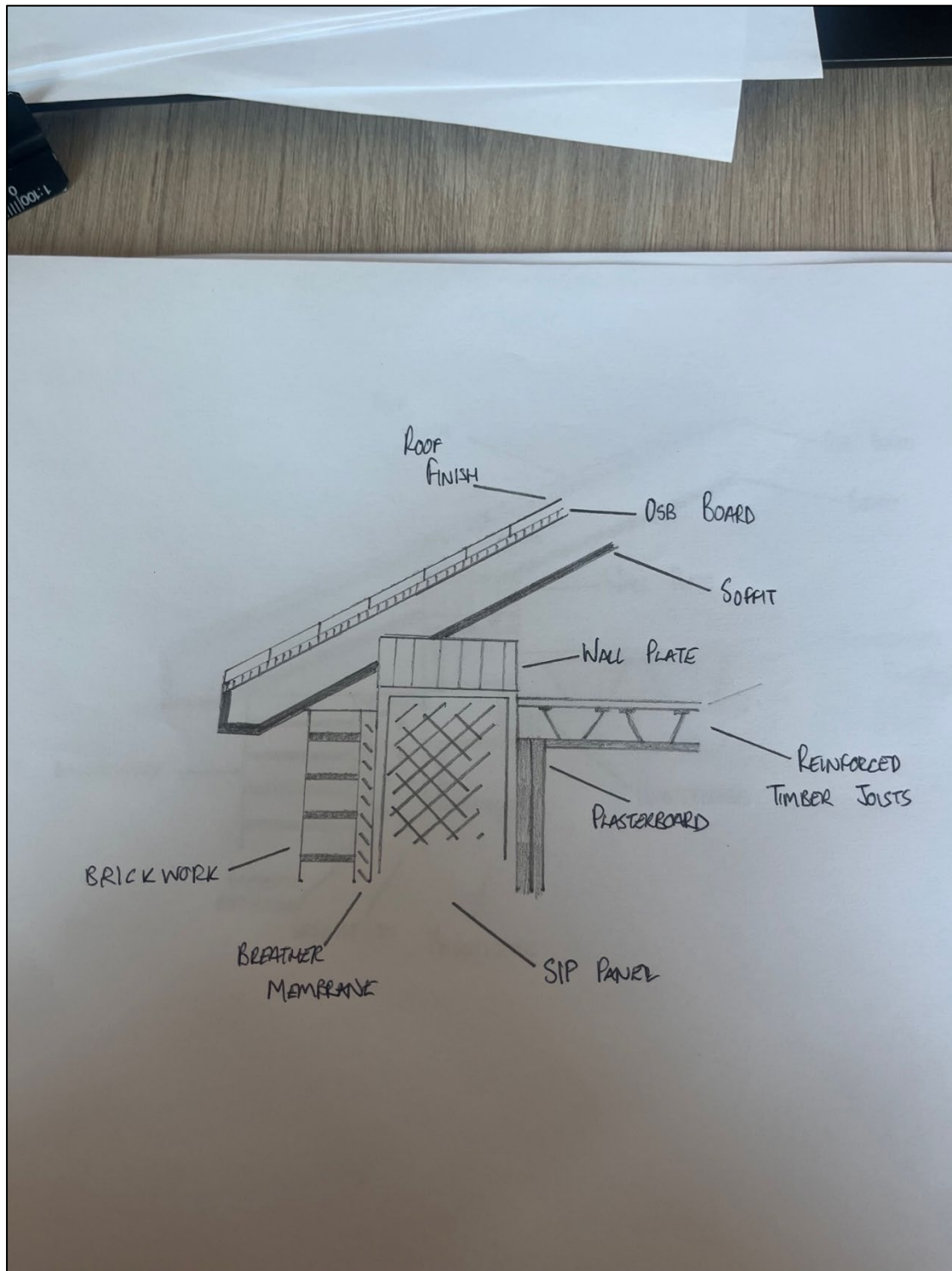
Sketch 6 – Window Detail Twin Timber Frame



