7 LIFE CYCLE / WHOLE LIFE COSTING

In many construction projects, initial investments costs may only account for around 20% of the total costs which the owner will incur during the period of ownership – particularly when energy bills and maintenance costs are taken into account. If the costs of staff using buildings are included then this is reduced to just 0.5%.\(^{16}\)

Whole life costing (WLC) or life cycle costing (LCC\(^{17}\)) is the methodology for systematic economic consideration of all costs and benefits accruing to the owner over a set period of analysis. A true WLC approach to a construction project would take into account the costs of planning, development and design, construction and implementation, operation over the life time of the building, and decommissioning costs.

WLC can be a key enabler of more sustainable approaches to construction and of the adoption of new and innovative sustainable construction products and techniques. Whilst many sustainable construction solutions may require higher initial investments, once running costs are taken into account they will generally provide a return on investment over time. This is further emphasised when a value is given to sustainability benefits, which may also include improving occupier performance through creating a more comfortable working environment. However, the majority of public sector construction decision-making is still principally based on a comparison of investment costs only and often over the short, rather than medium to long terms.

WLC can be used at any stage of a construction project as a tool for assessing the relative costs and benefits of project alternatives – for internal investment decision making and business case development, for application by the design team at different design stages, or as an evaluation tool within competitive tendering procedures.

The strongest opportunity to use WLC is during early design stages. This is primarily because at this stage most, if not all, options are open to consideration. Over the course of the project the authority’s ability to influence cost decreases. It has been estimated that 80–90% percent of the cost of running maintaining and refurbishing a building is determined at the design stage.

A variety of tools and guides on WLC for the construction sector exist including WLC frameworks (such as ISO 15686-5:2008) which provide a set of overarching principles, total building WLC tools (such as the Statsbygg LCC Analysis for Construction), which calculate the WLC of an overall building, or building component WLC tools (such as SMART SPP LCC and CO₂, Assessment Tool or Forum for the Future WLC and Carbon Tool) which can be used to compare specific systems such as heating or lighting.\(^{18}\)

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\(^{16}\) The Royal Academy of Engineering in the UK developed the 1:5:200 model in 1998 which suggested that if the initial construction cost of a building is 1, then its maintenance and operating costs over the years are 5, and the business operating costs in that building are 200. The 1:5:200 model should not be seen as an absolute but rather a rule of thumb.

\(^{17}\) These two terms are often used interchangeably. The following are taken from ISO 15686-5:2008 Buildings and constructed assets – Service life planning:
- LCC: the cost of an asset, or its parts throughout its life cycle, while fulfilling the performance requirements
- WLC: a methodology for systematic economic consideration of all whole life costs and benefits over a period of analysis, as defined in the agreed scope

\(^{18}\) For further information on WLC/LCC please see the SCI-Network report at www.sci-network.eu
A number of specific barriers can be identified to the greater uptake of WLC within public sector procurement:

**CAPITAL/OPERATING BUDGET SEPARATION**

The capital budget of construction is typically separated from the operating budget, and public authorities may be restricted in their ability to transfer funds between capital and revenue budgets. This can lead to one authority, or a department within an authority, accepting the lowest initial cost and then handing over the building to others to maintain, as there is no incentive for the procuring authority or department to consider the operating costs.

The establishment of joint project teams with both the procuring and operating departments will help to identify potential in-use costs and design innovations at the outset. It can help to involve the end user early in the procurement process. This process could be supplemented by engaging end-users in the design process to identify in-use requirements.

**EXPERT CAPACITY AND DATA AVAILABILITY**

Applying WLC can be a complex process, and many authorities will lack staff with the training and knowledge for this. This situation is compounded by the lack of available data on life cycle costs from relevant projects. Having staff appropriately trained, or employing WLC experts within the procurement team can help to overcome this issue, however initiatives to simplify and increase data storage at a national or European level would be very helpful.

**RECOMMENDATION 7.A:**

Identify a suitable model for WLC/LCC at project planning stage, which meets the principles of the ISO 15686-5 or equivalent, to inform decisions throughout the procurement process. This should at least cover:

- Total construction costs,
- Annual operation costs,
- Annual maintenance cost,
- Annual occupier staff cost (including training for building users/managers on relevant technologies),
- End of life costs.

**RECOMMENDATION 7.B:**

Ensure facility managers are closely involved in WLC procedures.

**INNOVATIVE KERB EDGINGS IN WAKEFIELD, UK**

For the procurement of innovative kerbing in Wakefield (see also section 3), offers were assessed based on whole life costs. This took into account purchase, delivery, use, and disposal costs. In addition the Council also identified the potential social, environmental and economic impacts and costs throughout the product’s lifecycle. This led to the selection of a lightweight kerbing made entirely from recycled materials, despite a purchase price 235% higher than standard solutions. The whole life cost was ultimately lower, due to improved health and safety associated with manual lifting and vibration from cutting and shaping as well as the need for lifting machinery, improved durability, and lower transportation costs due to the material being considerably lighter. CO2 emissions due to transportation were reduced by 73%, and embodied emissions were also 17% lower.
**Recommendation 7.c:**
Evaluate the cost of bid during competitive tendering for design and/or construction work using the selected WLC/LCC model, and communicate this, together with the weighting and associated scoring, in tender documentation.

**Recommendation 7.d:**
If a public authority does not have the internal capability to undertake robust LCC/WLC calculations, it is recommended to either:

- provide training for employees on WLC/LCC based on ISO 15686-5: 2008 to enable quantity surveyors, designers and engineers to incorporate WLC in the design and planning stages of construction projects (preferred option), or
- outsource the calculation to a third party expert. This is only advisable if the cost does not exceed the cost of increasing internal capability.

**Recommendation 7.e:**
Joint project teams should be established and ‘total budgets’ piloted with both procuring and operating departments, to help share project costs between departments. It is expected this will help identify potential in-use costs and encourage design innovations from the outset. Facilities management or property departments may be asked to pay a percentage contribution towards capital cost to influence the management of the operations budget and help optimise WLC decisions at the project outset.