LCC

Life cycle costs of a building are usually regarded to consist of the following elements:

1. Acquisition costs
2. Operation and maintenance costs
3. Repair and replacement costs

Acquisition costs include all the costs caused by the acquisition of a new building or a renovation/refurbishment of an old building.

Operation and maintenance costs follow from those actions that are necessary to create and maintain desired circumstances in a building. Operation and maintenance costs are usually considered to cause more or less frequently and they are often divided into the following items:

- Management and administration costs
- Energy costs (heating, cooling and electricity)
- Water and wastewater costs
- Janitorial service costs
- HVAC-systems service costs
- Cleaning costs
- Waste disposal costs
- Other operation and maintenance costs.

Depending upon an organization some tenant service costs like reception service costs, catering service costs or guarding costs can be equated with operation and maintenance costs.

During the life-time of a building many elements or systems need to be repaired or replaced with a new one. Costs caused by these actions are often classified as major repair and replacement costs. Taking into account these costs in LCC calculations needs a lot of information about building condition and knowledge about the service lives of existing building elements and systems.

However, user requirements for the building may change in time. In practice many buildings have to be refurbished or remodeled during their life-times. Costs of these kinds of repair actions are difficult to predict and they are often left out of the LCC calculations.

Particularly in the cases of relatively short LCC calculation time periods it may be also reasonable to include the residual value of the building in the calculations.

One fundamental problem in linking acquisition costs and the costs caused by the building use is the different birth-time of these costs. Acquisition cost is a one-time payment that is fulfilled in the beginning of the building project. Building operation and maintenance as well as needed repair and replacement works incur expenses in certain momentums during the whole using period of the building. In practice these costs caused in different momentums are unified by investment calculations methods. Commonly used investment calculation methods are present value method and annuity method. To carry out LCC calculations it is necessary to choose the relevant interest rate and the economic lifetime of the building. For practical purposes it is often useful to perform sensitivity analysis by varying the values of critical LCC calculation factors.
Successful use of LCC calculations provides decent cost estimates of all the LCC cost factors. At the early stages of the renovation project cost estimation data can be acquired for instance from

other same kind of projects executed lately. There are also often public rough estimation data available. When design work is finished detailed information of the building should be used as the basis of the life cycle cost estimations.

An example of the results of renovated school building life cycle cost estimation is shown in *table 1*.

Table 1. An example of the results of life cycle cost calculation for renovated school building (present value). Economic lifetime of the building 40 years and interest rate 6%. Residual value have been left out of the calculation.

Acquisition costs	Operation and maintenance costs	Repair and replacement costs of building parts	Total life cycle costs
1 300 €/m2	1 100 €/m2	200 €/m2	2 600 €/m2
(50 %)	(42 %)	(8 %)	(100 %)