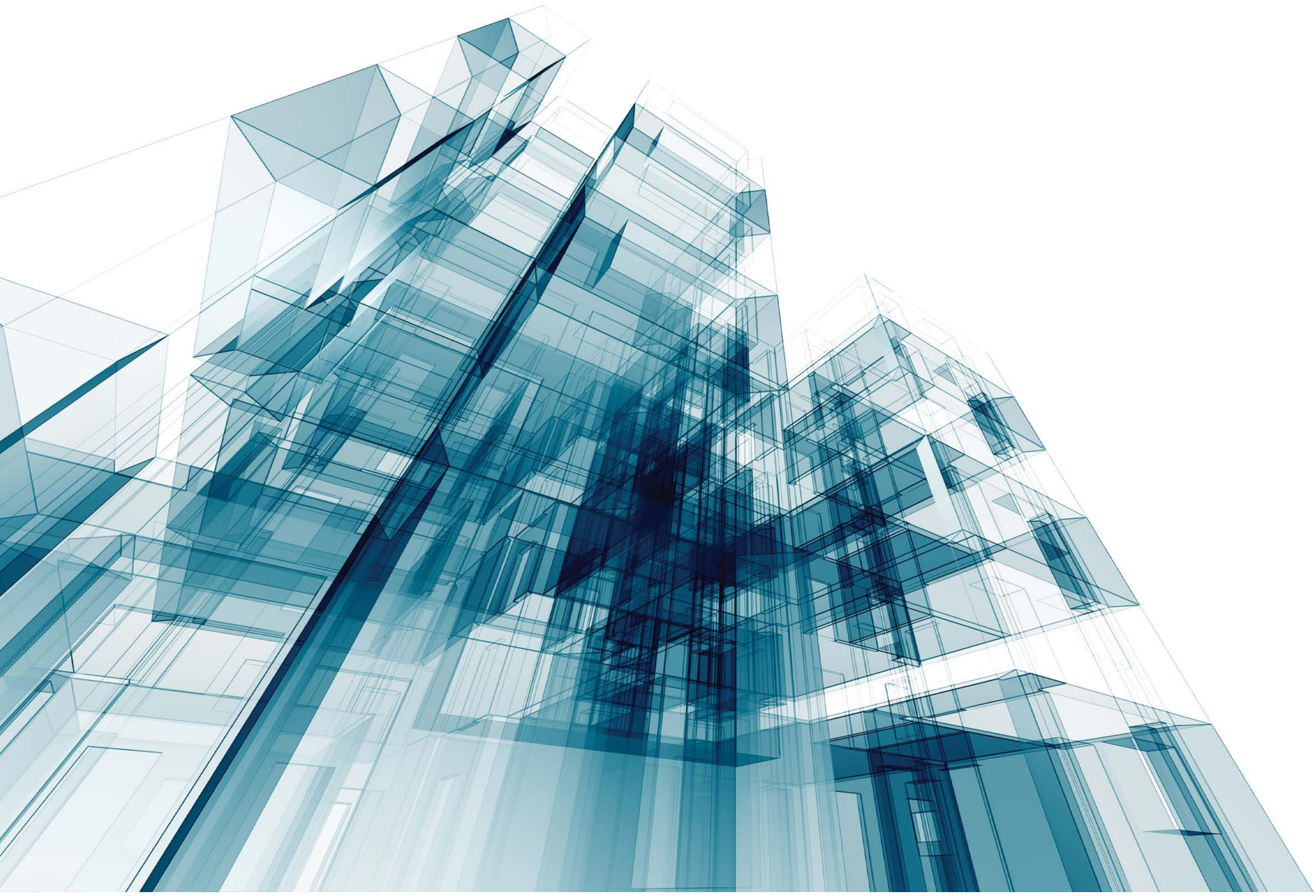
RICS guidance note

RICS professional guidance, UK

Life cycle costing

1st edition, April 2016



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RICS professional guidance

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Document status defined

RICS produces a range of professional standards, guidance and information documents. These have been defined in the table below. This document is a guidance note.

Publications status

Type of document	Definition	Status
Standard		
International standard	An international high-level principle-based standard developed in collaboration with other relevant bodies.	**Mandatory. RICS has adopted these and they apply to the profession.**
Professional statement		
RICS professional statement (PS)	A document that provides the profession with mandatory requirements in the form of technical requirements or conduct rules that members and firms are expected to adhere to. An RICS professional statement sets out the expectations of the profession. RICS-qualified professionals must comply with the professional statement applicable to their area of practice or be able to explain any departure from it. The relevant professional statement will be used by RICS and other legal and regulatory authorities in judging complaints and claims against RICS-qualified professionals. This category may include documents approved by RICS but created by another professional body/stakeholder, such as industry codes of practice.	**Mandatory on the basis of 'comply or explain'.** **Professional statements set out how the profession is expected to meet the requirements of the international standards.**
Guidance and information		
RICS guidance note (GN)	Document that provides users with recommendations or approaches for accepted good practice as followed by competent and conscientious practitioners.	Recommended best practice but not deemed by RICS to be in category of 'mandatory' for all practitioners.
RICS information paper (IP)	Practice-based information that provides users with the latest technical information, knowledge or common findings from regulatory reviews.	Information only.
RICS insights	Issues-based input that provides users with the latest information. This term encompasses Thought Leadership papers, market updates, topical items of interest, reports and news alerts.	Information only.
RICS economic/ market reports	A document usually based on a survey of members, or a document highlighting economic trends.	Information only.
RICS consumer guides	A document designed solely for use by consumers, providing some limited technical advice.	Information only.
Research	An independent peer-reviewed arm's-length research document designed to inform members, market professionals, end users and other stakeholders.	Information only.

1 General principles (Level 1 – Knowing)

1.1 Introduction

This guidance note summarises what is meant by a life cycle costing (LCC) and whole life costing (WLC) service for both new construction works and for the refurbishment of existing assets. The guidance follows the guiding principles outlined in the BCIS/BSI publication PD15686-5 *Standardized Method of Life Cycle Costing for Construction Procurement*.

The effective date of this guidance note is 1 July 2016. However, practitioners are encouraged to adopt the practices in this guidance note earlier if appropriate.

There is nothing intrinsically mystifying in the concept of life cycle costing. Many people do it, either consciously or unconsciously, in their normal purchasing. For example, anyone buying a car would want to know not just the purchase price but also its running costs, such as fuel consumption, the likely maintenance and parts replacement costs and, very often, the residual value on disposal.

Buyers are driven by the cost of ownership issues and may be willing to pay a higher capital cost if they have some guarantee that this will be more than offset by lower maintenance costs. They can estimate the value of the various options to themselves.

LCC in a construction context

The typical measure of total life cycle cost is a single sum representing the sum of capital cost and future cash flows. At its simplest it requires answers to the following questions:

1 What will need to be done?
2 When?
3 How much will it cost?

LCC is a tool to assist in assessing the cost performance of construction work, aimed at facilitating choices where there are alternative means of achieving the client's objectives and where those alternatives differ, not only in their initial costs but also in their subsequent operational costs. It allows these alternatives to be compared on the same basis.

It is used for budgeting and for option appraisal, for example:

1 higher expenditure on building fabric or insulation might lead to lower energy expenditure, or
2 a lighter weight, more expensive cladding system might lead to savings on frame and foundation costs, but will also cost more when it is renewed, or
3 a cheaper component might be less durable, and require more frequent replacement or maintenance.

LCC accounts for all relevant costs (only) over a defined period of time (the period of analysis).

WLC has a broader scope than LCC as it can include costs (and incomes) associated with the provision of the construction works that are not included in the client's costs. See figure 1 for the main cost headings in each. WLC may require inputs from outside the construction advice sector, such as valuers and accountants, who may input on residual values and income projections.

This guidance will use the term life cycle costing. However some publications use the term whole life costing as synonymous with life cycle costing.

What are the benefits for the clients?

- LCC encourages analysis of business needs and then communicating this to the project team.
- Costs of ownership (through construction, purchase or renting) of alternative options are evaluated over their whole life.
- Total cost of ownership/occupation is optimised by balancing initial capital and running costs.
- Analysis of risks and costs of loss of functional performance due to failure or maintenance are included.
- LCC promotes realistic budgeting for operation, maintenance and repair.
- LCC encourages discussion and recording of decisions about the durability of materials and components at the outset of the project.
- LCC makes it more probable that the best value for money solution is adopted.
- LCC provides data on actual performance and operation compared with predicted performance for use in future predictions and benchmarking.

Option appraisal using life cycle costing is specifically required for public sector organisation and guidance publications, notably *HM Treasury – The Green Book: Appraisal and Evaluation in Central Government*. Equally, many private sector organisations now require life cycle costs to be taken into account.

It is relevant to projects at all 7 stages of the Digital Plan of Work, from brief through to in-use, but is particularly relevant to stages 1, 2, 3, 5 and 7 (for new, maintenance, renewal or improvement projects).

This guidance is presented under the following headings, which correlate with the Assessment of Professional Competence (APC).

1 General principles: (Level 1 – Knowing)
2 Practical application: (Level 2 – Doing)
3 Practical considerations: (Level 3 – Doing/Advising)

As a minimum, a quantity surveyor is expected to:

- know the basic principles of life cycle costing
- know when to recommend a life cycle cost exercise to be done
- identify a suitable specialist if required.

Suitable specialists can prepare and present reports of life cycle costs to support better decision making.

1.2 General principles

This part will discuss the relevant costs, the notion of time, data gathering, and the principles of discounting and illustrate the rules and procedures with examples. A glossary of terms is included in Appendix C.

LCC is comprised of four basic steps:

1 defining the brief for analysis of LCC (at each project stage, at an appropriate level of detail for the client's purpose(s)
2 analysis of the problem
3 structuring and doing the calculations and
4 validating and interpreting the results.

LCC is carried out for one of two primary reasons:

- to predict a cash flow (perhaps to construct a budget) or
- to carry out an option appraisal (to decide which option is preferable in cost terms).

LCC option appraisal calculations are done either:

- to assess options at various points through the development of the project to ensure that the selected option represents the best value for money. Options may vary from strategic estate options to single component options or
- to inform a tender appraisal exercise where tenders submitted include information on costs post-completion of construction.

