INSIDE HOUSING 2009 SUSTAINABLE HOUSING AWARDS
CAT 3: SUSTAINABLE SOCIAL HOUSING REFURBISHMENT PROJECT OF THE YEAR

Submission for consideration by:
Assist Architects, 11 Maritime Street, Edinburgh

Project Title: Edinburgh World Heritage Site
Low Carbon refurbishment

Location: 9-11 Gilmour's Close, Grassmarket, Edinburgh

Client: Hillcrest Housing Association
Design Team: David Adamson and Ptns (QS), Clark Contracts (contractor), Waterman Group (structural engineers), Faber Maunsell (service engineers)

BRIEF OUTLINE DESCRIPTION OF PROJECT

The refurbishment of two 19th Century tenement Closes (formerly used as a homeless hostel but partially vacant) located at the centre of the Edinburgh's World Heritage site to provide **17 energy efficient new flats** for social housing with 10 of these providing specialist accommodation for vulnerable young people.

This project specifically tackles the difficult task of refurbishing an existing building to minimise CO2 emissions and dependency on non-renewable energy.

To achieve this, Assist specified a **Ground Source Heat Pump**, with 70m vertical bores drilled into the bedrock to provide onsite renewable energy for hot water and space heating. We also designed **south facing sunspaces** for passive solar gain, combined with a **positive input heat recovery system** to minimise the requirements for a non-renewable energy source. Finally, **enhanced insulation** was wrapped inside the existing stone fabric and **secondary glazing** added to the existing sash & case windows to minimise heat loss.

Alongside this was a programme of extensive stone conservation and façade protection funded and monitored by the Edinburgh World Heritage Trust.

Improving Energy Efficiency and Carbon Footprint Reduction

To minimise non-renewable energy consumption and reduce the building's carbon footprint, we specified a **Ground Source Heat Pump** to provide onsite renewable energy for hot water and space heating. The GSHP was a Thermia Robust 38 model supplied by **Eco Heat Pumps** who also supplied all the hardware required for this system.

14 no. 70m vertical bores were drilled into the bedrock at the rear of the building and this in itself proved a logistical challenge as the only way of accessing the rear of the building is through one of two Close Pends, 2m wide and 2.5m high. A specialist drilling rig was commissioned to crawl through the Pend and over a period of several days drilled the deep holes for the pipe loop (because of the site location and it's restricted footprint, the conventional coil loop system of GSHP laid out over a large area at shallow depth wasn't possible and a deeper, more intensive system was specified which took up less ground area).

The GSHP was connected to a communal heating and hot water system that supplies both Closes with hot water, heating the flats via a low temperature under-floor heating system from **Velta**. Each flat has three thermostats, one of which is located in the sunspace, to control the room temperatures.

Heat meters have also been fitted to measure the efficiency of the Heat Pump installation; initial calculations predict an efficiency rating for 4:1 but we intend to monitor this and also collect data from each flat to assess the true impact of this renewable system on the tenant's fuel bills.

Improving U-values and minimising heat loss

This project re-uses an existing historic tenement building which has a nominal footprint, with shop units on the ground floor and four storeys of refurbished flats above. The existing building fabric is a solid masonry construction with plasterboard lining which had an exceptionally high heat loss and u-value.

Our objective was to significantly improve the u-value and reduce the heat loss from the new homes above the basic requirements of the Scottish Building Standards.

To achieve this, 100mm of mineral wool was fitted to the inside of the masonry and a 50mm air gap created within which was hung Alreflex 2L-2 Dry Lining Wall Insulation which consists of two layers of polythene bubble sheet faced on both sides with an aluminium foil lining. This make-up was then sheeted with plasterboard and the combined effect was an improvement from approx **3.0 W/m²K** to **0.22 W/m²K.**

300mm of mineral wool quilt was added within the roof space to achieve a U-value of **0.14 W/m²K.** Between each flat a sacrificial ceiling contained 100mm of insulation, primarily for acoustic compliance, but the **Velta** under floor heating system was laid within 50mm rigid polystyrene to minimise any heat loss beneath.

