The Impact of Pavilion Design on Sustainable Outcomes
Analysis of two different design approaches

sustainability

Client
London 2012

Architect
Various

Contractor
Nussli

Year
2012

Life cycle carbon footprinting analysis of completed temporary structures has enabled KLH Sustainability to clearly prioritise aspects of pavilion design and construction to deliver sustainable outcomes. This case study presents the analysis of two structures; pavilion A and Pavilion B, both operational during the London 2012 Games.

Pavilion A is a two-storey structure totalling 280m^2. Slanting steel columns support a tensile mesh cladding surrounding the structure, which gives the pavilion an airy appearance. However, this seemingly lightweight design is very complex and requires heavy structural steelwork anchored onto a C60 250-300mm concrete raft. Internally, curved plasterboard walls divide the rooms according to their respective purpose (i.e. exhibition, interactive space and B2B area) short life-span of the pavilion.

Pavilion B, is a double height but one storey building totalling 245m^2. The showcase employs an innovative raised entrance solution to eliminate the need for excavations concrete pad foundations; the pavilion is stabilised using hired concrete ballasts. The main structure and roof is principally constituted of hired components. The bespoke rendering makes a clear statement of architectural merit and individuality.

Results

For pavilion A, the top four embodied carbon sources are:

- Material production
- Energy use in construction
- Waste transport
- Host commute.

For pavilion B, the top four embodied carbon contributor are:

- Material production
- Energy in use
- Waste transport
- Material transport

In both instances, the embodied carbon associated with the material production is by far the biggest contributor (~72%) to the overall lifecycle carbon emissions. Therefore development of a low carbon pavilion must focus on reducing material use and selecting low embodied carbon materials in the first instant.

Pavilion B, through optimising the use of hire components has achieved a 58% lower embodied carbon of construction than Pavilion A.

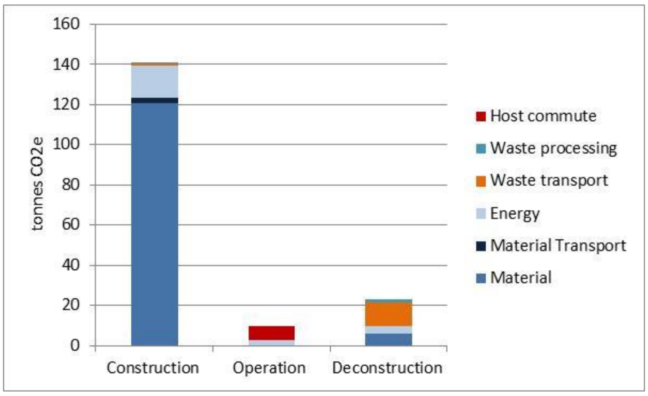

Figure 1. *Embodied Carbon Analysis: Pavilion A*

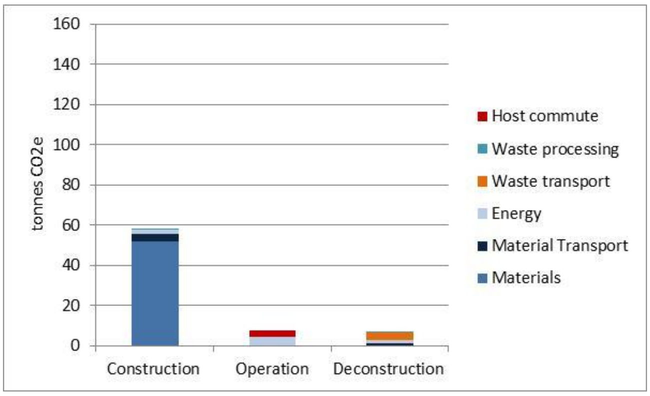

Figure 2. *Embodied Carbon Analysis: Pavilion B*

Analysis

The focus on minimising material consumption through intelligent design and engineering, delivers various benefits further down the line. These benefits observed for Pavilion B include:

- Reduced in fuel consumption during construction
- Low waste generation (<1.15tonnes/m^2) and associated disposal costs
- 40% reduction in build time
- 83% hired components by mass reduces supply chain risk

The obviously sustainable design also helped to promote sustainable behaviour within the contractor. Strong awareness of waste avoidance resulted in the salvage and reuse of soft wood and MDF for the construction of a local youth centre. Other smaller components including insulation were donated to local charities.

Lessons Learned

Concept

- Redefine the endpoint as removal of the temporary pavilion rather than the event itself to optimise design for deconstruction and reallocation of assets to charity groups.

- Engage sustainable construction expertise at the early design stages to ensure designers are focussed on addressing the most critical aspects of sustainability. A general rule of thumb is to prioritise embodied energy over operational energy.

- Where reuse is an ambition, ensure time and finances are allocated from the outset to fund dismantling and relocation of the pavilion structure**.**

Design

- Avoid the use of complex shapes and forms to minimise wastage

- Do not focus design efforts on minimising energy use in operation as they are not likely to be critical sustainability (depending on location and length of use).

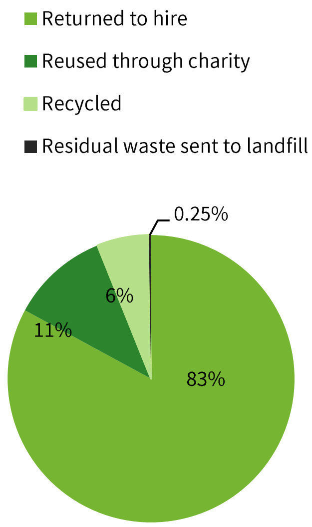

Figure 3. *Components End of Life Pavilion B*

Procurement

- Sustainability requires delivery processes in place to facilitate its implementation. The absence of clear procurement schedules, detailed scope of works backed with accurate specifications, and structured tender interviews will make sustainability integration very challenging

- When components cannot be sourced from existing stock, selecting local suppliers which can offer closed recycling schemes must be investigated as transport miles can represent up to 55% of the structure *deconstruction* embodied carbon.

Construction

- Ensure the installation methods correspond to the design intent to avoid mistakes which can impair future reusability (e.g. flooring glued with tackifier instead of being simply stuck with adhesive corner patch) or recyclability (e.g. changing supplier at the last minute without ensuring they have close-loop recycling scheme)

Deconstruction & Disposal

- Clearly identify components for salvage and reuse prior to dismantling. Ensure operatives are well-briefed to avoid accidental disposal.

- Consider location of the recycling facilities when appointing the waste management company to minimise “waste miles”.