Riverbank School Aberdeen, UK

Completion 2022

Project Type Feasibility Study

Client Hub North/Aberdeen City Council

Retrofit Type
Critical Infrastructure - Education

A feasibility study was carried out on a school in Aberdeen, Scotland, to assess the cost, carbon, environmental performance and programme implications of varying levels of retrofit taking place on an existing school building. In Scotland, when either building a new school, or renovating an existing one, there is the opportunity to receive funding through the Learning Estate Investment Programme (LEIP).

The current funding metrics consider energy performance as a key determinant, but there is no consideration for embodied carbon. The study therefore aimed to include this in evaluating the best value approach, whilst also considering cost, condition, suitability, risk, and programme. The condition and suitability assessments were carried out by Aberdeen City Council.

Methodology and Results

The four options that were assessed include a base level refurbishment, an enhanced retrofit, an optimum retrofit, and a full new build school, acting as a comparator.

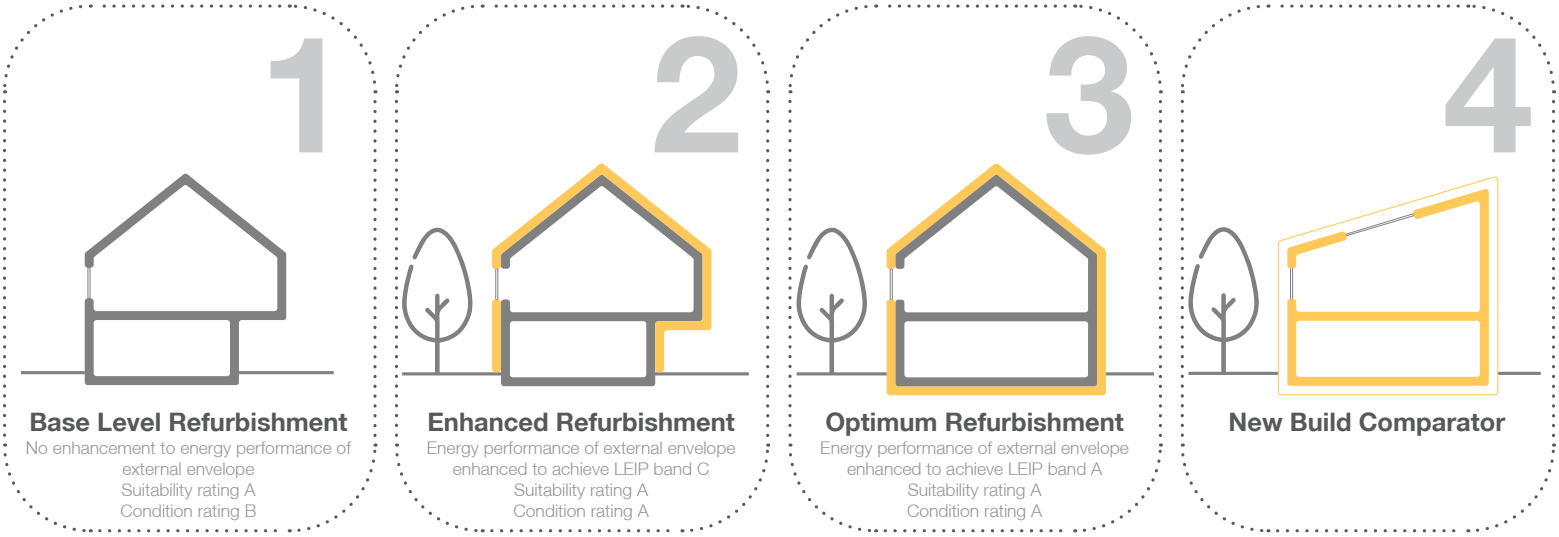
Option 1
The base level refurbishment involved a basic upgrade to the MEP systems that had reached their end of life but included no alteration to the building fabric.

This resulted in an increased energy performance of 198.3kWh/sqm/year and an embodied carbon of 336kgCO_2eq/sqm, costing £13,268,800 and taking approximately 150 weeks for completion.

Option 2
The enhanced retrofit involved upgrades to the external walls, the roof, replacement glazing, new roof lights and an increased airtightness to the perimeter walls. It also included upgrades to MEP services including lighting, hot water, ventilation and heating. As a result, the energy efficiency increased to 112.8kWh/sqm/year, with a resulting embodied carbon of 506kgCO_2eq/sqm. The proposed changes were estimated to cost £15,565,600 and take 159 weeks for completion.

Option 3
The optimum retrofit involved the same fabric and MEP upgrades as option 2, but with the addition of insulating the ground floor slab. This was calculated to increase the energy performance even further to 76.6kWh/sqm/year, but with a higher embodied carbon of 535kgCO_2/sqm. The upgrades were estimated to cost £16,952,900 and take 167 weeks for completion.

Option 4
The new build comparator involved demolition of the existing structure and using all new build elements to develop a new school building. This helped to draw comparisons between the retrofit options and the traditional approach to this type of project.



Using benchmark data from comparably sized projects, an energy efficiency of 67kWh/sqm/year and an embodied carbon of 792kgCO_2eq were determined, costing £17,030,000 and taking 175 weeks for completion.

Conclusions

The results showed that although the new build resulted in the lowest energy consumption, it was found that the optimum retrofit was still able to achieve 76.6kWh/sqm/year.

Both options therefore qualify for the band A energy performance (67-83kWh/sqm/year) and would receive the same level of LEIP energy funding. They both received condition and suitability ratings of A.

The big difference was in terms of embodied carbon. This was 46 percent higher in the new build when compared to the optimum retrofit and 61 percent higher than the enhanced retrofit.

There was only a small difference in capital cost, with the new build costing only 0.5 percent more than the optimum retrofit.

The findings of the study support the key benefits of retrofit being a reduction in embodied carbon. Embodied carbon should therefore be considered for inclusion in the LEIP funding metrics in the future to encourage refurbishment of the existing building stock as a viable option for local authorities.

Criteria	Existing School	Option 1: Base Level Refurbishment	Option 2: Enhanced Refurbishment	Option 3: Optimum Refurbishment	Option 4: New Build Comparator
Condition	B/C	B	A	A	A
Suitability	B	A	A	A	A
Energy Consumption	214 kWh/sqm/ annum	198.3 kWh/sqm/ annum	112.8 kWh/sqm/ annum	76.6 kWh/sqm/ annum	67 kWh/sqm/ annum
Embodied Carbon	N/A	336 kgCO_2eq/sqm	506 kgCO_2eq/sqm	535 kgCO_2eq/sqm	792 kgCO2eq/sqm
Capital Cost	N/A	£13,268,800	£15,565,600	£16,952,900	£17,030,000
Programme	N/A	150 weeks	159 weeks	167 weeks	175 weeks