



BACHELORS DEGREE ASSIGNMENT SPECIFICATION

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Programme:	Built Environment Programmes – Level 4.BSc (Hons) Project and Construction Management;BSc (Hons) Quantity Surveying; BSc (Hons) Building Surveying; BSc (Hons) Architectural Technology. HNC and HND pathways.		
Module:	Fundamentals in Construction Technology	Module Level (4, 5, 6):	4
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Lecturer:	Tom Duxbury	Internal Verifier:	Trevor Francis
Assignment Title:	Domestic New-build	Assignment No (x of x):	2 of 2
Hand Out Date:	Week Commencing 12/02/19	Submission deadline:	30/04/19

Referencing:	In the main body of your submission you must give credit to authors on whose research your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have read or quoted in order to complete this assignment (e.g. for books: surname of author and initials, year of publication, <u>title of book</u> , edition, publisher: place of publication).		
Disclosure:	I declare that this assignment is all my own work and that I have acknowledged all materials used from the published or unpublished works of other people. All references have been duly cited.		
Student's Signature:	<i>Assignments will not be accepted without a signature here</i> 	Date:	22.07.19
Turnitin: Lecturer totick to indicate if an electronic version of the assignment must be submitted to Turnitin. Note: the Turnitin version is the primary submission and acts as a receipt for the student. Both electronic and paper versions MUST be submitted by the same deadline. No marks will be released until both submissions are received. Late submission of either the electronic or paper version will result in a late penalty mark. Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, Refer. Only Year Tutors and the Programme Director may grant an extension.		YES	✓
		NO	

Learning Outcomes tested (from module syllabus)	Assessment Criteria. To achieve each outcome a student must demonstrate the ability to:
1, Identify the different types of substructure available for a low-rise building and techniques used in their production. 2, Define and produce annotated sketches that illustrate a broad range of common constructional forms, demonstrating understanding of their potential defect and repair needs 3, Identify the function and performance criteria that need to be addressed in buildings, their elements, components and materials.	Differentiate and select suitable building methods for these built forms and produce neat sketches that illustrate appropriate performance criteria. Produce evidential understanding of moisture management in modern standard construction and demonstrate an understanding of the defects that can occur.

FUNDAMENTALS IN CONSTRUCTION
TECHNOLOGY

ACBA4001: DOMESTIC NEW-BUILD

TABLE OF CONTENTS:

1. Question 1 - Foundation Method P₃ 1-2
2. Question 2 - materials and methods for the detailing of the following building elements and construction inter-faces P₃ 2-3
 - a. Ground Floor P₃ 2
 - b. The First Floor P₃ 3
 - c. Eaves detailing and roof covering P₃ 3
 - d. The Main Roof structure P₃ 3
3. Question 3 – Advantages and disadvantages of roof structures P₃ 4
4. Question 4 – Condensation and Ventilation P₃ 5-6
5. REFERENCES P₃ 7-8
6. Appendix
 - Appendix A
 - Appendix B
 - Appendix C
 - Appendix D
 - Appendix E
 - Appendix F
 - Appendix G
 - Appendix H
 - Appendix I

Q1.

a. Foundation Type

The foundation chosen for the domestic new build will be a trench fill. This type of foundation is the safest method and removes the risk of having bricklayers working below ground if a trench collapses. This foundation has also been chosen due to the subsoil being a firm clay and the uncontaminated land it is to be built upon.

Using the table from Appendix A, which was taken from BS8004 (BS: 8004, 2015, pg31) the minimal foundation width can be determined once the load is known.

The minimum thickness that can be used is 150mm (BS: 8004,2015)

According to BS6399-1, 1996 (Loading for buildings) a residential structure should be designed for a distributed load of 1.5kN/m², and a point load of 1.4kN.

To determine the maximum load, divide the area by 1.5kN and use the table from Appendix A.

Dead and imposed loads should be calculated in accordance with BS EN 1991-1-1, BS EN 1991-1-3, BS EN 1991-1-4 and BS 648.

The concrete used in the foundation will be poured to within 150mm of the surface ground level (BS: 8004, 2015,)

Appendix B shows a detailed sketch of the foundation requirements along with measurements that comply with Building Regulations 8004(2015).