To compare alternative options with differing costs and timing on a comparable basis, costs need to be brought to a common basis. This is the process of discounting future costs to the base date.

LCC analysis typically uses **real** costs, i.e. those relevant at the time of analysis. There is a typical assumption that **inflation** and/or deflation rates apply equally to all costs, and therefore can be ignored. If **real discount rates** are used (as recommended by BS/ISO 15686-5) then the discount rate used to bring future costs to a present day **base date** excludes differential **inflation** (for example, higher than average energy cost **inflation** – which may, however, be applied subsequently as part of sensitivity analysis).

If **nominal costs** are used (i.e. those estimated at the time of expenditure) they will have been adjusted for **inflation**/deflation, and estimated efficiency or technological changes. This can introduce further uncertainty into projections, and therefore it is generally preferable to explicitly show these as part of a sensitivity analysis.

1.3 LCC standards and definitions

BS/ISO 15686-5 (Life cycle costing) covers the main principles, processes, calculations and definitions for life cycle costing.

The *Standardized Method of Life Cycle Costing for Construction Procurement* supplements the BS/ISO giving detailed UK rules for measuring LCC. This document is referred to as the SMLCC or BCIS/BSI PD 15686-5.

BS 8544 covers LCC during the in-use phase of building life, whereas both the other documents primarily focus on LCC during construction projects. It is also complementary to the BS/ISO. This also includes mapping to COBIE data structures for LCC in the context of Building Information Modelling – which is a growing issue in LCC (see 3.8).

Clause 1.7 of SMLCC defines life cycle costing as a:

> 'Methodology for the systematic economic evaluation of life cycle costs over a period of analysis, as defined in the agreed scope.'

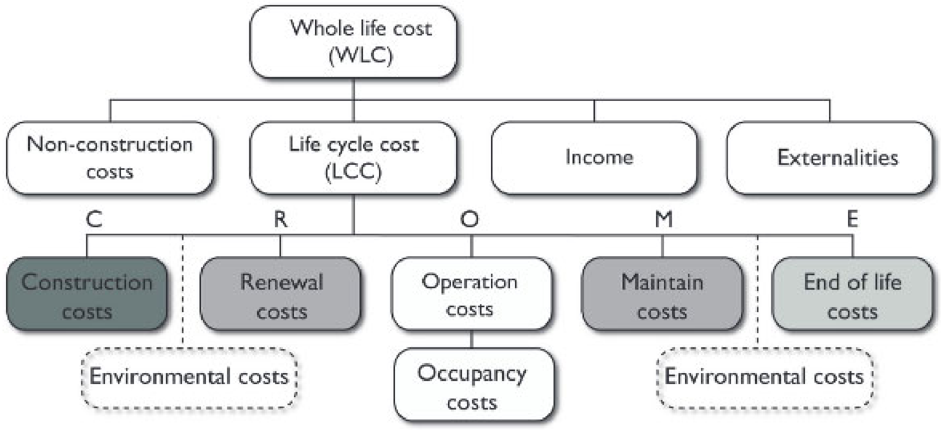
It also notes that life cycle costing can address a **period of analysis** that covers the entire life cycle or selected stage(s) or periods of interest therein.

This definition could equally apply to WLC. The difference between LCC and WLC is that LCC focuses only on the construction, maintenance, operation and disposal of the asset, whereas WLC also includes client and user costs, such as project financing, land, income and external costs (those not born by parties to the construction contract – such as tenants). The same rules and procedures, however, apply equally to WLC and LCC.

The difference is illustrated below in figure 1, from NRM Part 3, which aligns with the ISO and SMLCC.

Note: UK practice typically includes occupancy costs in LCC, but international practice typically includes these costs in WLC.

Figure 1: Key cost categories of WLC and LCC



1.4 LCC in development and design of construction projects

LCC should be considered for every construction project in the same way as for **capital cost** planning. The earlier in the design and development process that the LCC model is constructed, the sooner control of the financial aspects of the project can be carried out on the basis of cost of ownership.

There is a minimal extra cost of an LCC service if carried out at early design stages, which is the best opportunity to make substantial savings over the use period. There is very rapid fall-off in the influence of all parties over the LCC as the programme is fulfilled.

1.5 The essentials of life cycle costing

1.5.1 Level of LCC estimates

LCC estimation can take place at a number of levels, described in SMLCC (clause 2.9) as follows. LCC estimates typically occur during design development or post-occupation to determine whether an alternative specification or scope of work is worthwhile.

Component level. A single manufactured product, e.g. a central heating thermostat.

System level. A system is a number of identified discrete components combined to form a system, for example, a gas boiler, pump, thermostat, pipes, and radiators, etc. combine to form a central heating system.

Element level. An element is defined as a part of construction that performs the same function irrespective of the components from which it is made, for example, external walls.

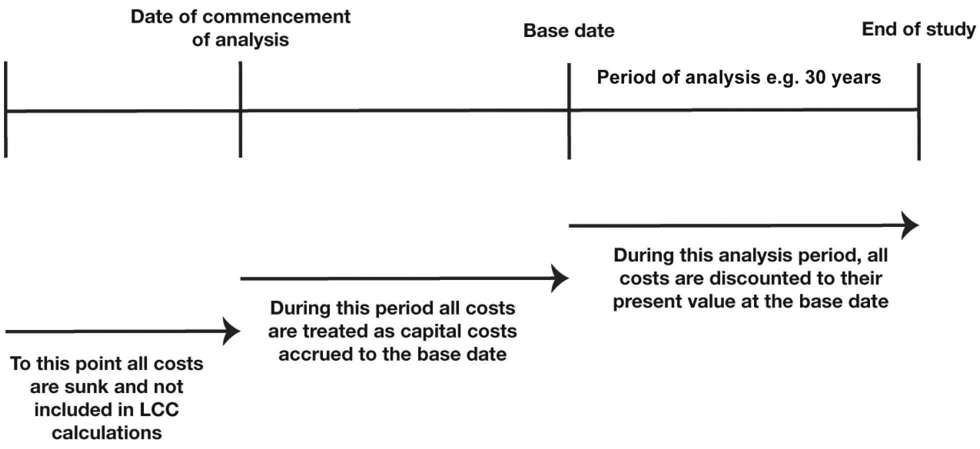
Cluster level. A cluster is a number of elements combined typically on the basis of a work package for contracting purposes, for example, envelope.

Single asset or whole building level. Normally considers different options for a single building, e.g. a study of new build options as against refurbishment options, possibly involving consideration of more than one site.

Multiple assets or portfolio/estate level. Normally in the consideration of options for the development of a portfolio of property e.g. consolidating staff into fewer properties. The current position should always be included as one option, i.e. the 'do nothing' option. However, the do nothing option is rarely without a cost

The level of study has a relationship with the chronology of the developing project as illustrated in figure 2. Generally the later items listed above are considered at earlier stages and component level options are considered later in design development.

Figure 2: Representation of key LCC dates



1.5.2 Relevant costs and cost data structures

The benefit of a common life cycle cost plan structure is in the standard presentation understood by clients and professionals alike, and also in the easy comparison and benchmarking of similar projects.

The defined structure for LCC of construction projects is described in section 3 of SMLCC under the following headings. Detailed guidance is given on what is included in each cost heading. One of the key requirements is that the scope of costs to be included should be explicit, and be agreed with the client.

LCC costs

1. **Construction costs** (equivalent of total development costs in NRM 1), including:

- site costs or opportunity costs of the site already in ownership (includes legal fees, stamp duty, etc. – not site acquisition costs)
- finance charges
- professional fees (architect, quantity surveyor, engineer, etc.)
- construction and infrastructure costs
- tax allowances (capital equipment allowance, capital gains, corporation tax, etc.)
- statutory charges
- development grants
- planning gain and
- third party costs – rights of light, oversailing charges, wayleaves and easements, etc.

2. **Maintenance costs**, often referred to as hard facilities management costs; commonly interpreted to mean all costs incurred in ensuring the continued specified functional performance of the asset, including:

- redecoration
- periodic inspection activity
- periodic maintenance and component replacement activities
- unscheduled corrective and responsive maintenance and component replacement and repair and
- planned and preventative maintenance and component replacement.

Maintenance costs are divided into Renewal costs and Maintain costs in NRM Part 3, as indicated in figure 1 above, and this separation is mirrored in BS 8544.

3. **Operation costs**, often referred to as soft facilities management costs; commonly interpreted to mean all costs incurred in running and managing the facility, including:

- general support services, letting fees, facilities management fees, and caretaker and janitorial services
- service transport, e.g. internal deliveries
- IT services
- laundry and linen services
- catering
- cleaning
- waste management
- rent
- rates and other local taxes and charges
- insurances and
- energy, specifically heating, lighting, air conditioning, lifts, etc.

Operation costs, including energy and cleaning costs, are often excluded from the scope of LCC estimates, but this should always be made clear to the client and highlighted as they are typically a major cost heading.

4. **Occupancy costs**, i.e. those additional services sometimes included within the soft facilities management definition, specifically to support the occupier's explicit operation.

Costs of staffing the building to facilitate the user's occupation. This is in addition to general support services mentioned above and typically includes security, but may also include mail room staff, switchboard operators, ICT support staff, car park attendants, laboratory technicians and other user-specific support staff.

Outsourcing contracts to provide the same services indicated above.

Occupancy costs are frequently excluded from LCC cost estimates. Internationally (outside the UK) they are considered part of WLC, not LCC. Reporting to clients should clarify whether or not they are included.

5. **End of life costs**. This specifically includes disposal and demolition, but may include end of life incomes, including:

- residual values – the monetary value assigned to an asset at the end of the LCC **period of analysis**
- **terminal values** – the scrap value of a component or asset at the point of its replacement
- end of life costs, other than those directly associated with the building, are not part of LCC (e.g. marketing and fees prior to sale, site clean-up costs post-demolition – but these may influence residual values).

If a whole life cost evaluation is to be done, the following may also be included:

WLC costs

6. **Non-construction costs** (land acquisition, fees, rental costs, relevant tax liabilities, etc.).

