

DEGREE COURSE: PROPERTY MARKETING, DESIGN AND DEVELOPMENT

MODULE: DESIGN AND CONSTRUCTION

BRIEF:

YOUR CLIENT, A HOUSING ASSOCIATION, WISHES TO PROVIDE THE FOLLOWING HOME (AS A DETACHED BUNGALOW) FOR THE FOLLOWING RESIDENTS:

ONE – 3 BEDROOMED HOME WITH GROSS INTERNAL FLOOR AREA OF APPROXIMATELY 120m² FOR ONE PHYSICALLY DISABLED PERSON (WHO RELIES UPON A WHEELCHAIR AND A SPECIALLY ADAPTED MOTOR VEHICLE) AND ONE CARE ASSISTANT.

JANUARY 2007

- 1. Sketch the proposed plan layout and elevations for the bungalow. Discuss the form of construction and compare the advantages and disadvantages of your choice and form of materials.**

Illustrate and describe the proposed method of constructing the roof and state the reasons for the choice of materials and design.

There is now an increasing array of options for the house builder e.g. Masonry Shell, Timber Frame, Steel Frame, Insulated Concrete Forms - ICFs, Pods and Prefabs, Structural Insulated Panels - SIPs, Green Oak and Post Beam Structures, use of unusual structural materials e.g. earth, straw bales, hemp etc. (1)

My design is a three bedroom timber framed bungalow externally faced with brick. The roof will be covered with concrete interlocking tiles and the timber windows and french doors will be double glazed. A covered carport will be provided at the side of the property, with a slip resistant surface illuminated by a PIR sensor. A wide, slip resistant level path will lead from the carport to the bungalow entrance, where there is an illuminated covered porch and a level threshold to the front door. The gross internal floor area of the bungalow is **X sq metres**. The floor plan and external elevations are Appendices (A1-5).

The likely build cost of £984 per m² is based on the Homebuilding and Renovating Magazine's Average Build Cost Guide (February 2007). The factors taken into account are a medium sized single storey property built in the South East by a main contractor to a standard/good level of build quality, having regard to the special needs of the disabled person. The total build cost is estimated to be **£984 x Xsq metres**, excluding fees, services and external works which are likely to be in the order of £30,000.

The capital cost of building this bungalow is only part of the total cost of the project. The future operating and maintenance costs can be significant. Therefore, construction choices should be based on whole life costs. A study carried out by the National Audit Office on behalf of the ODPM states:

“The search for best value in homebuilding is not simply a question of finding the lowest cost. It is vital to maintain and enhance quality including those aspects of quality that affect durability, lifetime running costs and overall performance in areas such as sustainability”. (2)

Timber frame is increasingly becoming a popular method of construction due to its light weight, modular and engineered components, high quality performance, low maintenance and construction efficiency. In Scotland 60% of new build housing is timber frame and in the UK 1 in 6 new build housing is timber frame (1). A cross section of a timber frame panel is in (Appendix B)

The advantages of timber frame construction are:

- The prefabricated superstructure is factory built and erected very quickly in four or five days once on site.

- Weather delays are minimal.
- Once erected and weatherproof, bricklayers can work outside while other trades work inside.
- With timber frame construction services are easily run through and concealed within stud partition walls.
- It is cheaper and easier to build very high insulation levels into the timber studs of a timber framed house.
- Timber frame is a dry building system with minimal shrinkage and settlement. Decoration can be carried out soon after completion of the building without the fear of cracking or deterioration of finishes.
- In recent years there has been a significant rise in labour/material costs in the construction industry. Timber frame costs have risen modestly so cost differential between timber frame and masonry has diminished.(3)
- The external brick facing is a low maintenance finish.

The disadvantages of a timber frame are:

- The strongly growing demand for timber frame has caused a capacity shortage and the lead time required to get the frame on site can be 12 to 16 weeks. The speed advantage is diminished, although the amount of time spent on site is still reduced (3).
- The foundations for a timber frame building have to be accurate within a tolerance of + or – 5mm. (3)
- Changes to the timber frame are not easily achieved once the frame has been manufactured.
- Because all walls are timber stud, noise transmission between rooms must be addressed. There are effective dense soundproofing materials that can be used in timber frame such as “Soundslab” (Appendix E).
- The building of the superstructure is taken away from the site crew into the hands of the sub-contractor - the timber frame company.

