ECOLOGY BUILDING SOCIETY – HQ Environmental Specification

Building Design Objectives:

- to create an inspiring attractive building which will be a pleasure to work in over the years,
- to demonstrate sustainable design as an inspiration for others
- to create comfortable and stable working conditions throughout the year
- to reduce the amount of material used in the building and therefore minimise the CO2 emissions in its manufacture and transport
- to reduce the level of energy needed to heat and cool the building and so minimise CO2 emissions in use
- to achieve value for capital investment

The Site

After a long search for either a suitable building to convert or refurbish, or a site for new-build, growth in business meant that relocation became urgent. For continuity of staff it was important to locate close to the existing premises. The Silsden site is in a good location, accessible from the station, and near to the town centre; it is on the edge of a business park; it was not farmland and could be described as a brownfield site.

Building form & orientation

The shape and siting of the building has been influenced by the long narrow shape of the plot, by the open views to south, north, and west, and by the need to avoid a view to the office/warehouse building across Belton Road.

The site and therefore the building has its long axis north-east / south-west, which became the line of primary circulation down the sloping site, from the main entrance through the building, aligning with a distant view of the south-west hills.

We took the decision to prioritise the optimum siting of the building in the landscape, for the enjoyment of staff and visitors.

The building is placed close to the centre of the site at its widest point, away from the nearest houses, and engages with the existing mature trees. The main entrance is located at the north-east end of the building, nearest the pedestrian route to the town centre, allowing expansion space to the south-west.

Building scale:

The creation of a small - scale building with a low roofline means the building fits well into its location on the edge of a small country town. The single storey

section facing Belton Road allows high-level light into the centre of the ground floor and the first floor deck fits within the roof-space facing the garden.

Natural light:

The building was designed to bring as much natural light into the working areas as possible. Since the smaller rooms without windows – plant room, toilets and archives – are located alongside Belton Road as a more defensive, cellular structure, no natural light is available through the spine wall. Light from above, from high level and roof windows, was brought in to reach all floors via the double height space over the main route through the building, and is a useful device to achieve a more even spread of light.

Most of the glazing is along the long rear elevation, lightweight in contrast, which allows views into the proposed gardens and to the large mature trees by the west boundary wall. The trees will help to protect the building from any potential glare from the low westerly summer sun.

Rather than provide external shading to any of the windows, it was decided to install internal blinds and shading where necessary, and additional tree planting opposite the north-west and south-west windows. During the settling in period, staff recorded where glare or overheating problems arose, and shading is being installed to suit particular needs.

The reception area receives natural light from the fully glazed main entrance lobby, which provides clear views of the site entrance and the pedestrian access bridge, and from the south west, with views to the gardens.

Additional natural light reaching the ground floor open plan office area via sunpipes was originally proposed but cut out to save costs. Monodraught Diamond Sunpipes were installed to supplement natural light provision in the offices of the chief executive and finance director and to bring light into the toilets and archive room.

Building Elements

Floors:

Floor design was based on the principle of using the floors as heat stores. Thermal mass is provided by the heavy, dense concrete ground floor slab & first floor deck.

Floor surfaces should be as exposed as possible – a linoleum floor finish rather than carpet, to allow the properties of the dense material to take effect

The floors absorb heat, from sunlight reaching the floor surface through the windows, from the gas fired space heating system (in winter), from computers and other office equipment, and from the building occupants. This stored heat will be released from the floor and radiated back into the room when the surrounding air temperature cools down.

The process of storing and releasing heat will result in a stable, even radiant temperature throughout the day creating a comfortable environment for

occupants. Maximum use is made of incidental energy, minimising the need for dedicated space heating.

In summer, the floors absorb daytime heat, from solar gain, equipment and occupants, and release this stored heat overnight as the air temperature cools. The building is then comfortably cool at the start of the working day.

This thermal mass can be achieved at the lowest cost by the use of concrete and concrete block. It can be achieved without cement, but probably not in the context of a standard competitively tendered building contract, since speed is critical.