7. **Income**.

8. **Externalities** – costs associated with an asset but not reflected in the transaction costs of the acquisition. For example, a new hotel may require the water company to install a new water main, so a cost is incurred but not by the client or contractor. Externalities are not commonly included in LCC calculations.

Reference to the client is recommended to determine precisely which costs should or should not be included. Some costs are not relevant and are not accounted for in the calculation. HM Treasury's Green Book has useful advice on costs included and excluded from public sector option appraisal exercises, as follows:

- All relevant costs outlined above are included.
- Costs that are 'sunk', i.e. the client has already expended the money or is irrevocably committed to the spend, are not included.
- **Depreciation** as an accounting mechanism is ignored. However, residual values (the estimated value of the asset at the end of the LCC **period of analysis**) will be included in option appraisal exercises and tested for sensitivity.
- The **opportunity cost of capital** committed to the project is ignored.

Costs that are 'unchanged' are ignored, e.g. on a project comparing double glazing with single glazing it is unnecessary to take account of window cleaning costs. Similarly, if rates or insurance are assessed on a m^2 basis, then they can be excluded from decisions unless carrying out an option appraisal of solutions of differing areas.

1.5.3 LCC period of analysis

The LCC **period of analysis** should be determined by the client. It might be the length of a private finance initiative (PFI) concession, the length of a lease, the anticipated functional life of a whole building, or time to first refurbishment, etc.

Various definitions exist to define the length of time during which the building satisfies specific requirements, which can be described as:

- economic life – a period of occupation that is considered to be the least cost option to satisfy a required functional objective
- functional life – the period until a building ceases to function for the same purpose for which it was built
- legal life – the life of a building, or an element of a building until the time when it no longer satisfies legal or statutory requirements
- physical life – life of a building or an element of a building to the time when physical collapse is possible
- social life – life of a building until the time when human desire dictates replacement for reasons other than economic considerations and
- technological life – life of a building or an element until it is no longer technically superior to alternatives.

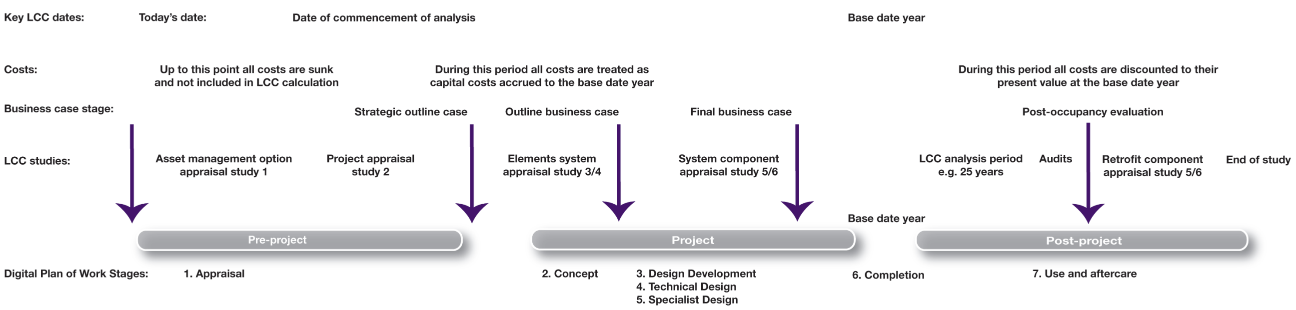
However, in the majority of studies the LCC **period of analysis** should be less than any of the periods described above. There is no recommended method of determining an LCC **period of analysis** in BS ISO 15686-5: 2008 or in SMLCC. The use of long analysis periods (more than 30 years) should be treated with caution and with consideration for possible technological, commercial and legal changes. Specifically where LCC is done in conjunction with environmental analysis there may be a long **period of analysis** as the default is often the entire life of the building to ensure consistency with life cycle analysis (LCA) of environmental impacts.

In the public sector, the use of the Treasury **discount rate** changes for calculations beyond 30 years. Clearly, buildings and building components commonly last longer than 30 years and the HM Treasury discount rates step down from the starting point of 3.5% p.a. to 3% p.a. from years 31 to 75 and further beyond that point.

1.5.4 Base date

This is the start date for calculations. For example, if the base date is completion or handover of the building all expenditure up to that date is added and treated as capital expenditure. No discounting is involved. However, revenue expenditure is discounted to reflect the time value of money. It is vital that the **base date** and the **period of analysis** from the **base date** is the same for all options compared. This concept is illustrated in figure 3.

Figure 3: Level of study and stages of the project



1.5.5 Real and nominal costs

As stated above, the two primary reasons for doing LCC are: either cash flow prediction or option appraisal. Both require an estimate of the relevant costs over the length of the LCC **period of analysis**. Clearly, as the period lengthens, these predictions become more uncertain, because of the various assumptions made. Such cash flow forecasts are slightly easier if it is established that technological and organisational change and differential inflation/deflation can be ignored. However, the establishment of a cash flow forecast, with costs adjusted for the time value of money, allows the forecast to be revisited and fine-tuned regularly, so that the forecast is always the most accurate prediction.

The adjustment of cash flow costs for **inflation**, deflation and estimated efficiency or technological change results in a cash flow of costs **at the amounts that are expected to be paid in the future**. These future costs are referred to as **nominal** costs. However, as noted in 1.2 it is recommended that you use **real** costs.

Real costs are the costs current at the base date. These costs can be considered in two parts:

- the **capital costs** (all relevant costs incurred before the **base date**) and
- through life costs (all relevant costs incurred after the **base date** and during the LCC **period of analysis)**.

Discounting is the process used to bring all future costs to a value at the **base date** and can be carried out in two ways: **annual equivalent** and **present value** (described in 1.5.6).

Bringing the **capital costs** and **through life costs** to a common value at the **base date**, allows options or tenders that have the same (or acceptable) performance but differing **capital costs** and through life cost spend profiles to be directly compared.

Although either **real** or **nominal costs** can be used, it is important to be clear that the choice also affects the **discount rate** used to bring future costs to current values.

1.5.6 Discounting, inflation and the time value of money – introduction of net present value (NPV) and annual equivalent value (AEV)

The time value of money refers to investment and price movements over time. Investments generally increase in value by a percentage rate of return. Alternatives or options are evaluated based on the notional return on the estimated investment, had the monetary amount been invested rather than expended on the option being considered. The percentage return used in LCC to bring such future costs to present day values is called the **discount rate**.

Inflation is a rise in the general price level, reflecting a decline in the purchasing power of money. The rates of **inflation** for differing items are not constant. In general, manufactured high technology products tend to fall in price over time; fuel prices increase when the raw product becomes scarce, and labour prices tend to increase in line with productivity improvements.

In general, a return (or **discount rate**) based on the **difference** between the bank **base rate**, or a bank investment rate and the **inflation rate**, should give a satisfactory rate for comparative calculations. This is a real **discount rate**. However, if differing estimates of **inflation** are included in **nominal costs** then the **discount rate** will need to take account of the general level of **inflation** for all costs (a nominal **discount rate**). The basis for **both** the costs and the **discount rate** should be either **nominal** or **real**, but not a mixture.

Assessing the impact of **inflation** on the relevant costs at the points in time when the costs are incurred allows its impact on a generally smooth income stream to be appreciated. Awareness of the sensitivity of the cash flow forecast to varying **inflation** rates gives an appreciation of the risk within the cash flow. Generally, risk increases with the distance into the future of the predicted expenditure. However, it is recommended that this should be specifically identified as a sensitivity analysis on the basic cash flow forecast, not embedded in the basic calculations.

For the option appraisal of public sector projects the current edition of HM Treasury's Green Book will state the **discount rate** to be used for all LCC analysis periods of 30 years or fewer. This rate is net of **inflation (real)**, it does not need to be adjusted for **inflation**.

1.5.7 Doing the calculations

The principle of discounting is to permit the LCC of differing options to be brought to a comparable time base, i.e. a comparative evaluation at the **base date**. There are two ways to bring LCCs to a comparable time base, that is, **present value** and **annual equivalent**. Other metrics, such as payback analysis, are also relevant, and are described in Appendix A. Several of the techniques are illustrated in Appendix B.

Present value

- **Present value** (PV): the present day worth of a future cost discounted at a given interest rate. The **net present value** (NPV) is the total present day worth of a future cash flow discounted at a given interest rate.

Very simply, **present value** represents the amount of investment today required to pay for the **capital cost** plus all future operating (revenue) costs. The sum to be invested is less than the total of all the costs because some of the costs occur in the future, and therefore the sum invested today attracts interest until the time it is spent. **Present value** is the theoretical total amount to be invested in a bank today at a given rate of interest to pay for all future capital and revenue costs. This assumes that when the final payment is made the bank account stands at zero.

Net present value (NPV) is the present day value of future costs net of future incomes. Even though LCC is concerned only with costs, the measure is typically called NPV, just as it is for whole life costs, which may include incomes. This saves expressing all the costs as negatives in the calculations. It may also be referred to as net present costs (NPC).

An example of calculation of NPV is included in Appendix A.

Annual equivalent value (AEV)

- **Annual equivalent value** is the loss suffered by investing a sum of money in a building rather than a bank.

The annual cost of investing in a building is the interest that would have been gained and expended per annum, i.e. not compounded. Therefore, if £30,000 is spent on a building and interest is at four per cent, then there is a theoretical loss of £1,200p.a.

The problem with investing in a building rather than the bank is that at the end of the building's life all that is left is a ruin, whereas if you had invested the money in the bank, you would still have the capital. If £30,000 is spent on a building, there is also the loss of the building at the end of its life; so the loss is greater than £1,200p.a. It is £1,200p.a. plus the amount that you would need to invest each year to replace £30,000 at the end of the life of the building. This accumulating amount is called a **sinking fund**.

An example of an AEV calculation is included in Appendix A.