As the plot is flat, free of contamination and surface obstructions, a strip foundation will be used, together with a pre-cast beam and block floor, insulated in accordance with manufacturer’s instructions.

This is a relatively straightforward roof and will be designed / constructed as an integral part of the timber frame package. Special attic trusses will be specified to provide a structural roof and floor in the same component (Appendix C). This detail

is cost effective and will allow conversion of the attic space into habitable rooms, should this be required at a later date.

The roof will be covered with concrete interlocking roof tiles which will be nailed to softwood treated battens laid over a breathable membrane, in accordance with building regulations and Housing Association criteria. Forticrete “Gemini” concrete tiles will be specified because they are award winning, competitively priced tiles guaranteed for 60 years (Appendix D). A proprietary eaves and ridge roof void ventilation system will be used. Rainwater goods will be plastic - gutters will be ogee and downpipes will be round. The roof tile and brick colour will be sympathetic towards the building materials in the surrounding area and in accordance with any planning requirements.

The roof space will be accessible through an insulated, draught-proof hatch. 400mm mineral fibre quilt insulation will line the roof space above the ceiling.

2. Describe ways in which the energy and internal environmental requirements in terms of heating, lighting, water, ventilation, noise etc – have been incorporated in the most energy efficient and environmentally friendly manner.

Timber is an organic, non-toxic and naturally renewable building material and in the UK is sourced from well managed softwood forests. Timber products have lower embodied energy and are recyclable, having less impact on the environment than masonry products. Timber is effectively carbon - neutral material and has the lowest CO2 cost of any commercially available building material. About 77% of the energy used in the production of wood products comes from wood residues and recovered wood. In contrast, concrete uses five times more energy to produce than timber. (1)

All timber used in the construction of this bungalow will have FSC or equivalent certification. This is one of the most rigorous checking systems for timber and it ensures that forests from which trees are taken are sustainably harvested and that forests are replanted. Timber will be treated only where essential for the circumstances and carried out industrially prior to use. The use of toxic chemicals and hazardous materials including paints containing lead will be avoided. Asbestos based products will not be used. Wherever possible, products in which formaldehyde is used in the manufacturing process will not be used. Appliances containing CFCs, HFCs and HCFCs will not be used.(4)

In addition, the bungalow will be more energy efficient and environmentally friendly because:

- The walls and roof will be insulated and have a U value of 0.25. (The U value is a measurement that describes how well building materials protect against heat loss. A typical brick cavity has a U value of 1.21). The improved insulation will reduce heating costs and conserve energy.
- The timber window frames will have factory fitted double glazing.

- Roof space will be insulated with 400mm zero ozone depletion insulation.
- Sound insulation will be included in all timber stud partitions between rooms, sufficient to obtain an A rating in the Green Guide to Housing Specification (4).
- South facing rooms will have large glazed areas to trap the sun's energy and passively heat the air coming into the home.
- Under floor heating will be installed and fired by an energy efficient gas condensing boiler which will convert 98% of the energy from gas into heat. As specified by the National Housing Federation Part C Chapter 8 item 8.8.1, the heating system will be designed to achieve internal air temperatures of between 18 degrees C and 22 degrees C when external air temperature is minus 1 degree C.
- The efficient draught proofing will be installed using improved seals around doors (including letterbox) and windows.
- Every habitable room will have a window which can be opened for ventilation. When the windows are closed, the trickle vents fitted to each window can be left open. In the bathroom, bedroom 1 en-suite and the kitchen, there will be electric extractor fans fitted. In the lounge there will be an air inlet to provide ventilation for the gas fire.
- All internal and external lighting will be installed in accordance with Building Regulations (Approved Document L1A - Conservation of fuel and power 2006). To achieve the desired Target Emission Rate (TER) as scheduled within the document, internal low energy lighting points will be used at a ratio of one per every four fixed light fittings, or at least one per 25m² dwelling floor area excluding garages, whichever is the greater. Low energy light bulbs are 80% more efficient and produce the same output as traditional bulbs and they last ten times as long. External lighting will be designed to accommodate only compact fluorescent lamps (CFL) or strip lights. External security lights will have a maximum wattage of 150 watts and be fitted with movement detecting shut-off devices (PIR) and daylight cut-off devices.
- Energy efficient A rated appliances will be installed.
- Water saving features will include low flush toilets, spray taps and external water butts to harvest rainwater for the garden - a minimum of 200 litres is specified by the Housing Association.
- Waste separation facilities will be provided in the kitchen to encourage waste recycling.