Internal walls:

The internal heavy dense masonry wall running along the main route through the building, together with the masonry cross walls, also provide thermal mass. They absorb and give out heat in the same way as the floors, and assist in the creation and maintenance of a comfortable internal environment, winter and summer.

Plastered and painted concrete blocks were used for the central spine wall and recycled bricks for the cross walls. The recycled bricks are also painted white, to reflect and maximise the light.

Horizontal boarded timber cladding wraps round both external and internal walls surrounding the kitchen & toilets.

External walls:

Part of the external walling is built of concrete block inner & outer leaves, with wide cavities for insulation. In some areas, the outer block leaf is replaced by dry-stone walling, in others by boarded timber on a timber frame.

Above first floor level, the gables are boarded timber on a timber frame with a plasterboard inner face.

The dry-stone walling along the Belmont Road frontage provides a visual connection to the field walls of the local area rooting the building in the local vernacular.

It is the view of our ecological design consultant, David Olivier, that the building should be as air-tight as possible, and that masonry construction would be the best way to achieve it, in terms of what is technically possible to build. He believes it is more effective to save energy by preventing heat loss through air-tightness than by avoiding the use of concrete and concrete blocks.

In terms of environmental costs during the life of a building, the capital build stage accounts for 10% of the total, and the costs arising from the building-in-use accounts for the remaining 90%. It is clear therefore that minimising energy use during the life of the building had to take priority.

Boarded timber on a timber frame, chosen also for aesthetic reasons, has been widely used in ecological building design, as timber is itself a renewable resource. It can be, and was, obtained from sustainable sources.

Windows and doors are high quality timber with Iplus low E glass, argon-filled double glazing from The Green Building Store.

Timber posts within external window screens are made from Parallam : re-cycled waste timber packed together in a resinous adhesive.

Roof:

A reasonably lightweight roof has been selected, since a heavy concrete roof would have meant either a masonry internal supporting structure, dividing up the ground floor office space into small areas, or a heavy steel frame, allowing an open plan office. Neither was thought to be the best use of resources or allow light open offices.

All roofs are constructed with Fillcrete Masonite beams, a good example of ecological design, where otherwise scrap timber is used to form a sturdy " i " beam. The thin hardboard used to form the web avoids the problem of cold bridging, when insulation is packed within the depth of the beam.

The choice of a nature roof (RGC "Rootstop" Green Roof System by Ram Roof Garden) was made partly on aesthetic grounds, and partly to allow the colonisation by insects, worms etc, of a similar area to the footprint of the new building. The sedum planting reduces the need for watering to a minimum.

Supporting structure:

The main nature roof above the two storey area is supported by ply box portal frames, bearing on to the ground floor and spanning on to the external upper section of the masonry central spine wall.

The single storey aluminium-covered roof facing Belton Road spans from the external masonry wall to the central spine wall.

The single storey roof over the main entrance, kitchen, toilets and part of reception spans between a steel post / beam structure and the inner masonry leaf of the external walls.

The first floor deck is largely supported by recycled brick cross walls at intervals along the building. At the timber framed external south-west wall, and over the reception area, the deck is supported by steel posts and beams. Masonite is also used as posts to form the external timber frame walls, clad in timber boarding. Parallam posts and beams are also used as supporting structures within the building.

Insulation:

High levels of insulation have been provided throughout. Rockfloor has been used beneath the ground floor slab (100mm thick) and to external walls (up to 200mm thick) Warmcell re-cycled newspaper is used in the roof (300mm thick)

Finishes:

Nature roofs - Sedum planting to both the main double height roof and the single storey roof over the main entrance area.

Re-cycled aluminium (Rigidal) - to the single storey roof facing Belton Road, with re-cycled aluminium gutters and rainwater downpipes.

External render - lime render (The Traditional Lime Company) to the concrete blockwork is coated with naturally pigmented limewash.

Timber boarding - which is naturally resistant to insect attack has been chosen so that it can be left untreated; cedar, larch and douglas fir for external boarding to gables and the north-west wall and cedar for internal boarded areas.