The advantage of using the **annual equivalent** method is that once the capital expenditure has been reverted to an **annual equivalent**, then the amount of annual revenue for a single year can be added to this amount, without adjustment, to realise an **annual equivalent** spend (or income) for a single year. The **annual equivalent** can be used to compare options with a consistent annual spend. However, this method does not give an appreciation of a total spend over the time horizon, nor does it deal simply with expenditure that is not annual, e.g. re-painting every five years. For this reason, annual equivalent is considered complicated in its use for the option appraisal of typical construction LCC problems. The NPV method is typically the default measure, and is generally shown in this guide, but practitioners can use the same basic cashflow to calculate either measure.

1.6 LCC links with other aspects of sustainability

Any full assessment of sustainability will consider the environmental, social and economic issues of any design decision. Models or tools that assist decision-makers must make explicit the complexity of the problem and the trade-offs and potential synergies that exist in the three facets of sustainability.

Brundtland defines sustainability thus:

> 'Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.

(*Our Common Future: World Commission on Environmental and Development (WCED)*, OUP, 1987)

LCC is an important part of the complete sustainability equation; indeed, methodologies such as BREEAM and LEED introduce the desirability for an LCC calculation to support decisions taken with respect to sustainability. BREEAM, for example, advocates an LCC calculation with several periods of analysis, covering both the whole building and detailed component option comparisons. LCC is the primary methodology for assessment of economic sustainability in BS/EN 15643-4: 2012. This standard is part of a framework that describes integrated assessment of sustainability of buildings. It requires that the LCC assessment covers the entire life of a building. The detailed rules for calculation of economic sustainability are in BS/EN 16627: 2015. Generally these standards are compatible with the approach in ISO 15686-5 and the associated UK standards and this guidance note, although there are detailed scoping rules that should be complied with if the client requires compliance with the BS/EN standards.

1.7 Sources of data for LCC

Sourcing reliable data in a readily usable form relevant to LCC studies for a variety of purposes and at different levels of detail is commonly regarded as an area of weakness in supporting life cycle costing calculations. This weakness, once recognised, can be addressed by understanding data type and variability characteristics in the data set. There are four categories of LCC data.

1 **Unstructured historical data**

Estate managers, office managers, facilities managers and others whose job concerns the running of the building are in the best position to record historic data. If recorded properly, this is a good source of LCC data. Similarly, account departments and energy managers also have all the necessary cost and consumption data, although it is rarely in a form that is readily usable for LCC calculations. Notwithstanding these problems, it should not be ignored.

2 **Structured historical data**

The RICS Building Cost Information Service (BCIS) is best known for its database of elemental building costs. The BCIS Building Running Costs Online service (formerly Building Maintenance Information (BMI)) is the UK's largest and oldest database of running cost analyses (see www.bcis.co.uk) based on an RICS Standard Form of Running Costs Analysis.

To quote the *BCIS Elemental Standard Form of Cost Analysis (4th edition, NRM)* (available as a free download):

> 'The purpose of cost analysis is to provide data which allows comparisons between the costs of achieving various defined functions, or maintaining defined elements, in one building with those in another. Furthermore, analysis creates a framework in which the property manager or surveyor may systematically collect data year by year. An element for cost analysis purposes is defined as a major physical part of a building that fulfils a specific function or functions irrespective of its design, specification or construction.'

Other examples of structured data are:

- HAPM Component Life Manuals published by Spons: list the typical operational life of components commonly used in housing.
- Means Facilities Construction Cost Data (published annually) by RS Means in USA. While priced in US dollars and based on data from US facilities managers, it does contain a wealth of labour constants that may be relevant to maintenance and cleaning operations internationally. Data, in the form of constants, are invaluable in building up rates from first principles.
- The Society of Construction and Quantity Surveying in the Public Sector (SCQS) Whole Life Cost Service has a database that is populated by subscribers. The assumptions made and the source of the data used are described by the contributors and appended to database items. If further information is required, the system allows subscribers to communicate.

Note that commercial models are available (e.g. for thermal modelling) and these may generate the basic data to which cost data can be added. For example, thermal models generate consumption data, which is multiplied by tariffs for different fuels.

3 **Data from modelling**

Modelling techniques yield predictive calculations. The technique requires a six-stage approach.

(a) Define precisely the activity to be modelled. This could be simple, i.e. cleaning curtain walling, or more complex, such as the modelling of energy consumption.

(b) Draw a flowchart of the activity.

(c) Extract the logic of the model and the discrete variables and formulae from the flowchart.

(d) Write a programme reflecting the logic and formulae.

(e) Run the programme, inputting values for the variables.

(f) Observe the outcome and, if required, run the programme again with different values for the variables to test for sensitivity.

4 **Data from manufacturers, suppliers and specialist contractors**

Although logically the best source of data for systems and components, the quality of data from manufacturers, suppliers and specialist contractors tends to be compromised by caveats aimed at restricting liability. Technical sales staff are the best people to approach, although a general statement along the following lines can be expected:

> 'these fans work for years; they come with a 2-year guarantee but providing they are well maintained should run for 8 to 12 years. Some fans are still going after 16 years.'

From this comment you could assume that the fan is unlikely to fail in the first 2 years, is unlikely to last 16 years, and probably has an average life of about 10 years.

A logical and recorded approach to the source of data allows the life cycle cost plan to be populated with data that are known to be reliable.

It is important that reference service lives taken from a range of data sources are considered and adjusted to reflect the project conditions. There is further guidance on use of service lives in BS/ISO 15686-8.

1.8 Deliverables – the LCC report – essential aspects

The LCC report will include, *inter alia*, the following information:

- the person/organisation for whom the report is produced, including an agreed statement of the information required by that person/organisation to support informed decision making
- the primary reason for doing the study, e.g. an option appraisal of two construction solutions; office building with atria, office building without atria
- the stage of the **capital cost** plan used by the LCC exercise, e.g. RIBA stage 2 concept design;
- a statement of the LCC **period of analysis**, the **base date** and the **discount rate** used
- a clear reasoned account of any assumptions made in doing the calculations including any sensitivity analysis
- summary of the study results
- recommendations and
- appendices as required; a glossary of terms used, tabulated summary of LCC calculations in SMLCC format and a synopsis of data sources.

2 Practical application (Level 2 – Doing)

2.1 Introduction

Section 1 gives a basic introduction and description of the terms and procedures used in life cycle costing. This section explains the application of life cycle costing to different study types.

LCC cash flow predictions facilitate the analysis of an expenditure profile over the LCC **period of analysis**. Cash flow predictions can be used as a basis for LCC planning in a similar way to the **capital cost** planning usually carried out in elemental format. The **capital cost** facet of the life cycle cost should be identical to the **capital cost** plan. Cash flow predictions represent the best estimation of capital and future expenditure for the selected option.

LCC option appraisal exercises are designed to compare strategic and technical optional solutions to a client's problem on a financial basis only. A common factor in option appraisal exercises is the use of the discounting methodology to bring all future costs to a **present value** or **annual equivalent**. As stated earlier, this guidance focuses on **present value**, which is considered the easier option from the perspective of doing construction option appraisal.

The definition of the problem in all types of option appraisal is fundamentally important. It is recommended that you record it and agree it with the client. The agreed definition will include the extent to which capital, maintenance, operation, occupancy, end of life and non-construction costs should be included in the calculation. A summary of the agreed scope, the basis for **present value** calculations and the source of the data will be included in the final report to the client.

LCC tender appraisal exercises are different from option appraisal exercises only in the specification of required scope included in the bid submission. The tender specification distributed by the client should include information on the required LCC **period of analysis**, the **discount rate**, and any data best supplied by the client, e.g. fuel tariffs. A report to the client of the LCC tender appraisal will include a recommendation on the most advantageous tender.

2.2 Taking the brief for the study

LCC comprises four basic steps:

1. defining the brief (for LCC)
2. the analysis of the problem to be examined
3. structuring and doing the calculations
4. validating and interpreting the results.

Defining the problem, and therefore the brief, precisely, is fundamentally important and arises from the following:

- What is the reason for the whole life study? For example:
  - A study to predict cash flows over a fixed period of time for budgeting, cost planning, cost reconciliation, tender preparation and audit purposes.
  - A study as part of an option appraisal exercise.
  - A study as part of a tender appraisal exercise where tenderers include a bid for the capital works and either information on, or a bid for, operations and/or maintenance. Such studies will be carried out in a way that is transparent to the tenderers and in accordance with a set of rules notified to tenderers in the tender information pack.
- What information does the client require to make an informed decision?

2.3 Analysis and calculations – key variables

There are several variables that form an important part of LCC calculations, but which do represent either a decision (by the client or assessor), or a judgment. The most important are:

- the **period of analysis** (typically decided by the client)
- the **discount rate** (set for UK public sector clients but representing either the cost of borrowing or the loss of alternative investment for private clients)
- the cycles or intervals between maintenance activities (typically based on analysis)
- the unit rates for work to be done (typically based on analysis).

Where there is uncertainty about the impact of such variables on decisions they can be changed individually (or globally in the case of rates) as a sensitivity analysis. Examples of sensitivity analysis are included in Appendix B. This allows advice to be given on the uncertainty. For example, if the optimum choice is highly dependent on the cycles used, or the analysis is highly dependent on a slightly different **period of analysis** (say five years) this is relevant to the client.

Sensitivity analysis is much easier to carry out where the variables are kept as specific cells in the tool, to which calculations refer (e.g. an absolute address for the variable in spreadsheets), rather than where they are embedded in the detailed calculations. This allows a single value to be changed rather than editing all calculation cells. See Appendix B for examples of sensitivity analysis where the impact of changing a single variable such as **discount rate** or cycles of replacement can be seen.

2.4 Analysis and calculations – dealing with terminal and residual values and other incomes

Assessment of incomes, where they form more than relatively minor positive cashflows, bring the assessment into whole life costing (WLC), not LCC. It is permissible to assess such incomes, but they should be kept separate from the LCC cashflows and indicated as part of the WLC assessment.

Terminal and residual values (such as on sale of the building during its lifetime), may play an important part in those WLC exercises focused on option appraisal. Residual values are of less importance in LCC exercises focused on cash flow prediction based on nominal costs.

Terminal values represent the scrap value of a system or component that fails during the LCC **period of analysis**. For example, the replacement of lead flashings should take into account the scrap value of the lead, which is included in the LCC calculation as a **terminal value**.