The windows also posed a significant problem, being original sash and case single glazed units. Due to the building's location within the Edinburgh World Heritage site, it wasn't possible to replace the windows with double or triple glazing, so we opted for secondary glazing, which had to meet EWHT's conservation requirements, to help reduce the heat loss from the flats.

The orientation of the building is east-west along the southern edge of the Grassmarket and as such, the rear elevation wasn't susceptible to as strict conservation controls as the front street elevation to the north. To maximise passive solar gain, we designed south-facing sunspaces which are cantilevered off the main structural core of the building. These provide passive solar gain which, combined with a positive input heat recovery system, minimise the requirements for a non-renewable energy source, and provide attractive semi outdoor spaces within the high-density fabric of the Old Town.

Minimising reliance on non-renewable fuel and combating fuel poverty

A Positive Input **whole home heat recovery system** from **Expelair** was specified to work in tandem with the sunspaces and the GSHP to minimise the use of non-renewable energy. The MVHR system provides whole home ventilation using a combination of the positive input ventilation principle, continuous low level extract ventilation and heat exchange heat recovery. Simultaneously, air is extracted from 'wet' areas such as the kitchen, bathroom and sunspace. Supply and extract pass through a heat exchanger which transfers heat to the supply air and discharges the extract air outside.

Reducing construction waste and recycling/sourcing green building materials

It is well known that reusing and refurbishing old buildings can save more $C0_2$ emissions than building environmentally friendly new ones. In this instance we have taken a redundant city centre

building and through grant aided conservation and the implementation of a sustainable design strategy we have extended the lifespan of the building and provided new accommodation without the emissions, waste and use of embodied energy associated with constructing a new building.

The conservation work included repairing the stone façade with **natural stone** and **lime mortar (aided by advice from the Scottish Lime Centre)**, the re-use of the existing slates and the addition of **second-hand Scottish slates** where required, and the **overhauling** of the **existing sash and case windows**.

Because we were reusing an existing building, apart from the strip-out (where waste from the old building was sorted by skip), there was **significantly less waste produced** in the refurbishment than in the construction of equivalent new building. A minimal amount of concrete was used throughout the building (primarily for the new GSHP plant room), and as noted, all stonework repairs and re-pointing was undertaken with **lime mortar**. Steel was used to cantilever the sunspaces from the original structure of the building but this can be recycled at the end of its lifespan. Structural and finishing timber was from a sustainable source whilst all insulation materials used have a low GWP and ODP of zero. The aluminium cladding to the sunspaces is **100% recyclable**.

Conservation of water

Re-using an existing building meant no new masonry products, concrete or mortar was required. This omission from the construction process meant that **significantly less water was used** in this refurbishment than compared to a new build, and this **minimised the amount of potential discharge of contaminated liquids** into the existing drainage system.

Dual-flush WCs were also specified for the flat bathrooms and **aerated taps** were also specified to minimise water use by the tenants.

Minimising Construction Traffic

The location of the site on the main busy thoroughfare of the Grassmarket combined with the fact that the rear of the building can only be accessed by vehicles through a 3m high pend meant that the removal of waste (as well as the delivery of materials) had to be carefully co-ordinated and limited. A bus stop and pedestrian crossing in front of the site restricted the number of skips which could be loaded at any one time so **waste was sorted on-site** prior to being taken to the front of the building and removed.

Car-free scheme

Due to it's city centre location, with local bus routes and train stations within a few minutes walk from the site, and also due to the site's tightly built-up environment within an historic part of a World Heritage Site, the proposal was **designed to be car-free**. This also suited the requirements of the particular users, with 10 units providing specialist accommodation for vulnerable young people.

Summary

This project took a redundant and historic building in the centre of Edinburgh's Grassmarket, improved it's Energy Efficiency, reduced it's Carbon Footprint, refurbished and conserved it's historic fabric, ensured the building would be fit for use for another 60 years and provided specialist social housing. Thus we feel that this project is a strong candidate for INSIDE HOUSING's 2009 sustainable housing award sustainable social housing refurbishment project of the year.

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