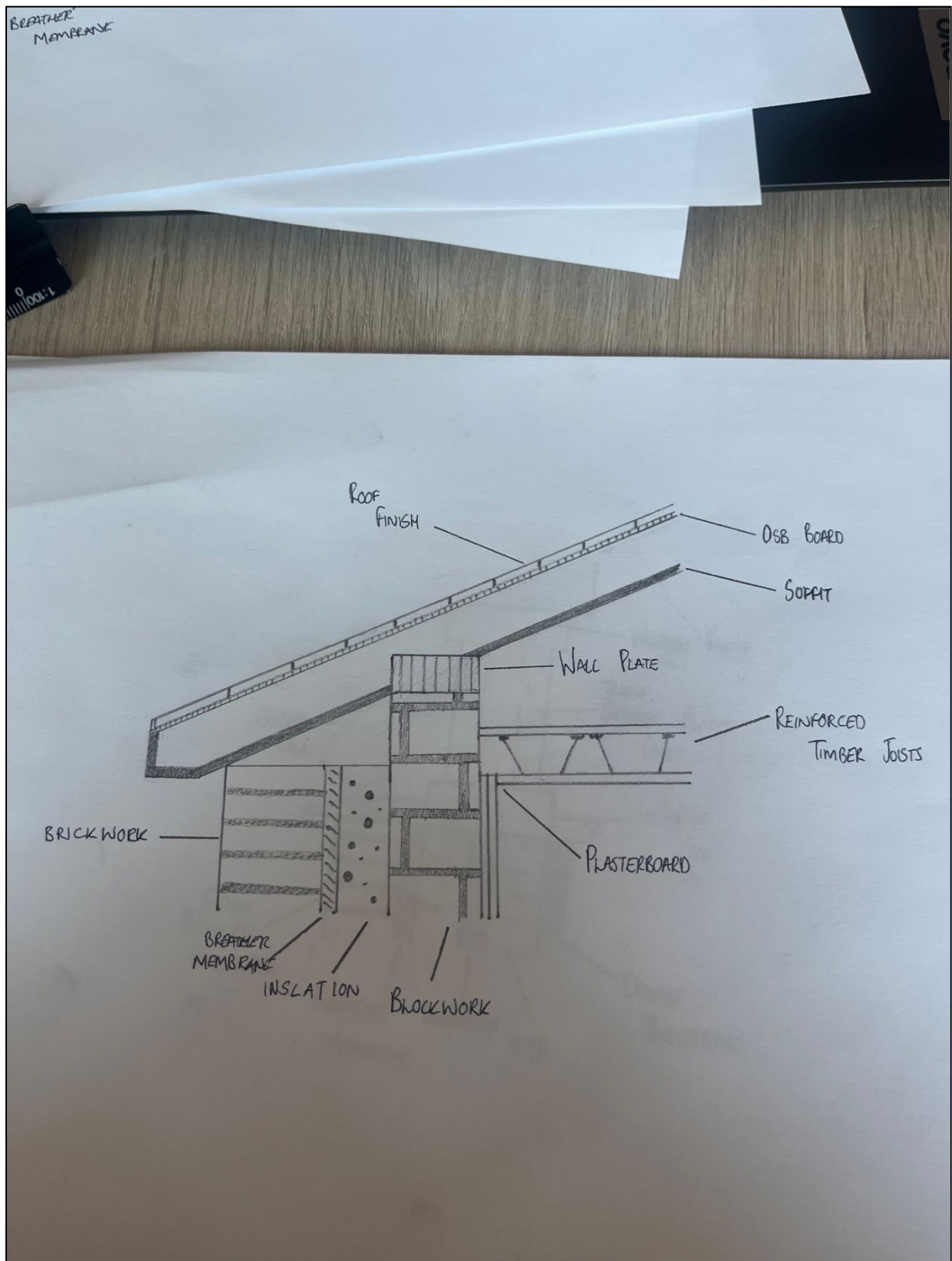
5. Roof Structure

- 5.1. In SIP construction, eaves detailing must work with the prefabricated, airtight structure. SIP panels sometimes extend beyond the wall line to generate overhangs, requiring precise junction sealing to preserve insulation and avoid air leaks. The eaves detail includes a breather membrane, soffit board, fascia, and additional fixing timber. Unlike traditional roof structures, which use rafters or trusses seated on wall plates, the SIP system combines roof and wall panels more fluidly. When using trusses, however, adjustments such as structural connectors or grooves may be required. Overall, eaves detailing in SIPs is more performance-oriented, focusing on thermal continuity and airtightness rather than structural simplicity.
- 5.2. In classic brick and block walls, eaves detailing usually includes a trussed or cut roof bearing on a wall plate on top of the inner leaf, with the outer brick leaf extending upward to form a hollow. Fascia boards, soffits, insulation, cavity trays, and ventilation gaps are all components of the eaves. A continuous air barrier and well-sealed breather membranes are also essential to prevent air leakage. When detailed correctly, the eaves can maintain the building envelope's thermal integrity, reducing heat loss and improving energy efficiency.
- 5.3. Eaves detailing in twin wood frame construction is more difficult due to the double stud wall layout, which often includes a centre insulated cavity. The roof structure, which commonly consists of designed rafters or trusses, must span both frames while maintaining load continuity and thermal separation. Eaves features include extended rafters or overhangs, as well as the precise integration of breather membranes, soffit ventilation, and continuous insulation. Twin frame systems require coordination between the two frames and the roof for airtightness and thermal integrity, as opposed to ordinary roof designs in which rafters rest solely on a single wall plate.