Residual values represent the value of an asset at the end of the period of study. The common method of determining the **residual value** is based on the straight-line method of **depreciation**. For example, if a particular system were to cost £50,000, with an expected life of 50 years, then the **residual value** at the end of a 30-year analysis period is £20,000.

There is an argument that there is no need to carry out a **residual value** calculation for elements such as foundations, structural frame, and other elements, which, by their very nature, define the technical life of the building. An analogy can be drawn between a candle and the candleholder. For example, a heating system and its various components represent the candle, and the foundations and structural frame represent the candleholder. Components of the heating system should wear and fail during the life of the building; in an LCC calculation therefore, **residual values** of components of the heating system are accounted for, whereas the structural frame will attract no **residual value**.

Remember that **residual values** are only important for option appraisal calculations. For example, consider a 25-year option appraisal study of two components, one with a working life of 15 years and the other with a working life of 20 years. Logically, both components should be replaced during the analysis period but at the end of the **period of analysis** the component replaced at 15 years will have a **residual value** based on five years of remaining life, whereas the component with a working life of 20 years will have a **residual value** of 15 years at the same point in time.

2.5 Calculations – designing an appropriate LCC model

BCIS/BSI document PD 156865 *Standardized Method of Life Cycle Costing for Construction Procurement (SMLCC)*, sets out a method for problem specification and subsequent appropriate approaches to LCC.

The proper specification of the problem is a necessary prerequisite to carrying out the study. Section 4 of SMLCC sets out a standard approach to the structuring of LCC estimation and implies a number of rules which, if followed, should allow the proper specification of the LCC problem. If all LCC exercises are carried out and presented in the same way, then it is easy to compare across projects.

Clause 4.23 of SMLCC states that information should be entered into the LCC plan using a standard defined structure. The defined structure is described in section 3 of SMLCC under the following headings:

- Construction costs
- Maintenance costs (note to comply with NRM 3 this should be split into Renewal and Maintain costs)
- Operation costs
- Occupancy costs
- End of life costs
- Non-construction costs (land, fees, etc.)
- Income
- Externalities.

The benefits of a common LCC plan structure are the standard presentation, understood by clients and professionals alike, as well as the easy comparison and benchmarking of similar projects. Another advantage is that it enables data to be brought into a common structure for numerous types of LCC studies.

Before committing to the analysis of costs, consider any specific requirements that the client has for the use of the LCC estimate, as this may impact on key variables. For example, a requirement if the LCC has to be suitable for submission for BREEAM, this will impact on the study period and the need to report both discounted and non-discounted cash flows; it also requires the initial study to be carried out at an early stage of design.

2.6 Analysis and calculations – post-occupancy – including BS 8544 and NRM3

At project stage 7 (use and aftercare), data will become available against which the accuracy of the LCC predictions can be measured. LCC audits may be done at predetermined intervals and reported, with other performance aspects of the building, in a post-occupancy evaluation report.

Additionally, at this stage, any changes to the building will be assessed and reported using the measures of economic performance to enhance the reporting data. For example, actual energy consumption is typically monitored against estimated energy consumption. This can help to determine whether operational changes are necessary, and may indicate that some equipment may need adjustment or renewal.

During use and aftercare typical decisions might include whether:

- *ad hoc* repairs continue to be cost effective or it would be appropriate to programme for a planned maintenance activity
- to consider refurbishment or investment in energy efficiency improvements
- whether to replace with like for like or not.

Equally decisions will be affected by the occupier's general strategy and plans. For example, whether there are plans for disposals and consolidation of the estate; expansion; or a change in occupancy levels.

Examples of evaluation techniques and tools applicable to this stage are included in BS 8544: 2013 Annex B, together with a detailed maintenance cost data schedule in Table 2 of the standard.

2.7 Analysis and calculations – sustainability and energy efficiency assessment

As described in 1.6, any full assessment of sustainability will presume a systems approach that considers the environmental, social and economic issues of any design decision.

Methodologies such as BREEAM and LEED introduce the desirability for an LCC calculation to support decisions on new and refurbishment projects taken with respect to sustainability. Policy documents, such as the government vision at the time of publication for the construction industry *Construction 2025: strategy,* provide targets for both capital and life cycle cost savings in addition to other areas for improvement. Similarly, the RICS SKA rating assessment tool covers the assessment of sustainability of fit-out projects. Although the focus is on life cycle assessment it will encourage consideration of life cycle costs.

Note that LCC can only support an appreciation of economic aspects of sustainable design that are quantitative. If any non-quantitative aspects are given a notional quantitative value (e.g. disruption to traffic flows or health impacts) they should be identified separately and kept out of the basic calculation.

LCC information combines with qualitative or quantitative environmental and social considerations in depicting the total sustainability development analysis. Some developers like using LCC techniques and its outputs as tools to increase selling prices and rental incomes. The techniques are also beginning to be used to justify the relationships between qualitative judgments made in institutions and decision making, particularly when considering fitness for purpose regarding specifications used to meet users' and other stakeholders' requirements.

The models of LCC used to evaluate the economic aspects of sustainable design generally focus on systems and components, NRM levels 5 and 6. These models tend to focus on cooling, ventilation, heating and power generation and other energy consuming equipment. Policy targets, such as for carbon reduction, and incentives, such as Feed-In Tariffs (FIT), encourage the use of LCC.

Note, however, that it is important to separate out the impact of tax incentives or penalties in the basic calculations.

As noted in 1.6, there are detailed rules for integrated assessment of sustainability included in BS/EN 15643-4: 2012 and in BS/EN 16627: 2015. These rules may alter default assumptions used in models, for example they prescribe longer periods of analysis than is typical for a free-standing LCC assessment, and they may also have rules that require specific treatment of sustainability incentives/tax allowances or key sustainability issues such as treatment of waste streams. Similarly there are detailed rules for LCC assessment for BREEAM credits or other environmental assessment schemes. Early on in the process you should think about to how to map the cost analysis to the reporting requirements, if they are part of the client's objectives.

2.8 Calculations – sensitivity analysis and risk

Sensitivity is associated with risk management. In the context of LCC it is primarily aligned to changing the variables, for example, the LCC **period of analysis**, and the interest rates.

In the majority of LCC models, variations in the **discount rate** can be analysed by 'what if?' questioning of the results by changing the **discount rate**. Ideally models should be set up so that a change to a single entry for the **discount rate** acts across all affected calculations.

Changes in the LCC **period of analysis** and other variables such as unit rates or scope often require the duplication and alteration of the basic model. Planning the structure of the model with sensitivity in mind can save considerable time. An example of this would be building the model for the longest period under consideration, and facilitating looking up cumulative values at different time intervals. This would save having to revisit the model for components whose replacement or maintenance cycles did not fall within the shorter **period of analysis**.

Examples of the effects of changing variables are given in Appendix B. Further examples can be found in BS/ISO 15686-5: 2008. Risks and uncertainty are also explicitly considered in the SMLCC Section 6, as is a risk log example in Annex E.

2.9 Validating and interpreting the results from an LCC model

An essential pre-requisite to interpreting and reporting results is to understand the primary purpose for carrying out the LCC estimate.

An LCC cash flow calculation demonstrates the anticipated spend profile for capital and **through life costs** over the period of study. This type of study is carried out as part of any Build Own Operate Transfer (BOOT) contractual arrangement of which PPP/PFI is a particular type. In considering a BOOT tender, the tenderer will need to appreciate when the high and low points of spend occur in the cash flow profile, and specifically how these relate to the unitary payment to be made by the client. Focus is often on the period just before the end of the contractual period of responsibility (or handback). There may need to be iterative considerations of options to reduce either maximum spend points, or to smooth expenditure, or to delay replacements beyond the contractual period.

An LCC option appraisal may be carried out as a comparison of options with reference to a **base case**. Where there is a base case, the results from the metrics of economic performance may assist decision-making. See Appendix A for common metrics in use in LCC appraisals.

An LCC tender appraisal may arise in two ways. If the tender:

- price submission is a unitary payment, i.e. an identical payment per period of time over the concession period
- includes an element of through life cost as part of the tender evaluation, although the construction contract may be based on the provision of the capital works only.

In this situation, rules should be provided to the tenderer to facilitate the tender submission and permit tenders to be evaluated on a like-for-like basis. The rules should include, for example:

- the importance given to the capital spend
- the importance given to the through life spend
- the LCC **period of analysis**
- the **discount rate** and
- the supply of information relating to low energy, zero carbon as part of the tender submission.

In all situations, the report to the client should include:

- confirmation of the purpose of the LCC calculation (as required by the client)
- the scope, form and level of economic evaluation
- all underlying assumptions
- the source of information and data
- the method used for the calculation
- the results of the LCC calculation, including any sensitivity analysis and
- recommendations and conclusions.

Even if formal sensitivity analysis has not been carried out, it may be useful to highlight the key drivers of costs in the report – particularly if these directly impact the recommendations or stem directly from client requirements e.g. for the study period.

3 Practical considerations (Level 3 – Doing/Advising)

3.1 Introduction

Part 3 describes some of the practical and commercial considerations that overlay the basic calculations, reflecting the point made at the beginning that LCC is comprised of four basic steps:

1. taking the brief
2. analysis of the problem to be examined
3. structuring and calculating the mathematics, and
4. validating and interpreting the results.

3.2 LCC models for different project development stages

The model underlying the LCC calculation should be related to the purpose of the calculation, which, in turn, is related to the stage of the project's development.

Note: The Digital Plan of Work (DPoW) outlines the information requirements for any constructed asset, new or existing. It deals primarily with information created, developed and used within BIM models. The DPoW is part of the NBS BIM Toolkit and was developed as part of the government BIM strategy.

There are three aspects to any plan of work:

- the project stages
- the users and
- the data.

The RIBA Plan of Work 2013 is an example of a plan of work.

The DPoW project stages are based on the Association of Project Management project life cycle. The level of detail for the information aligns with the requirements of BS 1192: 2007.

