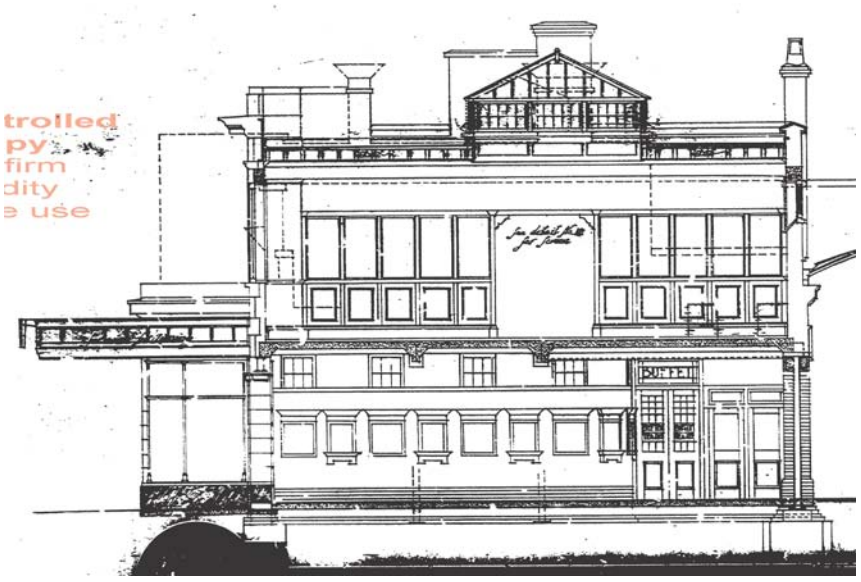
Best practice at Farringdon

Balancing the requirement for low carbon energy efficiency within a heritage structure.

The issue

The heritage significance of Farringdon Station is due to it being one of the earliest stations on the world's first underground passenger railway. The oldest surviving part of the station dates from 1865 and the building was designated a Grade II listed building in 1994.

The white two storey building that forms the entrance to the current station is a 1923 structure designed by architect Charles Walter Clark. When originally completed the Edwardian station included small shops and a café which flanked its entrance. Significantly, a restaurant with panelled timber interior and glazed roof lanterns was located at first floor level Farringdon Chambers.



Section through Farringdon Chambers (circa 1923)

Retro fitting a low carbon building

The Thameslink programme's Sustainable Design & Construction Strategy has been in place since 2008, and has identified CEEQUAL as a design tool and as a measure of environmental and sustainability performance. One of the key objectives for CEEQUAL is to restrict carbon emissions and assess the energy demands and carbon dioxide emissions from a proposed development.

Compliance with Part L2B (existing buildings that are not dwellings) of the Building Regulations is the standard benchmark for measuring heat loss through the fabric of a building. However, implementing modern heat retention methods conflicts with the building's 'heritage' status and is, generally, not supported by English Heritage and the local planning authority. Resolving this matter presented a challenge to both the engineering and consents teams.

The GRIP 5 design for the refurbishment of the Station Entrance Building was produced to meet the requirements of Part L of the Building Regulations. The design featured various heat retention methods including an inverted insulated roof, secondary glazing and insulated dry lining to the external walls; while the services design incorporated energy efficient lighting and a heat recovery ventilation system.

However, when the GRIP 5 design was presented to English Heritage's Historic Buildings and Areas Advisor and the local planning authority's conservation officer, their reaction was that the thermal upgrading to the external walls was considered unsympathetic to the heritage asset and problematic due to its impact on the existing window architrave, skirting boards and plaster cornice. Network Rail was advised that these elements of the design were unlikely to be granted planning permission and listed building consent as it was considered that they would affect the character of the listed building.

Innovation

Although it is not a recognised requirement for Building Regulations Approved Document L compliance, Network Rail commissioned a carbon study model which analysed the existing station entrance building's thermal and carbon output based on a number of scenarios. The output data from the model enabled Network Rail to assess the energy efficiency measures proposed in three scenarios.

Three scenarios were assessed:.

- *Existing building fabric;*
- *Partial enhancement to building fabric with the exclusion of drylining to the external walls; and*
- *Atkins GRIP 5 scheme.*

Figures for the building fabric's elemental performance (u value) and building emission rate (amount of Kg of CO_2 / sq metre per annum) were generated which demonstrated that the Target Carbon Emission Rate (TER) was in line with the Building's Emission Rate.

As a result of this work Network Rail developed a partial enhancement scheme which would provide an acceptable compromise between improving thermal efficiency in particular parts of the building (i.e. the roof and windows) to offset the inefficiency inherent in the design of the external walls and the restrictions posed by the building's heritage status.

3 INTERPRETATION OF THE MODEL RESULT

3.1 RESULT SUMMARY

3.1.1 Carbon Emission Comparison:

Notional Building Emission Rate: $KgCO2/m^2$ per annum	Target Emission (TER) $KgCO2/m^2$ per annum	Building Emission Rate (BER) $KgCO2/m^2$ per annum		
		Study-1 Existing	Study-2 Part Compliance (Without wall dry lining)	Study-3 Full Compliance (with wall dry lining)
29.3	21.4	36.0	26.8	21.1

Benefits

The carbon model study identified a projected improvement of 9.02 kg/ CO_2 per square metre per metre which is the equivalent of approximately 4.5 tons of carbon per year being released into the atmosphere.

Through extensive consultation with the consent granting bodies and having successfully addressed the conflicting requirements of heat retention and alterations to a heritage asset, Network Rail was granted planning permission and listed building consent for its works to the Station Entrance Building.

The approved design preserves the building's historical integrity whilst managing to deliver a compliant building which is fit for purpose and demonstrates a commitment to Section 7 of the CEEQUAL assessment schedule (Energy and Carbon).

Targets and objectives

The carbon analysis undertaken has helped Network Rail meet its targets and objectives in the following areas:

- CEEQUAL – material use; energy; waste management; transport;
- Farringdon Sustainable Design and Construction Strategy - transport; energy and carbon; waste; sustainable material use; and
- Farringdon Targets and Objectives – minimise waste; restrict carbon emissions; use sustainable materials in a sustainable way.

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