Carter Jonas

Former Saville Estates Office - Childcare Nursery

Heating Feasibility Report



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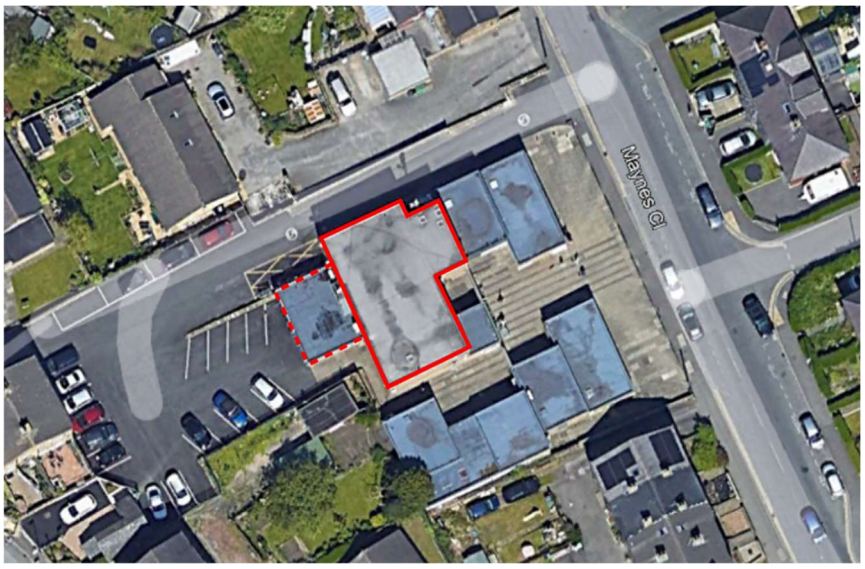
1 Introduction

WSP were appointed by Carter Jonas to carry out a high level heating feasibility study for a proposed new childcare nursery at the former Saville Estate Office in Dewsbury. The existing heating system is electric underfloor heating with high associated running costs.

A non-intrusive inspection of the existing heating services installation in the office was carried out on Wednesday 22nd September 2021.

The existing estate office is located on the upper floor of the building above the Thornhill Coop store. The total useful floor area of the space is approximately 170m².

The plaque on the building says it was opened in 1967 and is therefore approximately 54 years old.



Site Location Plan

1.1 Available Information

Prior to visiting site WSP were not provided with any record drawings or as built information, no record drawings or operating and maintenance manuals were available during the site visit and no other record information has been provided since the site visit.

1.2 Limitations

WSP did not inspect parts of the Mechanical and Electrical Engineering Services that were built in, covered up, or otherwise made inaccessible in a normal course of construction, alteration, or fitting out.

The site visit was a visual non-intrusive inspection and therefore it is not possible to make any definitive statements regarding services that are concealed or were not visible during the site visit.

No definitive calculations have been undertaken to determine capacity of the plant items, nor have compliance or performance tests been carried out on any systems or plant items.

2 Replacement Heating Feasibility Study

2.1 Existing Heating System

The existing office spaces are heated via an all-electric underfloor heating system. Each room is fitted with a local thermostat to provide individual temperature control within the area served.

Underfloor heating systems typically have a slow control response time due to the way the heat is delivered to the space. The heating elements first heat up the floor, then the heated surface radiates heat into the space via convection. The two-stage process can result in a delay due to the time it takes for the floor to cool down after the heating is turned off.



Typical Office & Room Thermostat

Electric underfloor heating is considered 100% efficient because each unit of electricity used is converted into useable heat with no losses. However, electricity has one of the most expensive unit prices per kWh making it less economical to run.

It is understood that the heating system was installed around the time of the original office fitout which would suggest the system is circa forty years old. Based on CIBSE Guide M expected life factors the system is likely to be approaching the end of its useful economic life and we would recommend replacement as part of the childcare nursery refurbishment works.

2.2 Proposed Replacement Heating System – Air Source Heat Pump

There is no gas supply to the site, therefore a replacement heating system would need to be supplied by electricity.

External plant space is limited to the first floor accessible roof area. This removes the option for a ground source heat pump. However, an air source heat pump (ASHP also known as VRF or VRV) could be considered feasible for the site.

Air source heat pumps use technology similar to that of a conventional chiller (vapour-compression refrigerator unit), or the vapour-absorption cycle, which is used to 'pump' thermal energy from a high temperature source (inside/outside) to a low temperature sink (outside/inside). If the equipment can both heat and cool the internal space, the system is referred to a 'reverse-cycle' ASHP.

Typically, the seasonal coefficient of performance (SCoP) of an electrical ASHP is around 3. For every 1kWh of electrical energy consumed by the compressor 3kWh of thermal energy is transferred to or from the conditioned space.

Capital & Running Cost

Based on an initial rule of thumb heat loss calculation, the peak space heating load is around 20kW. The capital cost of an electrical ASHP system equates to around £400 per kW. A 20kW system would have a capital cost of approx. £10,000.

In heating mode, the equipment is around 3 times the efficiency of electric underfloor heating. This means the heat is generated at around 33% of the cost of the electric underfloor system.

Based on 20MWh heat generated annually (assumes areas are heated 50% of the estimated occupied hours), the cost saving would be approximately £2,000 per year compared to the existing system (assumes 14.5p/kWh electricity).

Plant & Equipment

ASHP equipment typically consists of indoor fan coil units and external condenser/evaporator units.

The existing ceiling voids are approximately 150mm deep. This should provide adequate depth for interconnecting pipework which needs to distribute between the indoor and outdoor units.

Based on conversations held on site we are not expecting the ceiling void depth to change as part of the refurbishment. The shallow ceiling void limits the options available for indoor fan coil units. 150mm would not provide enough depth for a ceiling mounted cassette unit or concealed fan coil unit. As a result, the fan coils would likely need to be of the wall mounted type.



Typical Wall Mounted Indoor Unit

External units tend to be installed in rooftop plant areas or within ground level plant enclosures. As noted previously external plant space is limited to the accessible first floor roof area.

This area has already been utilised by the Coop store for external plant so could be considered feasible for the nursery (subject to structural engineers advice, may require strengthening to house plant). A typical 20kW external unit would require 1m^2 of space and weigh approximately 250kg.





Existing Roof Access & External Plant

Planning Requirements

ASHP's are required to satisfy local planning authority requirements, and are not allowed under 'permitted development' rules (i.e. planning permission is required for their installation).

The equipment's seasonal efficiency must comply with the minimum standards laid out in the UK Building Regulations (Part L2 2010 – see non-domestic building services compliance guide – 2010 version).

The visual impact of the equipment will require assessment if it is to be installed on the roof of the building, as with any conventional roof-mounted plant.

Noise

ASHP's are required to satisfy local planning authority requirements under noise control, and are not allowed under 'permitted development' rules (i.e. planning permission is required for their installation, usually requiring assessment of noise emissions).

Lifecycle Cost / Lifecycle Impact

Over one year, the carbon emissions associated with the electric underfloor heating system would be around 3.6tCO_2 (assumes 0.180kgCO_2/kWh based on UK 2020 grid supplied electricity carbon factor).

Using the same carbon factor the annual emissions associated with the electrical ASHP generating 20MWh of heat would be around 1.2tCO_2, resulting in a saving of 2.4tCO_2 per year.

ASHP equipment has a typical life span of up to 15 years.

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