The DPoW identifies seven key strategic stages for the client to define the maturity of building, infrastructure or civils project information, including:

- why it is required
- what it is for and
- who will use/manage it

providing the foundation for its validation at each stage of the asset life cycle. Examples of LCC models with respect to differing business case development stages are illustrated in figure 3 and described below:

3.2.1 Strategic outline case (Stage 1 of Digital Plan of Work)

At the strategic outline case stage the project is defined by its mission; primary function, and client project values, i.e. the key success factors by which the client will judge the project a success. At the strategic outline case stage therefore, the LCC calculation is most likely to be one or more option appraisal exercise(s) at this level. The following are examples:

- Crossing a wide estuary. The option appraisal may consider a bridge, a tunnel, or a ferry.
- Provision of primary education in an area of expanding population. The option appraisal may consider the construction of a new school, the extension of an existing school or the provision of a bus service to take children to an existing school with a falling roll.

The LCC model will be populated by data from similar past projects or by high-level data from experts. An example of a Gross Internal Floor Area (GIFA) level appraisal is included in the SMLCC Annex D. In the strategic outline case report, the LCC option appraisal will help to inform decision-making but costs can be considered as only one part of a more complex value equation.

3.2.2 Outline business case (Stage 2 of Digital Plan of Work)

At outline business case stage, the technical solution to be analysed is established and the design advanced to the stage of the concept design (Stage 2). This will allow LCC option appraisal at elemental level, addressing:

- functional space
- structural solutions and
- high-level decisions concerning external fabric, internal subdivision, heating and ventilation, i.e. the level of technical solution required before obtaining planning permission. The outline business case will contain an LCC plan comprising the stage 2 **capital cost** plan and an outline LCC plan.

The outline business case will contain a number of option appraisal exercises with clear justification for the option chosen.

3.2.3 Design development (Stages 3 to 5 of Digital Plan of Work)

At design development stage, LCC option appraisal will be carried out at detailed element, system and component level; informing decision taking on detailed questions of value for money. The measures of economic performance are most likely to be used at this stage. Examples of each of these types of appraisal are included in the SMLCC Annex D (the current edition has not been updated to reflect the revised NRM elemental cost data structures or the DPoW stages).

3.2.4 Final business case (Stage 6 of Digital Plan of Work)

At the time of the final business case, tenders will have been received and the **capital cost** plan confirmed. The final business case signals that the time for option appraisal has ended and therefore the LCC will be focused on cash flow forecasting over the LCC **period of analysis**. The purpose of the LCC cash flow forecast is to enable the client to appreciate the LCC implications of the project in terms of both capital and life cycle costs. It forms part of the decision on whether to proceed to stage 6 (construction).

3.2.5 Post-occupancy (Stage 7 of Digital Plan of Work)

In the use and aftercare stage LCC is typically used for budgeting and obtaining funding for maintenance or renewal plans, and setting programmes for them, together with appraisals of levels of investment, detailed options, audits and reviews of maintenance provision and use as part of wider estate reviews. More guidance on each of these is in BS 8544: 2013.

BS 8544 highlights that the critical purpose of LCC at this stage is to achieve a specific outcome, such as maintaining acceptable performance, including both replace and maintain activities. The approach should be outcome driven. One of the key challenges will be assembling relevant data, both existing and required, which may entail ensuring accuracy and completeness. This may be done through surveys or inspections to establish existing physical condition and remaining life of components or systems, as well as a review of proposed maintenance or replacement plans against budgets and prioritisation of expenditure to achieve required outcomes. It may also entail establishing risk criticality rankings. Techniques are described and illustrated in the BS 8544. Detailed data structure guidance, including mapping to COBIE data structures for Building Information Modelling is also included in figure 5 and Appendix A.

3.3 Meeting client requirements in tendering

Procurement systems that include LCC by definition, e.g. PPP/PFI, Design, Build, Finance, Maintain (DBFM) and some other BOOT systems, are characterised by the tender being based on a unitary amount to be paid by the client to the service provider per period of time. Although such contracts generally include periods of intense negotiation, including factors to be considered in the LCC, ultimately the service provider carries the risk of an inaccurate LCC calculation. One issue to note is any gaps there may be between different parties' responsibilities – for example, in PFI procurement there will be some definition of the scope of 'life cycle replacements' as opposed to 'hard FM maintenance costs'.

Alternatively, the tender may include a requirement for LCC evaluation in the assessment of the successful tenderer but the contract sum is based on the **capital cost** only.

The following are factors to consider in making an LCC requirement of the tenderer.

- Why include an LCC element in a tender for a project for which the construction contract is based on a **capital cost** (contract sum) only? Record (in writing) the reason for the requirement and copy to the client.
- How to assess tenders? Specify this explicitly, so that there is no confusion among tenderers regarding the method of evaluating the tender submission. Ideally include a pro forma for reporting of LCC to facilitate comparisons between tenders.
- Include in the tender documents the client's requirements for authenticating the data on which the tenderer's LCC calculation is based.
- Include in the tender report an assessment of the extent to which the tenderer's LCC data and calculations can be relied on, including compliance with any good practice guidance or standards.
- Qualify any recommendations for the choice of successful tenderer by carefully reporting the above.

3.4 Whole life value

Whole life value is not discussed in this guidance but it is important to recognise that LCC is one part of a larger topic. The cost effectiveness of a building should be looked at in terms of the whole value of the building to the client. For example, the effectiveness of a supermarket may be judged in terms of the number of customers that can park their cars, move efficiently through the shop, move through the checkout and return to their cars to leave, allowing space for the next customer. This equation is more than simply providing the lowest cost building, as it takes into account the opportunity value of the parking space.

3.5 Alternative projects/ programme assessment

BS 8544: 2013 section 6 includes detailed guidance on how to assess a prospective programme of renewals or maintenance, and how alternative assessment entails prioritisation, funding and scenario modelling, planning (including expenditure modelling) and capturing feedback data. The objective is to achieve a holistic assessment of expenditure across an agreed programme of projects that links the agreed maintenance and replacement plans and meets the performance objectives, such as minimum compliance with mandatory or statutory requirements or achieving agreed levels of energy improvement. It also includes some guidance on letting a programme of projects, but there is more in BS 8572: 2011 (*Procurement of facility-related services. Guide*).

3.6 Model inputs and data assessment including use of 'proprietary' models

There are two categories of computer-based LCC programs, which can be described as glass box or black box systems. A glass box computer-based LCC program is characterised by the visibility of the process, such that each step in the LCC process can be seen by the operator.

Conversely, a black box computer-based LCC program is characterised by the input of data and the output of results with each step in the process being invisible to the operator. The most common glass box systems are based on spreadsheets but there are some proprietary systems available on virtual building model applications.

The primary advantage of developing in-house LCC models is that the build up and calculation steps are visible. The primary disadvantage is that much research, development and testing will be required to provide a user-friendly interface and reliable results. Additionally the model will need ongoing maintenance.

The primary advantage of selecting a proprietary system is that these steps will already have been done, but it is essential that the robustness of any underlying assumptions and data are understood.

In addition to evaluating the ongoing costs of acquiring the tool, licensing, hardware and training (as with any software acquisition) there are specific issues to consider. Check the methodology statement by the developers to ascertain answers to the following questions:

- Can global changes (e.g. to reflect tender price index changes for location or date of projects) be made quickly and recorded?
- Does the model show the unit rates used for specific activities, and can these be amended by the user?
- Is the build-up of rates clear (e.g. labour or productivity rates used to develop capital or facilities management costs)?
- Does the structure of the model follow current good practice guidance?
- Are the data sources up to date?
- Can the model be used for both early stage design (high level) and later developed designs?
- Can the calculations be saved and/or exported for future use?
- Can the results be used to benchmark one project against another?
- Can the results (or partial results) from one project be used as the basis of calculation as benchmark data?
- Is your client's data secure?

3.7 Benchmarking

A consistent basis for costing and analysis of LCC is necessary to ensure a robust basis for benchmarking. The various standards quoted give detailed guidance on scope and data formats – the scope must be consistent across all examples for benchmarking. Items included or excluded from the reported rates should be reported clearly to clients (e.g. whether VAT, fees, risk allowances are included). Additionally for LCC the **period of analysis** and whether the costs reported have been discounted (and if so at what rate) should be reported.

Note that there is more general guidance on cost benchmarking in the RICS guidance note 86/2011 *Cost analysis and benchmarking*, 1st edition.

Generally rates should be expressed in £ per unit area per annum. This allows further metrics to be derived consistently. LCC cost estimates are typically reported at several levels of detail, depending on the project stage and how granular the assessment was. The recommendations are based on the NRM functional units or in terms of Gross Internal Floor Area (GIFA). This is illustrated in figure 4 below. See NRM Part 1 Appendix B (1) for a list of functional units.

Figure 4: Benchmarking units for LCC

	Built asset (level 0)	Grouped elements (1)	Element (2)	Sub-element (3)	Component (4)
Construct	m^2 or function unit	Construct work cost estimates(m^2)	Cost planning (concise)	Cost planning (amplified) Detailed measurement	Cost planning (specific) Detailed measurement
Renewal	m^2/pa or function unit	Renewal work cost estimates (m^2/pa)	Renewal work cost estimates (m^2/pa)	Cost planning (various) Detailed measurement	Cost planning (various) Detailed measurement
Maintain	m^2/pa or function unit	Maintain work cost estimates (m^2/pa)	Cost planning (various)	Cost planning (various) Detailed measurement	Cost planning (various) Detailed measurement
Other aspects	As agreed in scope (e.g. end of interest)	Relevant maintenance considerations	Relevant maintenance considerations	Relevant maintenance considerations	Relevant maintenance considerations

