Refurbishment resource efficiency case study: Angel Building, London

Commercial office block on prominent site in Clerkenwell

The complete refurbishment of a 1980s commercial office block in Central London addressing Resource Efficiency through concrete minimisation and cement replacement.

Business benefits

- Re-use of the existing concrete structure provided financial savings and resource efficiency.
- Prefabricated components provided programme efficiencies and site waste reductions.
- Structural glazing provided programme efficiencies and material reductions.
- Self compacting concrete avoided the need and cost for additional finishing.
- Transport mileage was reduced by sourcing concrete from a plant less than a mile away.
- Surpassing the project target for waste generation saved an additional £158,575.
- Rainwater harvesting is estimated to conserve two million litres of potable water annually.

Planning for resource efficiency

Retaining the structure was fundamental to the building’s reincarnation and provided capital cost savings and operational benefits.

The addition of a low energy displacement ventilation system and two biomass boilers have reduced the building’s annual carbon emissions and running costs.

The refurbishment secured BREEAM 2006 ’Excellent’.

Prefabrication was used for the components listed below.

- Steel frame
- Internal glazing panels
- Curtain walling
- General and architectural metal work
- ETFE roof
- Pre-cast Terrazzo floor tiles

Building background

Angel Building is on a prominent site at the corner of St. John Street and Pentonville Road, near Islington High Street. The building was constructed in the 1980s and was formerly known as ‘The Angel Centre’.

Following the departure of tenants British Telecom, the outdated servicing, inefficient layout and deteriorating fabric of the building was apparent. Derwent London considered the building to have significant operational inefficiencies. A major refurbishment and extension was undertaken to restore the building and to add 60% more ‘Grade A’ lettable space.

Project details

- Client: Derwent London
- Contractor: BAM Construction
- Architects: Allford Hall Monaghan Morris
- Project cost: £72 million
- Lettable space: Over 24,154 m²
**Materials quantity**
- A total of 39,500 m$^3$ of concrete was retained by reusing the existing structure.
- Glazing was a significant element of the refurbishment. Structural glazing units were used which enable individual glass units to sit directly on the in-situ concrete. This removed the need for additional framing and benefitted the programme.
- Of the additional 7,300m$^3$ concrete poured on-site, 1,800m$^3$ was self-compacting concrete (SCC). This provided an exposed surface with a superior finish and avoided the need for additional finishing.
- The piling mats included 600m$^3$ of crushed concrete sourced onsite.
- Excess concrete from pours were used to create temporary paths around the site.

**Materials wastage**
- Demolishing the concrete frame would have generated a total of 39,000 tonnes of aggregate waste.
- 85% of construction waste was diverted from landfill through off-site separation of strip-out waste, including steel, granite and concrete.
- 31,361m$^3$ of waste was generated; surpassing the project target of 37,000m$^3$.
- An additional saving of £158,575 was achieved by the 6,000m$^3$ improvement on waste target.

**Recycled content**
New concrete poured on-site was specified to include cement replacement.
- Pulverised Fuel Ash (PFA) was selected for its aesthetically desirable colour and finish.
- PFA is a waste by-product of coal combustion.
- Angel Building concrete contains 36% PFA.

**Embodied carbon**
Demolishing the existing concrete structure and replacing it with a new steel frame would have led to:
- wastage of the 7,400 tonnes of embodied carbon in the existing concrete frame; and
- an additional 2,000 tonnes of embodied carbon in the new steel frame.
Additional embodied carbon savings were achieved.
- 36% PFA cement substitute reduced embodied carbon by more than 600 tonnes.
- All concrete used on site was sourced from a concrete plant less than one mile from the building. This reduced overall vehicle emissions and the embodied carbon of the new concrete.

**Water use**
- Water efficient taps, toilets and waterless urinals.
- Altered the roof to enable rainwater harvesting.
  The collected rainwater is predicted to save almost two million litres of water annually.

**Resource scarcity & security**
- 100% of timber used on the project was sustainably sourced with full chains of custody.