Due to the subsoil being a firm clay, there is the potential risk of frost heave and subsidence (NHBC, 4.4). NHBC recommend in a low plasticity clay, that the minimum depth for excavation is 750mm below ground. (NHBC, 2011). Although NHBC recommend a minimum depth of 750mm, Services need to be considered. Therefore, a depth of 1000mm is to be used in accordance with BS 8103 (pg.37)

b. Damp Proofing

Damp proof courses are required in new buildings to prevent rising damp and in some situations to prevent penetrating damp. Approved document C of the Building Regulations, Site preparation and resistance to contaminants and moisture, suggests that a damp-proof course may be a, '...bituminous material, polyethylene, engineering bricks or slates in cement mortar or any other material that will prevent the passage of moisture.' (Approved document C,)

Approved document C also requires that to prevent rising damp, a damp-proof course should be:

- Continuous with any damp-proof membrane in the floor.
- At least 150 mm above the level of the adjoining ground if it is in an external wall.

- If it is in an external cavity wall, the cavity should extend at least 225 mm below the damp-proof course, or a cavity tray should be provided with weep holes every 900 mm so that water running down the cavity cannot pass to the inner leaf.

Q.2

(i) Ground Floor:

In approved document C (pg. 35); Floors next to the ground should:

- (a) resist the passage of ground moisture to the upper surface of the floor;
- (b) not be damaged by moisture from the ground;
- (c) not be damaged by groundwater;
- (d) resist the passage of ground gases.

A minimum ventilation void of 150mm should be provided below floor joists or 75mm below any wall plate.

On shrinkable soil where heave could take place, an allowance for movement should be added to the underfloor ventilation requirement to determine the minimum dimension of the underfloor void. The allowance for movement relates to the shrinkage potential of the soil as follows:

- high potential - 150mm
- medium potential - 100mm
- low potential - 50mm.

Voids should be ventilated by openings providing not less than 1500mm² per metre run of external wall or 500mm² per m² of floor area, whichever gives the greater opening area.

Ventilators should be spaced at not more than 2m centres and within 450mm of each end of any wall. Air bricks should be ducted through cavities and be unobstructed.

Every part of the void under a timber suspended ground floor should be thoroughly ventilated through openings on at least two opposite sides. Where this is not possible, effective cross ventilation from opposite sides should be provided by a combination of openings and air ducts.

Provision should be made for ventilation through partitions and sleeper walls. If necessary, pipe ducts should be incorporated in adjoining solid floors, separating walls or other obstructions. Ventilation should not be obtained through a garage. A Ground Floor sketch has been provided in Appendix C

Thermal Insulation (5.2 D23 NHBC)

(a) positioning of insulation

Insulation may be:

- insulation quilt, or

- rigid insulation.

Insulation quilt should be supported between joists.

Rigid insulation boards should be adequately supported on battens fixed to the sides of joists.

(b) cold bridging

The design should ensure that any risk of cold bridging is minimised, giving particular attention to junctions between floor and external walls.

Precautions include:

- extending cavity insulation below floor level
- linking floor and wall insulation
- providing perimeter insulation to floors
- facing the supporting substructure with insulation.
- External rendered finishes should comply with BS EN 13914 'Design, preparation and application of external rendering and internal plastering'.

(ii) First Floor – See Appendix D for drawing.

(iii) Eaves detailing and roof coverings – See Appendix E for drawing.

(iv) The Main Roof structure. See Appendix G for spacing and sizes.

- For trussed rafter roofs not subject to uplift, the minimum fixing should be two 4.5mm x 100mm long galvanized round wire nails, skew nailed, one from each side of the trussed rafter. Alternatively, truss clips can be used, fixed in accordance with manufacturers' instructions.(NHBC, 2011)
- Trussed rafters should be designed in accordance with BS 5268-3
- The part of an attic truss which forms a floor should have strutting in accordance with Appendix 7.2-F. of NHBC,2011.

(c) slates

Natural slates should be fixed in accordance with BS 5534 and BS EN 1991-1-4. Each slate should be nailed twice when centre nailed. (NHBC, 2011)

Q3. Advantages and disadvantages of trussed rafters.

Benefit

Trussed rafter roofs provide more economic solutions than traditional methods for the following reasons:

Roof structures are erected quickly.

Trusses are generally narrower giving a more economical use of the timber.

Minimal skilled labour is required to erect them.

Standard designs require only external walls to be load-bearing, thereby eliminating intermediate supports.

Waste is minimized.

Handling and storage costs are reduced by manufacturing off site.

There need be no restrictions on lower floor layouts since the trusses can clear span on to external walls although greater spans and room widths can be achieved by utilising internal loadbearing walls.

Trussed rafters are computer designed and factory assembled units, resulting in better quality control.

Trussed rafters can be erected quickly, offering cost savings and providing a weathertight shell earlier.

Disadvantages:

The frames are constructed for a specific weight only. Any amendments to the roof etc. would need to be inspected as they may not be able to carry the load.

The rafter may have unknowingly been damaged in transit and therefore unsafe to use.

What other method could be used?