Internal gypsum plasterwork - is finished with organic paints, light colours selected to maximise reflectivity and therefore lighting levels.

Suspended acoustic ceiling panels - are Heracoustic F woodwool slabs, sprayed white with organic paint to reflect light.

Ceiling panels - are birch-faced ply with light stain.

Floor coverings - are mostly linoleum, some rubber, with wool or sisal carpet to the small offices and anti-slip ceramic tiling to the toilets. Where timber is coated, organic stains or paints have been used - timber boarded flooring is coated with hard wax oil.

Recycled glass mosaic wall tiles – are used in the toilets and kitchen (Smith & Wareham)

Snowflake recycled plastic counter tops – are used in the toilets (Smile Plastics)

Bamboo kitchen worktops.

Sanitary fittings:

Low flush wcs (Elemental Solutions) are used throughout, with ceramic wash-hand basins

Building Services

Heating system:

A low temperature hot water system was chosen, provided by gas fired condensing boiler - the most efficient type available - and a range of radiators to suit their location. The system operates at flow and return temperatures of 60/40° to maximise the efficiency of the system, halving the amount of water circulating and reducing the pump duties to one eighth of normal design requirements.

The provision of space heating allows sufficient flexibility in the system to provide comfortable internal temperatures throughout the building on the coldest winter days, without needing to compensate by other measures, such as the over-provision of insulation. Reliance on the heat emitted from artificial lighting, for example, would not allow distribution of the heat available to where it is required by the building occupants (at floor level).

Natural ventilation:

Trickle ventilators are used throughout the building, together with opening roof windows to provide a flow of external air when and where required. This element depends largely on a successful management strategy and co-operation by all staff members.

Air leakage has been reduced to a very low level so that the amount and direction of natural ventilation can be carefully controlled. The building has been designed to exceed an air leakage target of 5 m^3 / hour / m^2, comparing favourably to the best European and UK buildings. The building operates on 2 air changes per hour (the usual level in the UK is 8 air changes per hour)

Mechanical ventilation:

Many green building design proposals aim to avoid the use of any mechanical ventilation, however the energy consultant felt strongly that mechanical ventilation should play a part in the ventilation strategy, in order to allow greater efficiency in the design and operation of the heating and cooling systems within the building. This is mainly to ensure effective air distribution throughout the office spaces, creating a greater degree of stability of temperature and air quality. The mechanical ventilation system is designed to be switched on by staff as necessary during cooler parts of the year only and replaced by natural ventilation when the weather is warm.

The ventilation system will provide additional night time cooling during the summer months, for times when the external air temperature is too high for natural cooling of the thermal mass to be sufficient. The system is designed to work automatically throughout the evening and night-time and responds to the temperature to be achieved. The system also provides emergency heating if needed, at any time of year.

Full heat recovery is obtained through the ventilator units, to further reduce the heat input required from the boiler. It is essential therefore to use mechanical, rather than natural ventilation during cooler periods.

Hot and cold water services:

Hot water is provided mainly from an unvented central hot water storage cylinder adjacent to the boiler. Separate electric powered hot water storage is provided for the less frequently used kitchen and visitors' toilets, avoiding the need for long pipe runs from the boiler. Cold water is supplied from the mains except to the WCs, which are fed from an underground rainwater collection tank. The rainwater is channelled into the tank from the roofs, and is also used to irrigate the planted roof.

Lighting and electrical systems:

The innovative high efficiency lighting installation has been designed to make use of the reflective wall and other surfaces, reducing the power input required for the necessary lighting levels. Mirrors have been built into the task lighting units to further increase reflectivity.

The power distribution is standard, but maximises flexibility by the use of inexpensive ducts within the concrete floors and purpose designed outlets for power, lighting and data within each bay.

A 5kW photovoltaic panel system has been installed on the south-east roof to contribute to the electrical power needed for the building – encouraging larger-scale and cheaper manufacture of the system.