

ACBA4001

Fundamentals of Construction Technology

New build dwelling:
Technical report with drawings

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Illustration of the details for building elements

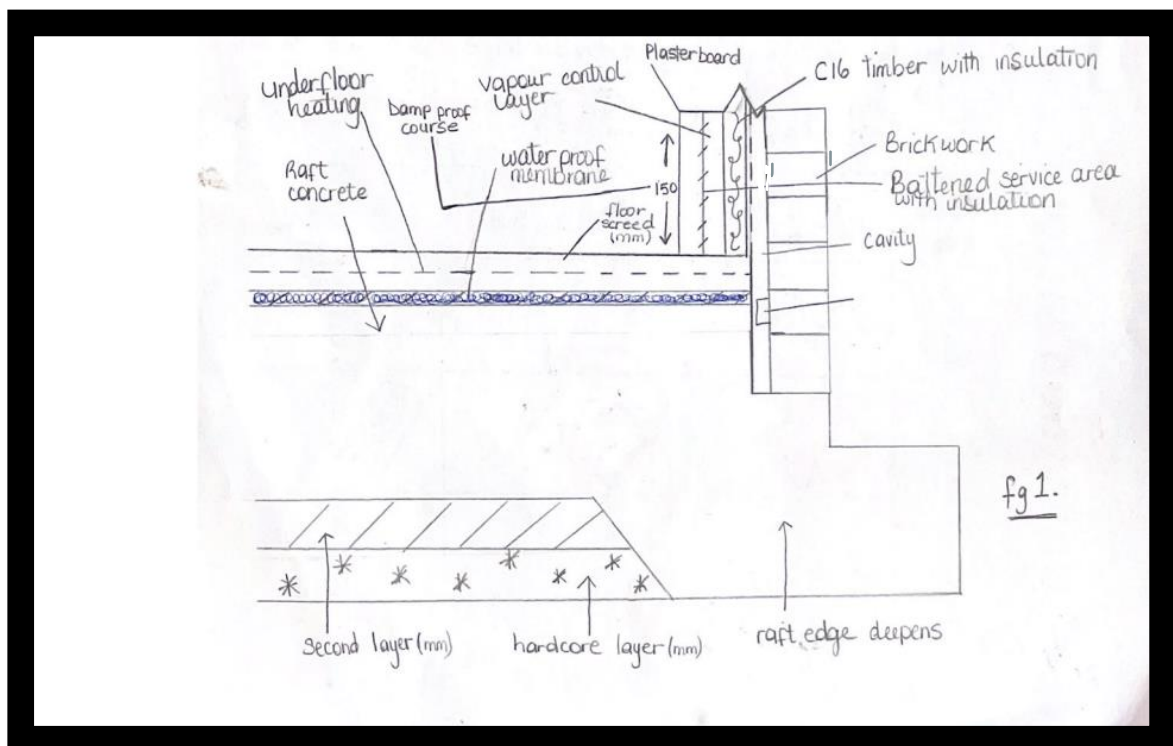


Figure 1.

In the drawing above, the raft foundation is shown in detail with all of its components. The raft foundation is a uniquely built slab extending over an area where a building is to be constructed. The raft foundation supports the building and transfers its weight to the ground.

The hardcore layer is the bottom most layer of the foundation. It is created by excavating the ground and its solid materials to a uniform and flat level, filling irregularities and creates a firm and level working base. Above this layer is the second layer which is usually sand to fill more evenly in between the solid materials. Where “raft concrete” is labelled, a 3 feet layer of plain cement concrete is then laid on the formation of the raft here. This layer is to create a flat and level base for the foundation. A water proofing layer is then placed above the concrete. This area is labelled “water proof membrane” in the diagram. After this, the underfloor heating which is steel is laid tied in to place, then the screed which is a thin layer of cement usually between 200mm- 300mm. Between the area of the floor screed and the timber joist flooring (shown in Figure 2. Drawing), there is a damp proof course (DPC) layer that is 150mm thick. This layer of DPC has various functions. According to an article on DPC by (shambhu, 2020), it helps to prevent the movement of moisture within the structure, to prevent termites and protect floorings etc.