Traditional cut rafters could be used. The downside is that a skilled labourer(s) would be required, increasing cost as well as the time it would take to make the roof.

Additional materials would also be required to create the roof.

Advantages: Can be made on site, no need to transport and less likely to get damaged in transit.

Q4. Condensation – Condensation within domestic buildings is caused when an object falls below the dew point temperature and warm air comes into contact with it (condenses). This is why in a building, condensation tends to appear on windows or walls (usually external). (GR5, 2015)

One method of reducing condensation could be to use triple glazing instead of double. Thicker walls and better insulation for homes have now made the windows colder compared to the rest of the house, triple could reduce the U value between the window and the rest of the house (albeit a small reduction compared to double glazing). Cost will be higher and the return in investment is around the same for double glazing (although not really suitable to replace an already built house, better suited to new a build). These are more often than not the coldest part of the room, also called cold bridges. Older double glazing can sometimes have condensation in between the glass, this is due to a damaged seal and air entering the void. How can this affect the fabric of the window? If condensation is internal, they could enter any damaged seals and create the problem above. The gases between the glass panes will disappear and will reduce the insulation effect and increase the U Value.

The increase in modern appliances used within domestic buildings, that generate moisture, have increased e.g. tumble driers, kettles, washing machines etc (Energy trust, 2019). Central heating is the most common form of heating homes in the UK (Energy Saving Trust, 2019), the rooms are warmer and so can contain more water, once the colder months arrive, this leads to moisture collecting on the windows and walls.

Condensation in insulation will affect its usability. Some fabrics e.g. Rockwool™ (Rockwool, 2019) are useless once moisture permeates them. This in turn will lower the wall/roof U value, and could fall below the building regulations of 0.18W/m²K for external walls and 0.13W/m²K for roofs (Part L1A,2011).

Condensation can cause certain damp or mould problems. This would be a risk to the occupier's health.

It can also affect the wooden structures/ plasterboard, concrete, insulation such as:

- Rotting timber – There are two common types: Wet and Dry rot, both occur from fungus.(Timberwise,2013).
- Damp in ceilings and walls
- Rising damp from cold floors
- Where air has restricted movement
- Insulation will fail if moisture enters it.
- Plaster Beetles -In a new house where plaster is still damp, or where damp plaster occurs in old property, very tiny, almost black beetles about 2mm long may be found - (BPCA, 2019)

How to reduce condensation?

- Install windows with vents, this will allow cooler air to enter the room and diffuse the moisture.
- Open windows when showering/bathing/cooking.

References:

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- BS 8103-1:2011 *Structural design of low-rise buildings Part 1: Code of practice for stability, site investigation, foundations, precast concrete floors and ground floor slabs for housing (Page 37)*
- BS 9250:2007 - Code of practice for design of the airtightness of ceilings in pitched roofs
- Building Regulations F2: 1995
- CI/SfB (47) Ne5 May 1999 Natural Slate Guide
- Domestic ventilation compliance guide 2010 edition – Section 5 New Dwellings
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- GREAT BRITAIN. Approved Document L2 – Air permeability requirements for buildings, 2006. London: The Stationery Office. Building Regulations Part L
- NHBC Standards, Chapter 7.2 : *Pitched Roofs* (2011)