3.8 Reporting and record keeping – including brief link to BIM

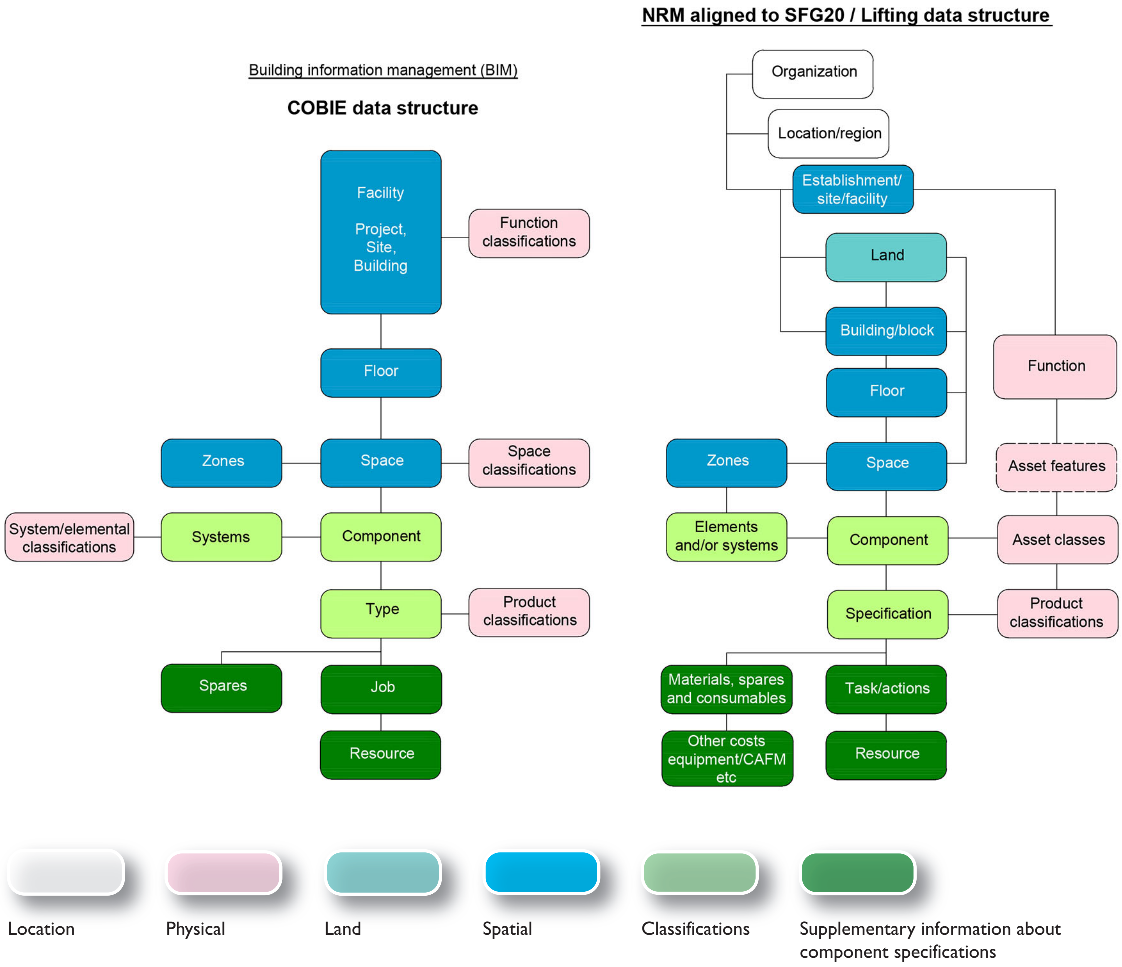
In addition to reporting unit or functional unit rates it is critical to structure the data used for LCC to facilitate comparisons, checking and use in subsequent analysis. LCC is data intensive, and data assumptions vary over time, therefore it is essential that you capture records of the origin, basis, assumptions and data structure to ensure that future LCC costs and interpretation are robust.

See BS 8587: 2012 for useful guidance on how to manage information for facilities, including checklists of typical contents of building manuals. See PAS 1192-2: 2013 for building information management for construction projects (capital works) and PAS 1192-3: 2014 for operational phase of works.

BS 8544 contains a mapping of LCC data for maintain and replace costs to the COBIE data exchange format in figure 5 and a detailed worked example in Appendix A showing a consistent data mapping from portfolio level down to elemental and component structure. It is fully aligned with NRM 3 data structure, and allows specification and service life data to be captured consistently.

Note: COBIE is a standardised tabular representation of a facility and its constituents, which allows information to be exchanged between different software packages. It is linked to targets for Building Information Modelling (BIM) in the UK.

Figure 5: Alignment of NRM costs data structure [1] with COBIE data structure (BIM)



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Appendix A: metrics for economic performance

Note: several of these metrics may also be used in derived form, e.g. NPV per functional unit or per m² of GIFA or per annum. For the origin of the **discount rate**, and how to assess what rate to use, see section 1.5.6.

Metric 1 – net present value (NPV) – see also 1.5.6.

A stream of future costs and benefits should be converted to a **net present value** using the following equation:

$$NPV = \sum (Cn \times q) = \sum_{n=1}^{p} \frac{Cn}{(1 + d)^n}$$

where

C is the cost in year *n*

q is the **discount rate**

d is the expected **real discount rate** per annum

n is the number of years between the **base date** and the occurrence of the cost

p is the **period of analysis**

∑ is the sum of all the costs that follow.

For example:

	Annual discount rate [d]	**3%**											
								Period of analysis [p]					
Cost type	**Year incurred [n]**	**Cost [C]**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	Discount rate [q]	1	**1.0000**	**0.9709**	**0.9426**	**0.9151**	**0.8885**	**0.8626**	**0.8375**	**0.8131**	**0.7894**	**0.7664**	**0.7441**
Capital (e.g. construction)	0	£100,000.00	£100,000.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Recurring (e.g. cleaning)	1	£5,000.00	£0.00	£4,854.37	£4,712.98	£4,575.71	£4,442.44	£4,313.04	£4,187.42	£4,065.46	£3,947.05	£3,832.08	£3,720.47
Intermittent (e.g. decoration)	5	£10,050.00	£0.00	£0.00	£0.00	£0.00	£0.00	£8,669.22	£0.00	£0.00	£0.00	£0.00	£7,478.14
Intermittent (e.g. replacement)	10	£12,000.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£8,929.13
	Total NPV p.a. [Cn x q] =		£100,000.00	£4,854.37	£4,712.98	£4,575.71	£4,442.44	£12,982.26	£4,187.42	£4,065.46	£3,947.05	£3,832.08	£20,127.74
	Cumulative total NPV [sum Cn x q] =		£100,000.00	£104,854.37	£109,567.35	£114,143.06	£118,585.49	£131,567.75	£135,755.18	£139,820.63	£143,767.68	£147,599.76	£167,727.50
	Total NPV = Cn x q for p =												£167,727.50

Metric 2 – annual equivalent value (AEV) – see also 1.5.6

To calculate the AEV:

$$AEV = \frac{Cd}{(1 + d)^n - 1}$$

where

AEV annual equivalent value

C is the cost in year *n*

d is the expected **real discount rate** per annum

n is the number of years between the base date and the occurrence of the cost

For example:

$$AEV = \frac{100 \times 0.06}{(1 + 0.06)^{25} - 1} \quad 1.82$$

Therefore, a cost of 100 units in 25 years' time at an interest rate of 6% will be equivalent to an annual investment of 1.82 units.

Metric 3 – net savings (NS)

Net savings is the difference between the amount invested and the amount saved, both expressed as **present value** amounts. The amount invested should include the **capital cost**, replacement costs, and take into account terminal and **residual values**. The savings should include reductions in operational and occupancy costs, including for example, reductions in the cost of energy, maintenance, janitorial staff, security, etc. NS is used to assess savings. A project is considered cost effective if savings outweigh expenditure. Choosing a project option with highest NS will have the same results as choosing one with lowest LCC.

Metric 4 – savings to investment ratio (SIR)

The savings to investment ratio gives the present value of the reduction in recurrent expenditure (operational and occupancy costs), as a ratio of the capital investment (the capital investment and the **present value** of periodic replacement costs taking into account terminal and **residual values**). Savings to investment ratio can be considered a value for money measure where any ratio exceeding 1.0 is considered value for money. Options can be assessed in order from highest to lowest SIR. The savings to investment ratio formula is represented by:

$$SIR = \frac{PV\ of\ reduction\ in\ operational\ and\ occupancy\ costs}{Capital\ cost + PV\ replacement + PV\ terminal\ and\ residual}$$

Metric 5 – internal rate of return (IRR)

IRR gives the percentage rate of return of the savings against the investment. Unlike the preceding techniques, which require a **discount rate**, the IRR represents the rate of interest at which the **present value** of savings is equal to the **present value** of the investment (or 0). Listing the options in terms of their IRR should give the investor meaningful information on which to make a decision. The IRR percentage rate of return is tedious to calculate manually but most spreadsheet programmes have an IRR function.

Metric 6 – simple payback (SPB)

The SPB gives a quick appreciation of the viability of the scheme without doing a **net present value** calculation. Simple payback gives an approximation of the point in time when the savings accrued exceed the investment made.

Metric 7 – discounted payback (DPB)

The DPB gives a more realistic appreciation of the payback point in time by taking into account the effect of the time value of money (i.e. it uses discounted costs). It is a measure of the time taken before the **present value** of the accumulated savings offset the **present value** of the investment. It is normal to complete a discounted payback calculation for the full LCC **period of analysis**, not just up to the point where payback is achieved, thereby demonstrating the impact of investment expenditure on replacements occurring immediately after the payback point.

Appendix B: worked examples of LCC

Note: the tables below are worked examples for illustration only, and do not constitute technical advice or methodology.

Table B1: sensitivity analysis over 20 years with changing discount rate

Year in which cost occurs	Expected yearly cost	Discount factors for 1%	NPV 1%	Discount factors for 3%	NPV 3%	Discount factors for 5%	NPV 5%
1	1,000	0.99	990	0.97	970	0.95	950
10	500	0.91	455	0.74	370	0.61	305
20	1,000	0.82	820	0.55	550	0.38	380
Total NPV	2,500	-	2,265	-	1,890	-	1,635

Note: discount factors are the annual discount rate used in the equations to represent the cumulative % rate chosen for discounting. So, for example, 3%p.a. discount rate produces a first year discount factor of 0.97. By year 10 the total discount factor is 0.74, by year 20 it is 0.55.