Also shown in the drawing above is part of the external wall. On the far side of the drawing on the external wall, the outermost layer is the brickwork of the wall. Inside of this brickwork layer, there is the cavity which is a space between the two layers. The next layer inside of the cavity space is layer for insulation which is made up of C16 timber. Beyond the insulation layer is a vapour control layer which controls condensation and restrict the flow of moisture. The

battened service area is an area of “dry lining” that helps to provide warmth and fight condensation in cold buildings. (DIY Doctor, n.d.) The inner most layer of the wall, used as the wall finish on the interior of the building is the finishing layer called the plasterboard.

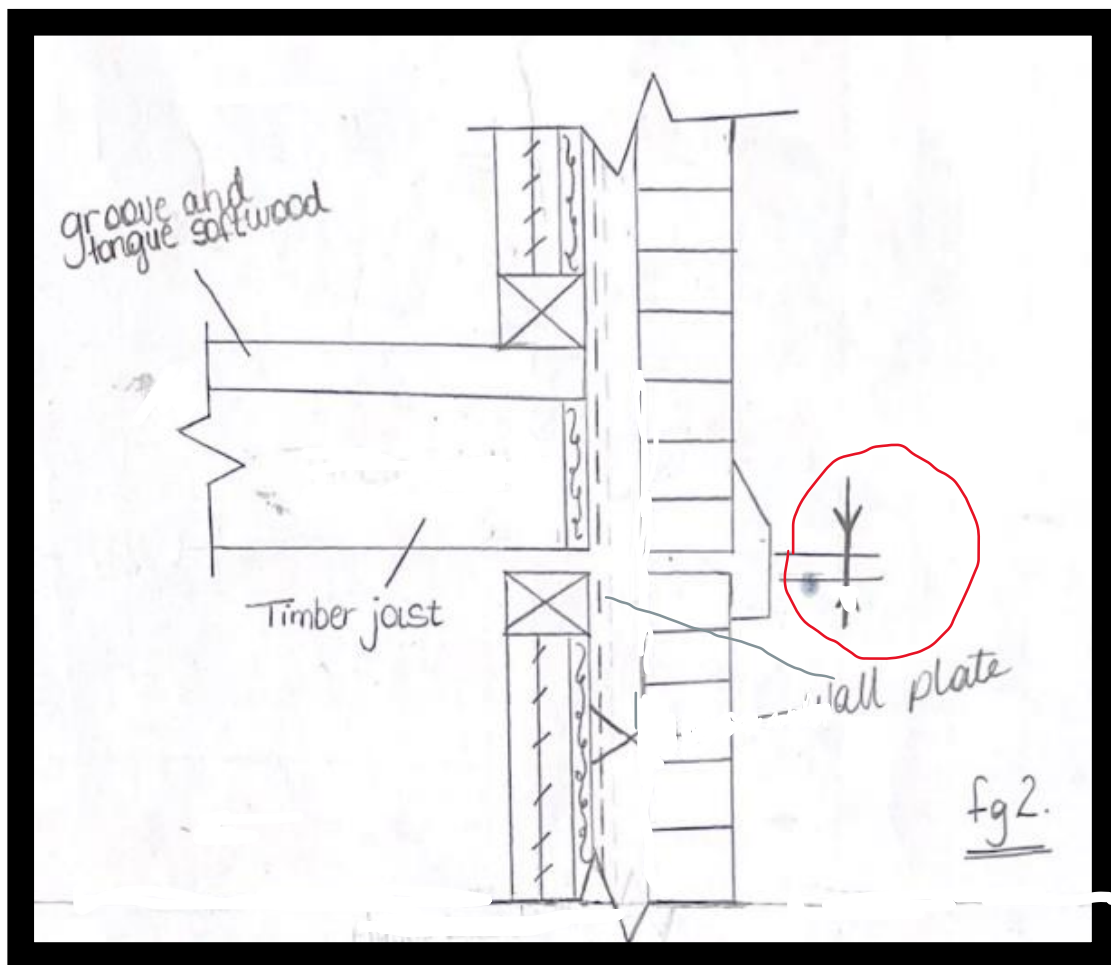


Figure 2.