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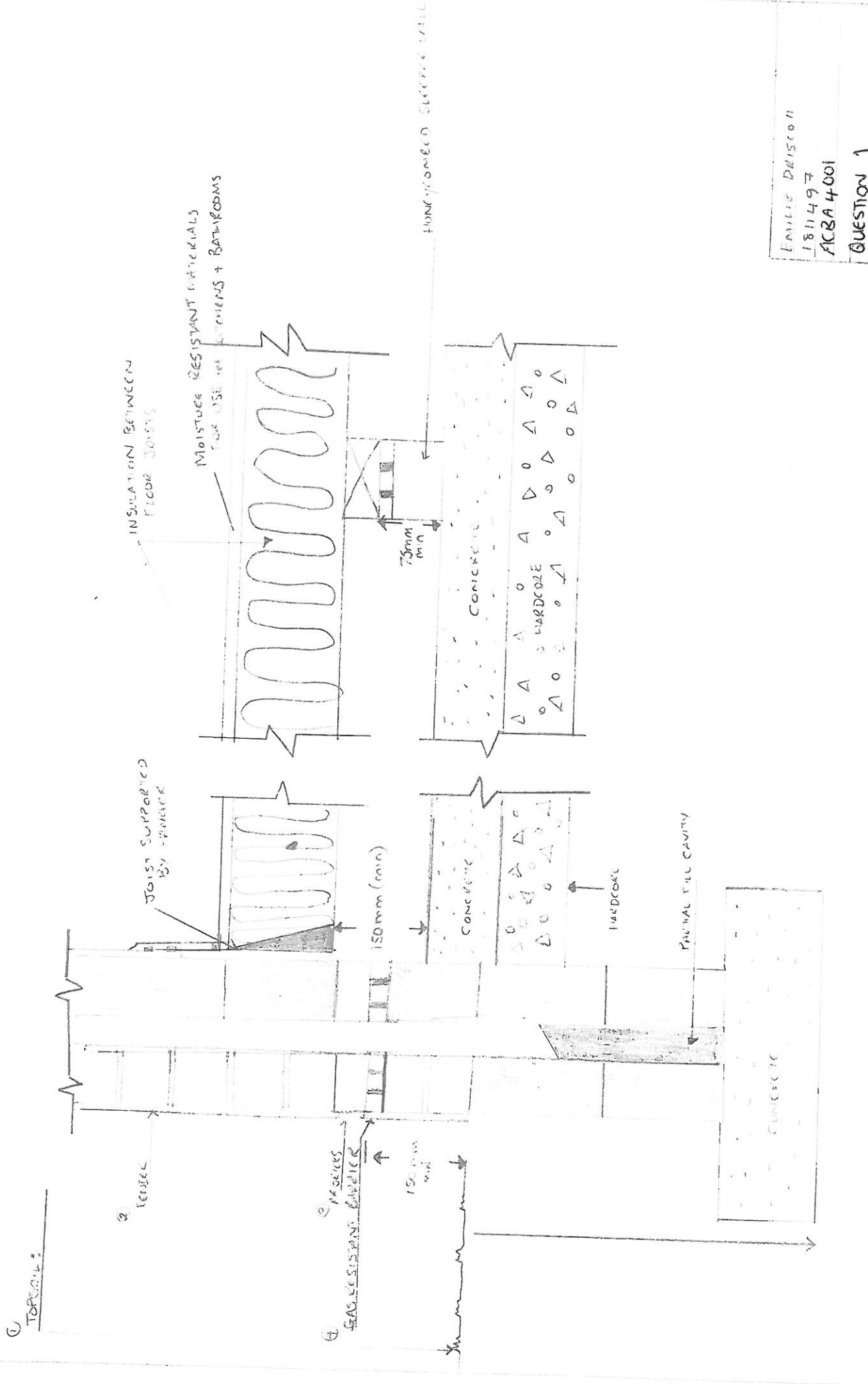
Timberwise(2019) *Identifying the difference between wet and dry rot*. Available at:<https://www.timberwise.co.uk/2013/04/identifying-the-differences-between-wet-rot-and-dry-rot/>(Accessed:15.07.2019)

APPENDIX A**Table 8 Identification of ground material and minimum foundation widths for wall load categories**

Rock or soil		Simple field test	Minimum foundation width ^A , in mm, for load category (kN per metre run)									
Type	Condition		A	B	C	D	E	F	G	H	J	
			(20)	(30)	(40)	(50)	(60)	(70)	(80)	(90)	(100)	
Clay Sandy clay	Stiff	Cannot be moulded in the fingers. Requires pick or pneumatically operated spade for excavation	250	300	400	500	600	650	800	900	1 000	
	Firm	Can be moulded with substantial pressure with the fingers and excavated with a spade	300	350	450	600	750	850	950	Refer to specialist advice		