Table B2: sensitivity analysis over 20 years with future costs increased by 10%

Year in which cost occurs	Expected yearly cost	Discount factors for 1%	NPV 1%	Discount factors for 3%	NPV 3%	Discount factors for 5%	NPV 5%
1	1,100	0.99	1,089	0.97	1,067	0.95	1,045
10	550	0.91	501	0.74	407	0.61	336
20	1,100	0.82	902	0.55	605	0.38	418
Total NPV	2,750	-	2,492	-	2,079	-	1,799

Table B3: sensitivity analysis over 20 years optimistic and pessimistic estimated service lives (ESL)

Cost heading	Year in which cost occurs (base case)	Cost	Cumulative cost		
			Base case	Optimistic ESL	Pessimistic ESL
Energy consumption	1	500	12,865	12,865	12,865
Minor replacement	10	1,000	2,244	1,780	2,841
Major replacement	20	5,500	4,731	4,037	6,894
Repair allowance	3	250	2,044	1,510	3,169
Total NPV			21,884	20,192	25,769

Note: estimated services lives are increased and decreased by 20%, and rounded to the nearest year.

Energy consumption remains a constant annual cost.

Table B4: Extract of LCC model, showing first 30 years at 5-year intervals – without discounting

Cost heading	Replacement cost	Estimated service life	Total NPV	Year 0	Year 1	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
CONSTRUCTION		0	2,000,000	2,000,000							
Stair finishes	100	20	55		-	-	-	-	100	-	-
Stair balustrades and handrails	200	20	111		-	-	-	-	200	-	-
External windows	500	35	0		-	-	-	-	-	-	-
External doors	400	35	0		-	-	-	-	-	-	-
Internal walls/partitions	1,000	25	478		-	-	-	-	-	1,000	-
Balustrades and handrails	200	25	96		-	-	-	-	-	200	-
Internal doors	700	20	388		0	0	0	0	700	0	0
Wall finishes	1,000	15	1,054		0	0	0	1,000	0	0	1,000
Finishes to floors	2,000	12	2,387		0	0	0	0	0	0	0
Finishes to ceiling	500	15	527		0	0	0	500	0	0	500
Fitting, fixtures and furniture	600	10	1,026		0	0	600	0	600	0	600
Sanitaryware	300	15	316		0	0	0	300	0	0	300
Services equipment	100	15	105		0	0	0	100	0	0	100
Disposal installations	200	30	82		0	0	0	0	0	0	200
Water installations	300	20	166		0	0	0	0	300	0	0
Space heating and cooling	500	15	527		0	0	0	500	0	0	500
Electrical installations	500	20	277		0	0	0	0	500	0	0
Fuel installations	300	30	124		0	0	0	0	0	0	300
Lifts and enclosed hoists	200	15	211		0	0	0	200	0	0	200
Fire-fighting installations	100	15	105		0	0	0	100	0	0	100
Lightning protection	100	20	55		0	0	0	0	100	0	0
Warning installations	100	22	52		0	0	0	0	0	0	0
Security installations	100	20	55		0	0	0	0	100	0	0
Building management control installations	200	15	211		0	0	0	200	0	0	200
External works	300	20	166		0	0	0	0	300	0	0
MAINTENANCE	1,000	1	19,600		1,000	1,000	1,000	1,000	1,000	1,000	1,000
OPERATION	1,000	1	19,600		1,000	1,000	1,000	1,000	1,000	1,000	1,000
END OF LIFE	500	50	0		0	0	0	0	0	0	0
			Total	2,000,000	2,000	2,000	2,600	4,900	4,900	3,200	6,000
			Cumulative total	2,000,000	2,002,000	2,010,000	2,020,600	2,035,500	2,048,400	2,061,700	2,075,700

Note: for clarity, only the costs incurred at each interval extracted are shown. Cumulative totals over 30 years include costs in hidden years.

Table B5: Extract of same LCC model – costs discounted at 3%p.a.

Cost heading	Life cycle replacement cost	Estimated service life	Total NPV	Year 0	Year 1	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
CONSTRUCTION	0	0	2,000,000	2,000,000							
Stair finishes	100	20	55		0	0	0	0	55	0	0
Stair balustrades and handrails	200	20	111		0	0	0	0	111	0	0
External windows	500	35	0		0	0	0	0	0	0	0
External doors	400	35	0		0	0	0	0	0	0	0
Internal walls/partitions	1,000	25	478		0	0	0	0	0	478	0
Balustrades and handrails	200	25	96		0	0	0	0	0	96	0
Internal doors	700	20	388		0	0	0	0	388	0	0
Wall finishes	1,000	15	1,054		0	0	0	642	0	0	412
Finishes to floors	2,000	12	2,387		0	0	0	0	0	0	0
Finishes to ceiling	500	15	527		0	0	0	321	0	0	206
Fitting, fixtures and furniture	600	10	1,026		0	0	446	0	332	0	247
Sanitaryware	300	15	316		0	0	0	193	0	0	124
Services equipment	100	15	105		0	0	0	64	0	0	41
Disposal installations	200	30	82		0	0	0	0	0	0	82
Water installations	300	20	166		0	0	0	0	166	0	0
Space heating and cooling	500	15	527		0	0	0	321	0	0	206
Electrical installations	500	20	277		0	0	0	0	277	0	0
Fuel installations	300	30	124		0	0	0	0	0	0	124
Lifts and enclosed hoists	200	15	211		0	0	0	128	0	0	82
Fire-fighting installations	100	15	105		0	0	0	64	0	0	41
Lightning protection	100	20	55		0	0	0	0	55	0	0
Warning installations	100	22	52		0	0	0	0	0	0	0
Security installations	100	20	55		0	0	0	0	55	0	0
Building management control installations	200	15	211		0	0	0	128	0	0	82
External works	300	20	166		0	0	0	0	166	0	0
MAINTENANCE	1,000	1	19,600		971	863	744	642	554	478	412
OPERATION	1,000	1	19,600		971	863	744	642	554	478	412
END OF LIFE	500	50	0		0	0	0	0	0	0	0
			Total	2,000,000	1,942	1,725	1,935	3,145	2,713	1,528	2,472
			Cumulative total	2,000,000	2,001,942	2,009,159	2,017,507	2,027,586	2,035,071	2,041,752	2,047,774

Appendix C: Glossary

Annual equivalent	The present value of a series of discounted cash flows expressed as a constant annual amount.
Base case	The existing situation against which improvement options can be compared or a specific solution selected as the benchmark against which other options can be compared.
Base date	The point in time when the LCC period of analysis starts and from when all future costs are discounted. All relevant costs accrued before the base date but after the start of the study, are deemed to be capital costs.
Base rate	The interest rate selected as the basis of the discount rate. This could be the current bank rate or client's opportunity cost of capital. The base rate is commonly adjusted by the inflation rate to give the discount rate.
Capital cost	Initial cost of the asset.
Depreciation	The distribution of the monetary value of an asset over a period of time commonly related to its productive or useful life.
Discount rate	The interest rate used to bring future costs to a comparable time base (base date).
Hard facilities management costs	The cost of necessary replacement, redecoration, repair and corrective, responsive and preventative maintenance necessary for the continued specified functional performance of the asset.
Inflation/deflation	A sustained and measurable increase/decrease in the general price level.
LCC period of analysis	The period of time used for the calculation of the LCC. The period is the time from the agreed base date to a given point in the future.
Nominal cost	The estimated future amount to be paid, including the estimated changes in price due to inflation, deflation, technological advances, etc.
Period of analysis	See LCC period of analysis.
Present value (PV)	The present day worth of a future cost discounted at a given interest rate. It can be considered to be the amount invested in a bank today at a given interest rate to accrue a required amount at a given point in the future.
Real interest rate	The rate adjusted to exclude inflation.
Real opportunity cost of capital	The interest rate reflecting the earnings possible from an activity other than that being studied.
Residual life	When applied to an asset, it is that life remaining at the end of the LCC period of analysis.
Residual value	The value assigned to an asset at the end of the period of analysis.

Service life	Period of time after installation during which an asset, or its systems and components, meets or exceeds the performance requirements.
Sinking funds	Funds accumulated by equal payments made at regular periods into an account that attracts a given interest rate to accumulate a required sum of money established before doing the sinking fund calculations.
Terminal value	The scrap value of a component or asset at the point of its replacement.
Through life costs	The cost of financing hard and soft facilities management through the life of the asset.
Treasury discount rate	The rate specified as the discount rate by the Treasury to be used as the discount rate in public sector LCC option appraisal calculations.

Appendix D: References

RICS references

The references below are current at the time of publication, but users should check that they are using the latest editions.

- NRM 1 *Order of cost estimating and cost planning for capital building works*, (2nd edition), April 2012
- NRM 3 Green, A., *Order of cost estimating and cost planning for building maintenance works* (1st edition), 2014
- RICS *Elemental Form of Property Cost Analysis* (4th edition), NRM
- *Cost Analysis and Benchmarking* (1st edition), RICS guidance note 86/2011, RICS, 2011
- RICS SKA rating
- RICS Standard Form of Running Costs Analysis

Other references

- BS 8544: 2013 *Guide for life cycle costing of maintenance during the in use phases of buildings* http://shop.bsigroup.com
- BS 8572: 2011 *Procurement of facility-related services – Guide* http://shop.bsigroup.com
- BS EN 15643-4: 2012 *Sustainability of construction works. Assessment of buildings. Framework for the assessment of economic performance* http://shop.bsigroup.com
- BS EN 16627: 2015 *Sustainability of construction works. Assessment of economic performance of buildings. Calculation methods* http://shop.bsigroup.com
- BS/ISO 15686-5: 2008 *Buildings and constructed assets. Service life planning. Life cycle costing* http://shop/bsigroup.com
- *HAPM Component Life Manual*, CRC Press, Taylor & Francis, 1992, ISBN 978 0 41555 778 8
- PAS 1192-3: 2014 *Specification for information management for the capital/delivery phase of construction projects using building information modelling* http://shop/bsigroup.com
- PAS 1192-3: 2014 *Specification for information management for the operational phase of assets using building information modelling* http://shop.bsigroup.com
- PD156865: 2008 *Standardized method of life cycle costing for construction procurement. A supplement to BS ISO 15686-5 Buildings and constructed assets. Service life planning. Life cycle costing*, BCIS/BSI http://shop/bsigroup.com
- SCQS *Whole Life Costing Service* www.wholelifecosting.co.uk

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