In the above diagram, this is a continuation of the external wall which shows the junction between the flooring and the wall. The finishing flooring that is used in the building sits right above the DPC layer (highlighted in Figure 1.) This flooring comprises of groove and tongue softwood which is the outermost and visible layer of the flooring. The groove and tongue softwood sits right above the joist layer, directly above the DPC. The joist is made up of solid timber which provides support for the flooring used in the building.

The area circled in red is the deflection gap. According to (www.designingbuildings.co.uk, n.d.) the deflection gap is “an element of structure that changes shape when load is applied. The change may be a distance or an angle and can be either visible or invisible, depending on the load intensity, the shape of the component and the material from which it is made. Deflection is a crucial consideration in the design of a structure and failure to apply due attention to it can be catastrophic.”

According to (www.designingbuildings.co.uk, n.d.) The wall plate is a load-bearing structural member used horizontally and part of a timber framework.

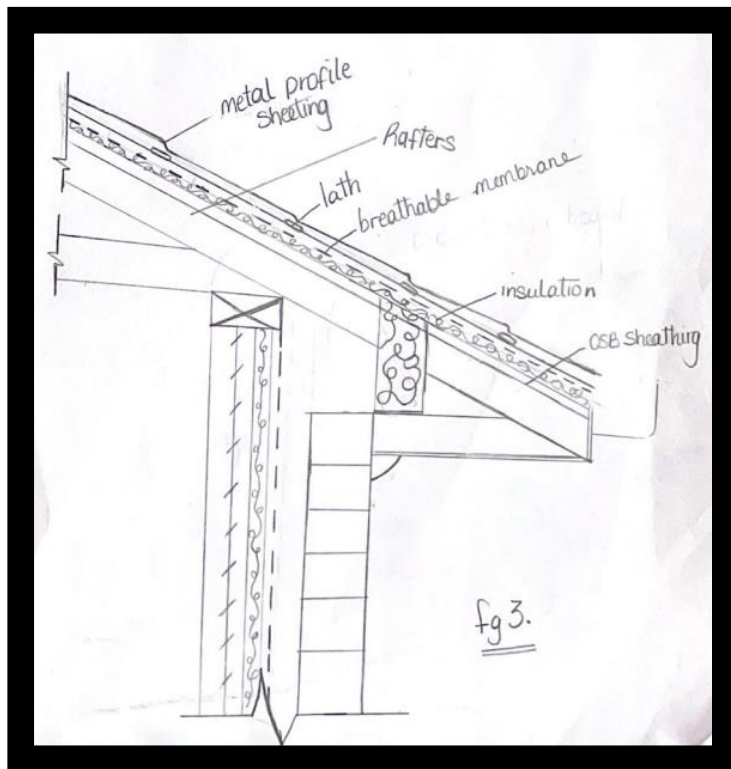


Figure 3.

Figure 3 is a diagram depiction of the eave structure on a building and its componer

According to (Designingbuildings.co.uk, 2018) rafter is a timber or steel component that extends from the ridge of the roof to the wall plate of the external wall. This structure creates the foundation of the eaves.

The OSB sheathing (Oriented strand board) is layers of wood compressed together with adhesives like wax, that are strategically place to give the eave foundation strength and stability. (www.roofingmegastore.co.uk, n.d.)

Insulation just like in walls, is needed in the eaves to control warm or cold temperatures.

Breathable membrane is placed to prevent water ingress to avoid the damp and mould growth. It is a house wrap which allows for ventilation in the roof. (jjroofingsupplies.co.uk, n.d.)

A Lath is a strip of wood beneath the lowest course of shingles on a roof (i.e., at the eaves) that raises the lower edges of the shingles, so they are nailed at the same slope as the shingles above.

Metal profile sheathing is the outermost layer of the eaves structure and provides a flat, uniform, and stable platform for nailing or screwing the roofing material.