APPENDIX B

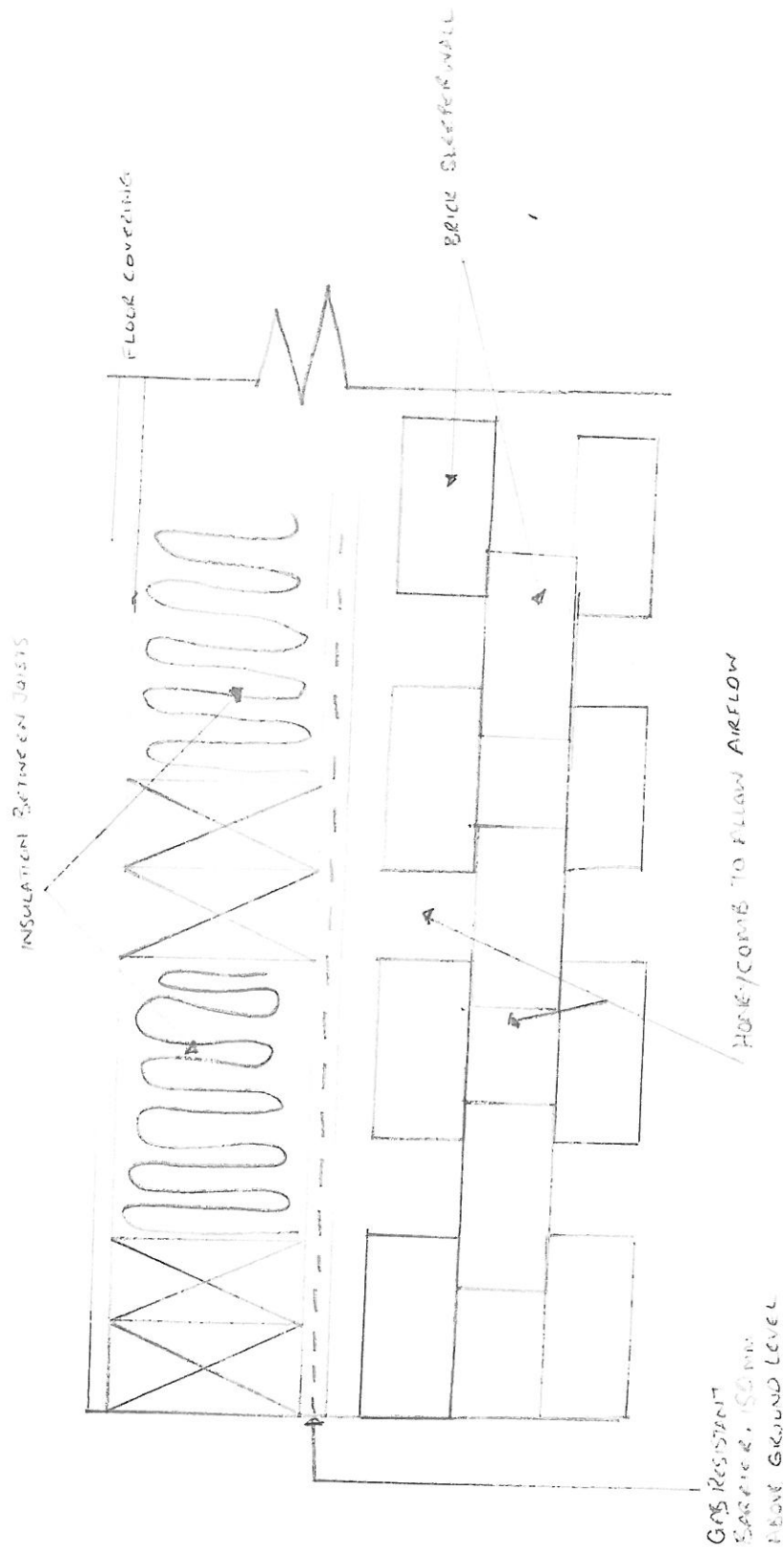
SUSPENDED TIMBER FLOOR



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QUESTION 1
NOT TO SCALE

APPENDIX C

HONEYCOMB SLEEVE WALL



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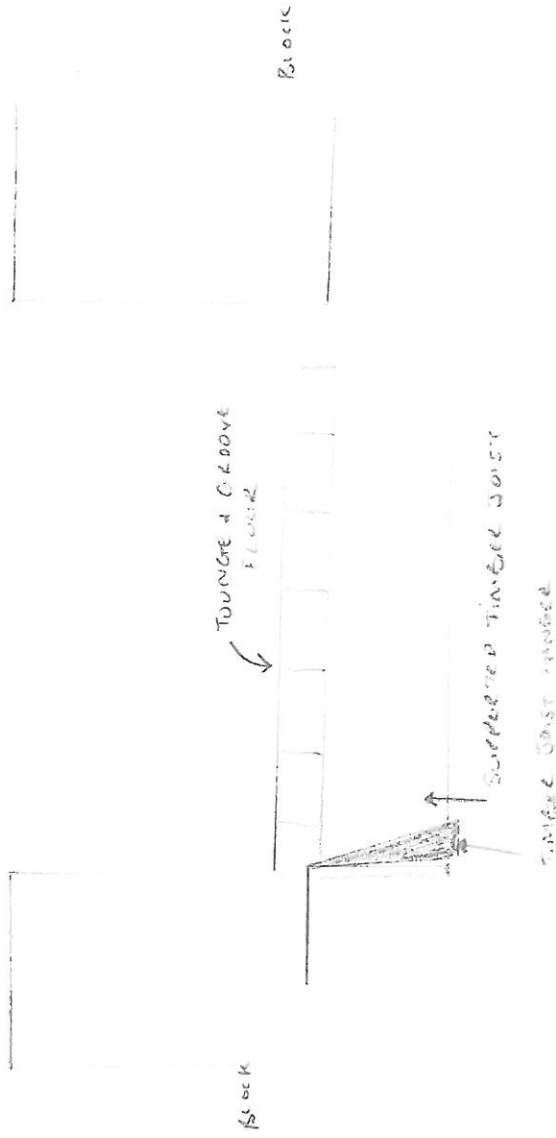
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QUESTION 2