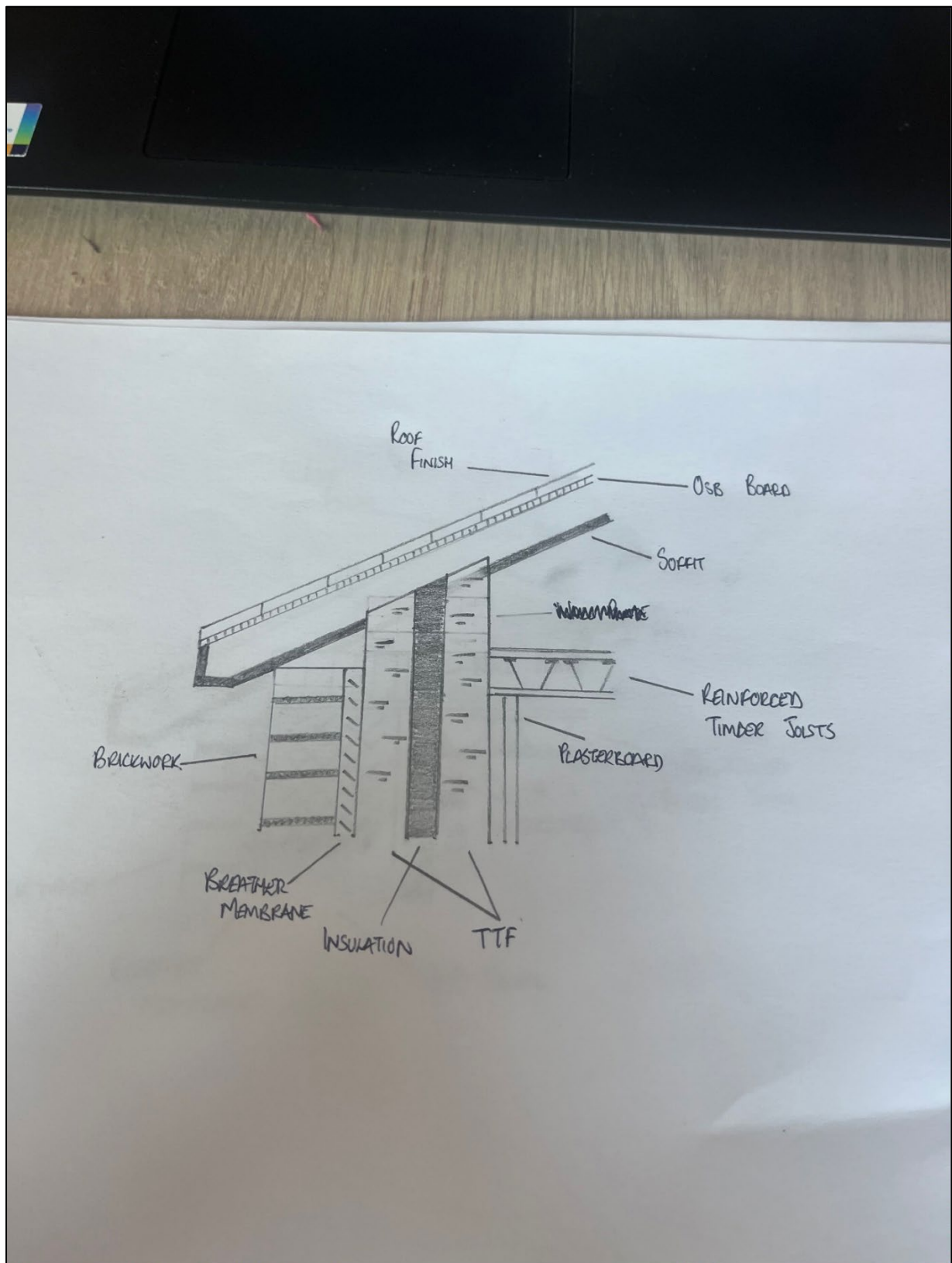
Sketch 7 – SIPS Rafter Detail



Sketch 8 – Brick & Block Eaves Detail



Sketch 9 – Twin Timber Frame Eaves Detail



6. Building Method Recommendation

I would recommend brick and block external wall construction for the new house because of its consistent thermal performance and ability to meet current UK Building Regulations. The cavity wall system, which consists of an outside brick leaf, an insulated cavity, and an interior block leaf, offers superior thermal resistance. Using current insulation materials like mineral wool or rigid foam boards can produce low U-values, meeting Approved Document L, energy efficiency requirements.

The blockwork also has a great thermal mass, which helps maintain temperature variations, improving comfort and lowering heating energy use.

Brick and block walls are also airtight and can be enhanced with insulated cavity closers and damp-proof membranes to minimize heat bridging and moisture infiltration. This method of construction produces a strong, resilient building that functions in all seasons while being affordable.

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