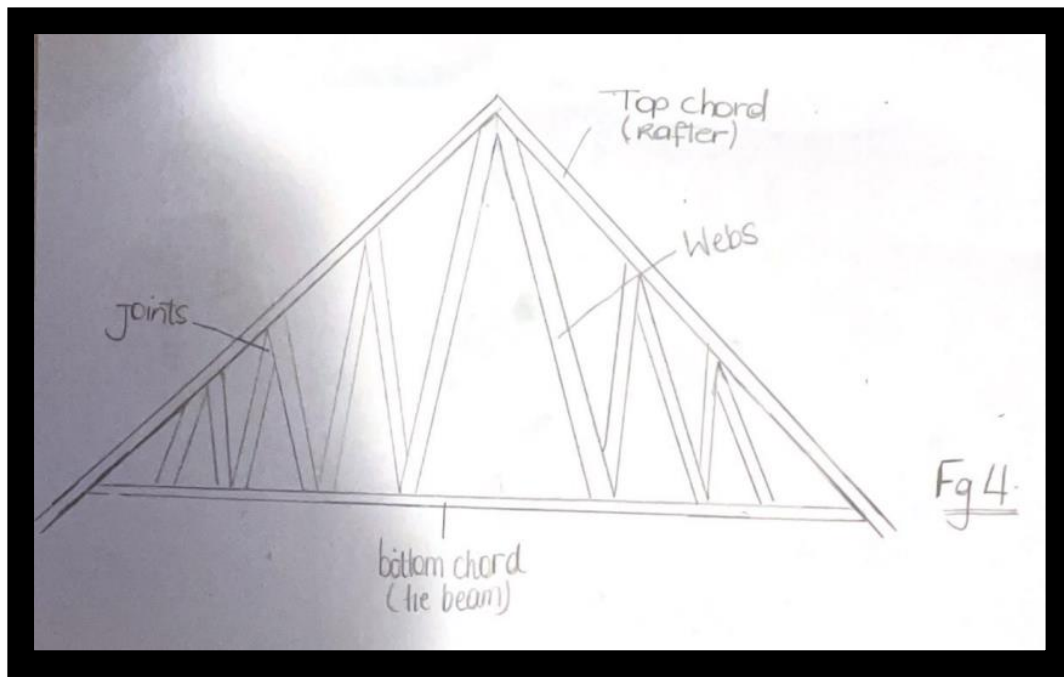


Figure 4.

Webs are sheets of timber or steel material that are placed strategically in triangles in tension and compression to evenly distribute weight load. The web connects the top chord to the bottom chord.

The top chord is a rafter, at the top where all the webs of the truss meet.

The bottom chord is known as the tie beam and is laid horizontally at the bottom of the webs. Its function is to carry ceiling loads where applicable. This member is subject to tensile and bending stresses.

The joints are areas on the truss where webs meet.

Truss

According to (Designingbuildings.co.uk, 2017) a truss is a structure which comprises of straight materials put together in a web of triangles, as one in a triangulated form and are connected by joints called nodes. This structure is used for roofs, towers and bridges that aids in supporting a structure by distributing weight evenly, changing tension and compression without bending and shearing force.

The truss is mainly comprised of 3 basic elements which includes a top chord which is usually in 'compression', a bottom chord that is in 'tension' and bracing which is between the top and bottom chords.

There are several types of trusses, which support different structures and its materials in different ways. Some of the more common truss structures are the simple truss, fink truss and flat truss.

In Figure 4. the truss structure illustrated is a double fink truss.

According to (Anon, 2021) the fink truss was designed by Albert Fink in 1854 commonly used in residential and bridge engineering and is one of the most popular types of home building truss.

Advantages of a Fink truss:

- The fink truss is simple, one of the most cost-efficient roof designs and allows for roof loads to be transferred on to the wall plates. The prices of building homes with fink trusses are lower than the cost to build traditional trusses.
- It is easy to assemble a fink truss due to the smaller size of member and less joints for them to fail.
- The fink truss is ideal for various architectural styles, allowing for a variety of roof lines while providing the necessary strength and stability.