NOT TO SCALE

APPENDIX D (1)

FIRST FLOOR & CEILING



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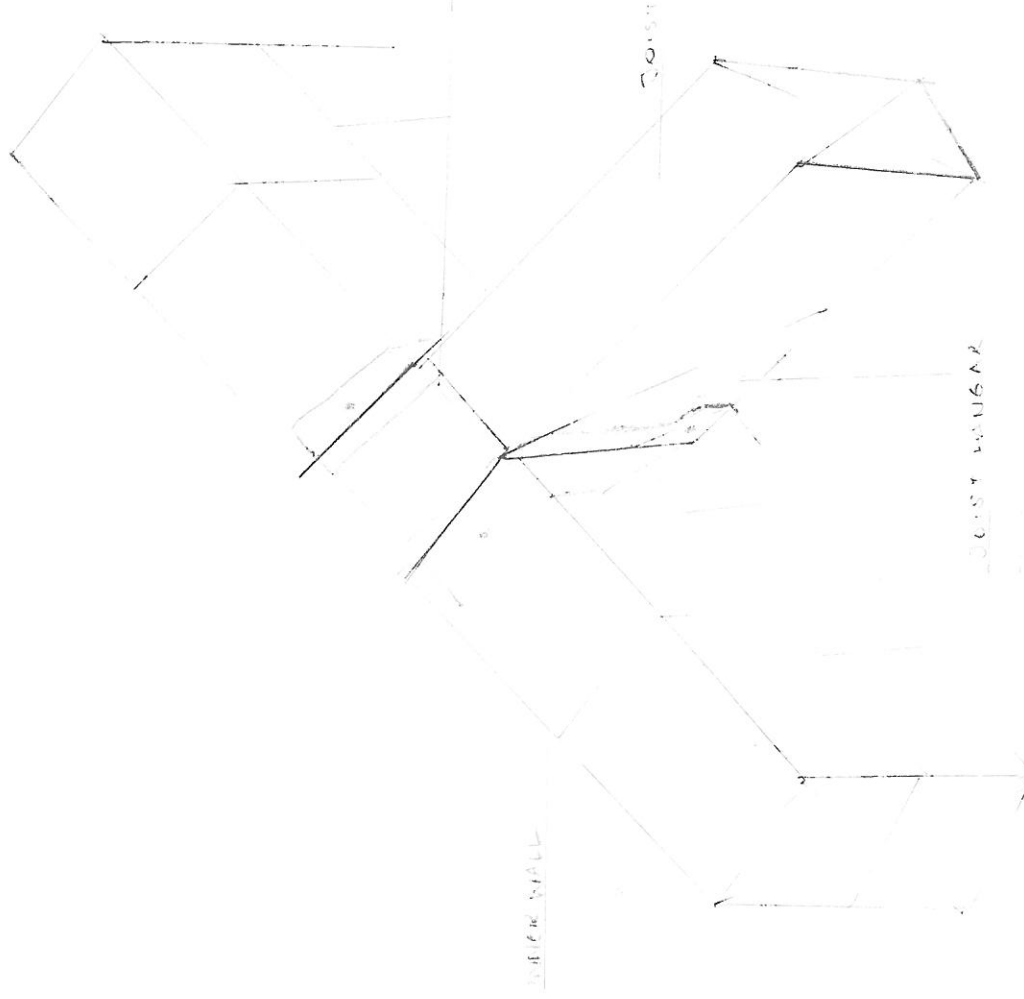
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QUESTION 2

NOT TO SCALE

APPENDIX D(ii)

