February 1990

BEST PRACTICE PROGRAMME

Good Practice Case Study 4

REFURBISHMENT OF PRE 1919 TERRACED HOUSING

Energy Efficient rehabilitation of PRE 1919 Houses on Merseyside

A package of energy efficient measures incorporated as part of a major refurbishment can substantially reduce heating bills in older housing, as well as providing additional benefits for the occupants and building owner.

SUMMARY

Many pre-1919 houses require major refurbishment to upgrade them to acceptable modern standards of accommodation. The standard refurbishment takes little account of energy use and even after refurbishment the houses can still be expensive to heat and continue to suffer from problems such as condensation and mould growth.

To investigate the benefits and economics of an energy efficient refurbishment, Merseyside Improved Houses (MIH), a housing association in the North West, provided a group of 25 pre-1919 houses in Liverpool. The houses were given an energy efficient upgrade; the measures included internal insulation on external walls, and attention to adequate ventilation.

Monitoring following the refurbishment confirmed that energy savings averaging £51 per house per year can be achieved with higher levels of thermal comfort. In addition the building owner benefits because the elimination of condensation reduces the need for frequent redecoration — saving on maintenance costs; the houses are warmer and more comfortable and consequently far more popular with the tenants.

BENEFITS

- Average energy saving £51 per year on space heating for each dwelling.
- Average internal room temperatures increased by 1°C compared with the control group of houses.
- Elimination of condensation and mould growth.
- Reduced maintenance costs for the future.
- A more attractive and acceptable external environment.
- The creation of more desirable homes and the avoidance of unlettable homes.

Figure 1. Refurbished Pre 1919 houses on Merseyside

Energy Efficiency Office
DEPARTMENT OF ENERGY

05 H6
CI/Sfb 1976 (81.2) 06 W7
R5

INTRODUCTION AND AIMS

Many pre-1919 dwellings are undergoing major refurbishment to upgrade them to modern standards of accommodation. However, the refurbishment package normally includes only one or two energy related measures. These are usually a modern heating system and loft insulation.

These measures alone have proved ineffective in reducing the widespread incidence of condensation and in creating comfortable living conditions. The dwellings are still poorly insulated and many are occupied by tenants who cannot afford the cost of running the central heating system to produce acceptable room temperatures. Tenants resort to other forms of heating, especially paraffin heaters which exacerbate the problem of condensation. The Figures 2-4 show some of the problems associated with older housing.

To improve the thermal comfort a group of houses were refurbished to good energy efficient standards as part of a major refurbishment scheme. Monitoring has subsequently shown that the package produces savings on heating costs, higher standards of thermal comfort and many other benefits. Figure 1 shows what can be achieved with major refurbishment.

The project was monitored under the Energy Efficiency Office's Energy Efficiency Demonstration Scheme. The main aim of the project was to assess whether it was practical to include a package of energy efficient measures in the routine refurbishment of pre-1919 dwellings. In addition the project was designed to assess both the economic and social benefits of better insulated dwellings.

THE NORMAL REHABILITATION PACKAGE

The normal rehabilitation package carried out on pre-1919 dwellings by Merseyside Improved Houses, costing on average £18,000 per dwelling, aims to make the structure of the dwelling sound and to bring the amenity level of the accommodation as close to modern standards as possible.

The energy related measures included in this package are 100mm loft insulation and the installation of a gas-fired back-boiler to provide full central heating.

After the rehabilitation many of the dwellings still suffer from condensation and the associated problems of mould growth.

Tenants also complain about the comfort levels in these improved dwellings. The problems appear to arise from a combination of technical, social and economic factors. The houses with poorly insulated solid walls are expensive to heat to adequate temperatures. Furthermore, some of the tenants are on low incomes. In general most tenants perceive that the cost of running the central heating represents poor value for money.

THE ENERGY EFFICIENT PACKAGE

To deal with these problems MIH devised a higher level of energy efficiency in their standard rehabilitation package. The measures selected were:

- internal wall insulation of all external walls with a laminate of plasterboard and rigid glass fibre slab
- double glazing of downstairs windows
- draught-stripping of external doors and windows
- extract fans in the kitchen and trickle ventilators fitted in all windows

These measures were selected to:

- save energy
- increase the level of comfort for the tenants (by providing an environment which was affordable to heat)
- reduce the cost of maintenance by reducing the risk of condensation

REHABILITATION SAMPLE

Twenty-five inner-city terraced houses were included in a programme of rehabilitation to the higher energy standard.

To determine the energy savings a comparison was made between a sample of the dwellings improved to a higher energy standard and a sample of dwellings improved normally.

CAPITAL COST

Basic rehabilitation £16,858/house, energy efficiency measures: additonal £1,142/house above the basic refurbishment cost.

Figure 2. Decaying timbers

Figure 3. Worn out plumbing

BUILDABILITY

The energy efficient measures were all installed successfully apart from one case of failure of the dry-lining board where the manufacturer's instructions were not followed. Where doors had warped the draught-stripping installed needed some adjustment. Pressure testing revealed that even after draught-stripping, the houses were still quite leaky, in terms of air infiltration.