Disadvantages of fink truss:

- It is delicate due to its smaller size in members and cannot withstand heavy roof loads for extended periods.
- Fink trusses relies on strong connections between the web members and cripples the ability to absorb forces as well as traditional trusses.
- The fink truss is weaker than traditional trusses and must be handled carefully when building.

Flat truss

Another type of truss system is the flat truss. A flat truss is designed with parallel top and bottom chords. This truss structure is more often used for floor construction. However, can also be used for roof applications.

Advantages of a flat truss:

- This type of truss is easier and quicker to install and require less labour.
- Flat truss is much easier to maintain and are safer.

Disadvantages of flat truss:

- Flat truss is not ideal and suitable for drainage.
- They have less stability and the ability to withstand weight.

Off-site construction

Off-site Construction can be defined as construction done outside the construction site in a more controlled environment such as a factory. According to the (The Constructor,2020), “Off-site Construction is a method of building that entails the planning, design, manufacture, transportation, and assembly of prefabricated building components on-site at a rapid rate and with a high level of finish. This level of accuracy is considerably superior to on-site construction.”

Off-site Construction may be confused with Off-site Manufacturing(OSM), Modern Methods of Construction(MMC) and Industrialized Building Systems(IFS).

Off-site Construction has become a prominent part of the construction industry in developed countries across the world. The advantages are the key features of Off-site Construction. The key features of Off-site Construction are reliable delivery, quality, time-efficiency, cost and waste. Therefore the use of Off-site Construction in situations when deadlines are quickly approaching on the project, when the project has repetitive use of structures internally and scenarios where on site has limited space for assembly. These are normal onsite problems on most projects showing the importance of offsite construction in developed countries.

Off-site Construction has four main methods being:

- Volumetric Construction.
- Hybrid Construction.
- Panel Construction.
- Sub-Assemblies and Accessories Systems.

Volumetric Construction “is a type of off-site construction that involves linking a succession of fairly large pre-built components, or modules to form a building. It's also known as prefabricated construction.” (Foot Anstey, n.d.) Three-dimensional units are manufactured in the factory and then transported to the job site where they are welded together. Steel, timber, or concrete frameworks can be used to construct the frames. As part of third-party approval, the firm has quality-controlled production systems. This form of volumetric construction can be conducted in a variety of ways, but the most usual method is to stack and/or connect factory-finished modules to produce a generally 'completed' structure. In the majority of circumstances, a fully modular assembly will only require little superstructure work to make the building complete and functional.

In the project the kitchen of the house can be made through the process of volumetric construction to increase the quality, as well as the consistency of the finish product.

Hybrid Construction uses special building technologies to deliver high quality, sustainable buildings on a smaller budget and in less time. These new technologies effortlessly combine concrete construction and traditional steel with precast concrete elements that are manufactured in a controlled environment. In order to create a single building, hybrid construction uses both volumetric and Panelized technologies. As a result, this structure is also known as semi-volumetric. Building facilities that are totally constructed or prefabricated in the factory are hybrid systems. These units have a finished look to them.

The bathroom facilities can be build in the hybrid construction method of Off-site construction.

Panelized construction,” often known as panelling, is a method of building walls, floors, and ceilings in a highly controlled environment using an off-site production facility. The modular components will be hauled to the construction site for installation once they are finished.” (Construction, n.d.) Panelized construction is a way of fabricating some components of a house in a factory rather than on-site. This building approach is a natural compromise between a traditional stick-built home and a fully modular prefabricated home. The inner walls of the house can be manufactured in the panelized construction method of Off-site construction.

The sub-assembly system is “the process by which the building components are initially constructed at the offsite location before they are permanently erected at the site. These elements include the building components, materials, equipment and prefabricated parts.” (The Constructor,2020)

Sub-Assemblies and Accessories Systems which is part of a component system, is any portion of a building that is manufactured in a factory and transported to the construction site. Sub-assemblies might be minor components like door locks and handles, or larger components like pre-assembled roof trusses. The truss for the timber house project can be assembled in a factory in the Sub-assemblies and accessories systems, where the environment is controlled.

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