JOIST HANGER DETAIL



JOIST BOLTS ARE SPACED AT 20\"/>

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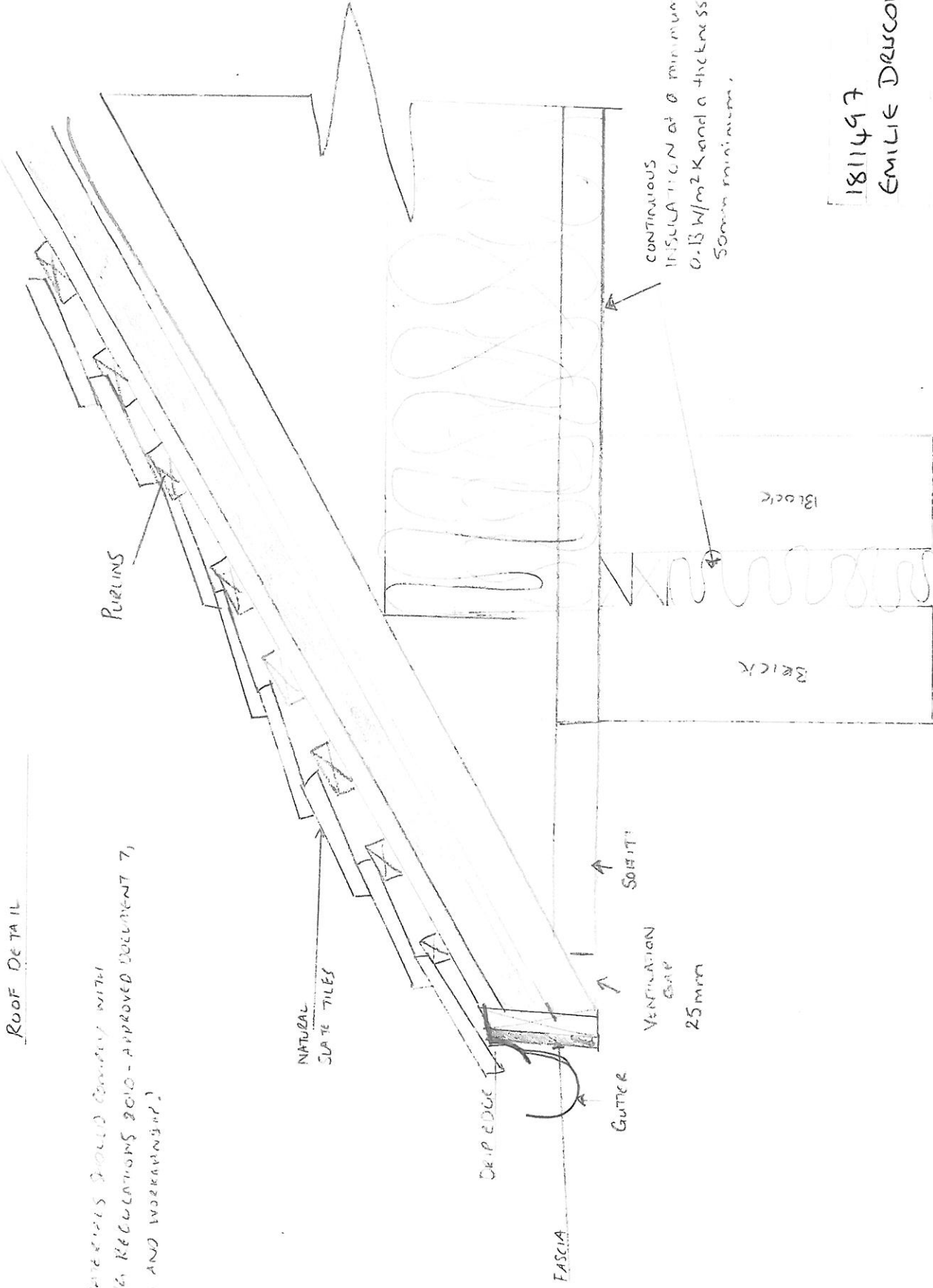
ACBA 4001
QUESTION 2

NOT TO SCALE

APPENDIX E(1)

ROOF DETAIL

ALL ROOF MATERIALS SHALL COMPLY WITH
THE BUILDING REGULATIONS 2010 - APPROVED DOCUMENT 7,
- MATERIALS AND WORKMANSHIP



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QUESTION 2.

NOT TO SCALE

APPENDIX E(ii)

VENTILATION TRANSFER THROUGH A FUME

NOTES

- 1) APPROVED DOCUMENT E, Page 33, States that a ventilation rate of 21 l/s is required for a 2 bedrooms house (not including ventilation)
- 2) Switch to electricity when does not produce as much moisture as gas
- 3) Use a dehumidifier if too much moisture is present

ROOF INSULATED TO A MINIMUM U VALUE OF 0.13 W/m²K (PART L1A, 2011)

REGULARLY OPEN WINDOWS FOR PASSIVE AIR FLOW

INSTALL EXTRACTOR FANS IN KITCHEN, BATHROOMS AND HIGH MOISTURE ROOMS. BS EN 13141-4, 2011.

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QUESTION 4

NOT TO SCALE.

EXTRACT VENTS ARE NOT BLOCKED

APPENDIX F

Appendix 7.2-E

Sizes and spacing of tile battens

The sizes and spacing of tile battens should be specified from the table below.

Batten lengths should be sufficient to span over not less than three consecutive supports.

The actual batten thickness (smaller dimension) should not be less than that given in the table nor more than 3mm oversize. Actual batten width should be within ± 3 mm of the basic size.