MONITORING RESULTS

The monitoring has shown that not only were space-heating energy savings of about 25% achieved in the energy efficient houses but also the tenants in the insulated houses were more comfortable than those in the uninsulated houses. The measures were also effective in preventing condensation on walls, even in kitchens and bathrooms. Condensation was not observed on the double glazing. On single glazing condensation was effectively collected in channels and drained to the outside.

Figure 4. Plaster in need of replacement, room requiring redecoration.

ENERGY SAVING AND OTHER BENEFITS

Fuel and temperature monitoring of the insulated dwellings compared with similar uninsulated dwellings was carried out for two years. The households ranged from single elderly to 4 person households consisting of two adults and two children. Average delivered energy for space heating for the insulated dwellings was 20GJ, compared with 31GJ for the uninsulated dwellings. The energy saving of 11GJ is worth about £40 per year to the tenant, based on the July 1989 gas price of £3.6 per GJ.

There is a strong correlation between energy consumption and the average internal temperatures in the houses. On average the trial houses were about 1°C warmer than the control houses. Normalising the temperatures in both groups, so that the control houses are the same as the test houses, produces an annual energy requirement of 34 GJ for the test houses. The energy saving of about 14 GJ is now worth over £51 per year to the tenant. The graph shown indicates the space heating requirement versus the difference between the internal and external temperatures for the range of dwellings in the project.

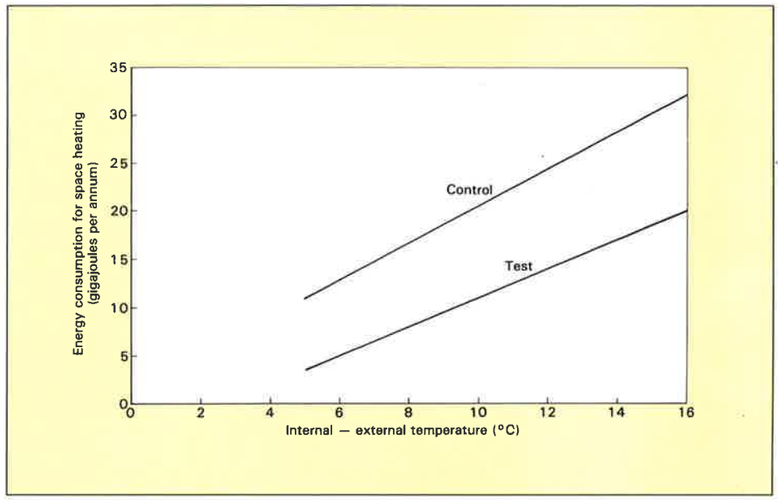
All households were consistent in their pattern of energy consumption over time. All the tenants in the insulated houses rated their homes comfortable and in winter had their heating on for an average of 10 hours a day. The untreated houses had some heating on for an average of 14 hours a day and in some cases tenants complained of draughts.

Only one tenant in an insulated dwelling complained of cold bedrooms, whereas over half the tenants of untreated houses complained of inadequate warmth in the bedrooms.

All the properties were carefully examined at the end of the project. After the dry-lining had been in use for two years there was no evidence of interstitial condensation within the insulation. Despite the extreme temperatures experienced in the winter of 1986-87 there was no evidence of frost damage to the surface of common bricks on the outside of the houses, even though the presence of insulation lowers the temperature of the external surface slightly.

The results of the project show that the measures installed were easily incorporated in the rehabilitation package and were of direct benefit to all the tenants involved, both in cost savings and in comfort improvement. The insulation package as a whole eliminated the risk of condensation and mould. This was welcomed by the tenants and in addition should reduce future maintenance costs to MIH.

It is difficult to quantify all the benefits resulting from the energy efficient refurbishment. Benefits such as higher comfort levels, greater tenant satisfaction and an improved external environment are difficult to quantify. In addition benefits such as reduced maintenance cost depend much on the policy of the building owner.



Energy consumption and internal external temperature differences

The elimination of mould growth through condensation will reduce the frequency of internal decoration, possibly prolonging the interval by a factor of 2, or more. The extent of the benefit to the building owner is dependent on their maintenance policy and the extent to which the tenant is responsible for the internal state of the dwelling. However, the need for less maintenance is clearly a positive benefit, although to what extent depends on the individual circumstances.

NATIONAL IMPLICATIONS

The individual measures demonstrated on Merseyside are not particularly novel, and the use of these and other measures should be regarded as current good practice. But putting together a cost-effective package of energy efficient measures during major refurbishment is less common. Dwellings of this type account for over 20% of the UK housing stock. There are nearly 5 million homes built before 1919 and many of these dwellings are in need of refurbishment, or will be before the end of the century. All of these homes could benefit from an energy efficient refurbishment.

HOST ORGANISATION

Merseyside Improved Houses
Liverpool North Area Office
25 County Road
Walton
Liverpool
L4 3QA
Tel No 051 523 9192
John Lennon — Development Manager

MONITORING ORGANISATION

Building Design Partnership
Sunlight House
PO Box 85
Quay Street
Manchester M60 3JA
Tel No 061 834 8441

Building Use Studies
14-16 Stephenson Way
Euston
London NW1 2HD
Tel No 01-486-6090

MERSEYSIDE

Further information: Enquiries Bureau, Building Research Energy Conservation Support Unit (BRECSU) Building Research Establishment, Garston, Watford, WD2 7JR. Tel No. 0923 664258 Fax No. 0923 664097