BS 5534 requires delivery notes to accompany the battens and the batten to be marked with the following information - supplier, origin, "graded BS 5534", and size.

	450mm span mm	600mm span mm
Slates (double lap)		
Natural: sized or random	25 x 50	25 x 50
Fibre cement or concrete	25 x 38	25 x 50
Clay and concrete tiles		
Double lap	25 x 38	25 x 38
Single lap	25 x 38	25 x 50

*Back 1

(b) member sizes

Unless the roof is designed by an Engineer in accordance with Technical Requirement R5, traditionally, nominal sizes of members would be as follows:

Member	Minimum size (mm)
Struts and braces	100 x 50
Wall plates (Scotland)	100 x 25
Wall plates (Northern Ireland & the Isle of Man)	100 x 38
Wall plates (other)	75 x 50
Hips	rafter cut + 25
Valleys	32 thick
Ridges	rafter cut + 25

Appendix 7.2-F

Strutting for attic trusses and cut roofs that have a floor

If the distance D exceeds 2.5m between

- the node points which form the width of the floor of the attic truss or
- the supports to a floor within a cut roof,

then additional strutting should be provided as follows:

Distance D	Rows of strutting
Under 2.5	none needed
2.5 to 4.5	1 (at centre of span)
Over 4.5	2 (at equal spacing)

Either herringbone strutting (38mm x 38mm timber) or solid strutting not less than three-quarters the depth of the floor and at least 38mm thick should be used.

Appendix 7.2-G

Durability classification of natural slates

Natural slates should have the characteristics given in the table below:

Characteristics	Code/grade from BS EN 12326
Water Absorption (not more than 0.6%)	A1
Thermal Cycle	T1
Carbonate Content (not more than 20%)	S1

APPENDIX G

Windows

The quality and thickness of normal window glass should be specified to suit the design wind load for the location, in accordance with BS 6262 and relevant data sheets issued by the Glass and Glazing Federation.

2.34 U-values shall be calculated using the methods and conventions set out in BR 443 *Conventions for U-value calculations*, and should be based on the whole element or unit (e.g. in the case of a window, the combined performance of the glazing and the frame).

In the case of windows, the U-value can be taken as that for:

- a. the smaller of the two standard windows defined in BS EN 14351-1; or
- b. the standard configuration set out in BR 443; or
- c. the specific size and configuration of the actual window.

Doors

The U-value of the door can be calculated for:

- a. the standard size as laid out in BS EN 14351-1; or
- b. the specific size and configuration of the actual door.

NOTE: For domestic-type construction, SAP 2012 Table 6e gives values for different window configurations, which can be used if there are no test data or calculated values.

APPENDIX I

Table 4 Summary of concurrent notional dwelling specification

Element or system	Values
Opening areas (windows and doors)	Same as actual dwelling up to a maximum proportion of 25% of total floor area ¹
External walls (including opaque elements of curtain walls)	0.18 W/(m ² ·K)
Party walls	0.0 W/(m ² ·K)
Floor	0.13 W/(m ² ·K)
Roof	0.13 W/(m ² ·K)
Windows, roof windows, glazed roof-lights and glazed doors	1.4 W/(m ² ·K) (whole window U-value) ² g-value = 0.63 ³
Opaque doors	1.0 W/(m ² ·K)
Semi-glazed doors	1.2 W/(m ² ·K)
Airtightness	5.0 m ³ /(h·m ²)
Linear thermal transmittance	Standardised psi values – see SAP 2012 Appendix R, except use of $y = 0.05$ W/(m ² ·K) if the default value of $y = 0.15$ W/(m ² ·K) is used in the actual dwelling
Ventilation type	Natural (with extract fans) ⁴
Air-conditioning	None

Table 4 Summary of concurrent notional dwelling specification (continued)

Element or system	Values
Heating system	Mains gas If combi boiler in actual dwelling, combi boiler; otherwise regular boiler Radiators Room sealed Fan flue SEDBUK 2009 89.5% efficient
Controls	Time and temperature zone control ³ Weather compensation Modulating boiler with interlock
Hot water storage system	Heated by boiler (regular or combi as above) If cylinder specified in actual dwelling, volume of cylinder in actual dwelling If combi boiler, no cylinder. Otherwise 150 litres Located in heated space Thermostat controlled Separate time control for space and water heating
Primary pipework	Fully insulated
Hot water cylinder loss factor (if specified)	Declared loss factor equal or better than $0.85 \times (0.2 + 0.051 V^{2/3})$ kWh/day
Secondary space heating	None
Low-energy lighting	100% low-energy lighting
Thermal mass parameter (TMP)	Medium (TMP = 250)