Estimation , Costing and Specification

Module 4

Introduction to Cost Modelling

- In the majority of cases in which an industrialist is about to manufacture a new product he first of all builds a prototype.
- He does this for a number of reasons; such as:
  - (i) To identify and solve three-dimensional problems that were not apparent in the drawings.
  - (ii) To identify the tools required for production.
  - (iii) To help estimate the cost of production.
  - (iv) To evaluate its functional performance
  - (v) To test the product's marketability.
  - (vi) To provide a sample for a customer as evidence of the quality standard to be achieved.

Introduction to Cost Modelling

- These models can be, for example, **physical (as in a three-dimensional architect's model); mathematical (as in a heat loss equation); or Statistical** (where some collected information indicates a certain trend).
- **Cost modelling** may be defined as the symbolic representation of a system, expressing the content of that system in terms of the factors which influence its cost.
- In terms of quantity surveying practice this usually means estimating the cost of a building design at an early stage to establish its feasibility.
- Cost models are mathematical algorithms or parametric equations used to estimate the costs of a product or project
- All methods , **techniques or procedures used by quantity surveyors for estimation or cost forecast may be termed as cost models**

Introduction to Cost Modelling

Purpose:

- To forecast construction costs for clients
- To estimate resource costs for contractors

Choice of estimation models will be influenced by various factors:

- Availability of information
- Experience/knowledge of the estimator or quantity surveyor
- Purpose of estimates

Classification of Cost Models

1. Traditional cost models
2. Empirical or causal models
3. Regression cost models
4. Life cycle cost analysis

1. Traditional cost models

- Quantity surveyors have been using a form of modelling technique for a number of years.
- In their measurement for Bills of Quantities they have been representing the building in a form suitable for the contractor's estimator; and **when prices are applied to the measured quantities the Bill becomes a representation (or model) of the cost of the building.**

1.Traditional cost models

- **1. Conference:-**
  - Calculating rate by discussion
- **2. Functional unit**:-
  - Similar to the superficial model, although different cost rates are applied to different functional areas within a building on the assumption that those different areas will cost different amounts to construct.
- **3. Superficial**:-
  - A single rate applied to the floor area of a building, then calculating total rate of building

1.Traditional cost models

- **4. Superficial-perimeter:-**
  - A variation on the superficial method
  - As well as taking the floor area of a building into account, the length of building perimeter is also included in an endeavour to increase accuracy
- **5. Cube:-**
  - A single cost rate applied to the internal volume of a building
- **6. Storey enclosure:-**
  - The measurement and costing of the area of the external walls, the floor and ceiling which enclose each storey within a building

1.Traditional cost models

- **7. Approximate quantity:-**
  - The measurement and pricing of a small number of grouped items.
- **8. Bill of quantities:-**
  - The measurement and pricing of many items, such as a Bill of Quantities

Elemental Cost Model:

- In this method the design of cost planning has been best achieved by **dividing the building into 'functional elements'** mainly into three levels.
- Elements are defined as the major parts of the building which always perform the same function irrespective of their location or specification. for eg.
- Level 01 MAJOR GROUP :
  - Substructure
- Level 02 GROUP ELEMENTS :
  - Foundations
  - Basement construction

Elemental Cost Model:

- Level 03 INDIVIDUAL COMPONENTS :
  - Standard foundation
  - Special foundation
  - Slab on grade
  - Basement excavation
  - Basement walls

- These elements have some relationship with the design process ,and **can be readily measured form the sketch drawings** and are easily understood and communicated to all the parties involved in the project including the client.

2. Causal or empirical cost models

Methodical cost estimation based on the available data and skills, experience, and knowledge of the estimator.

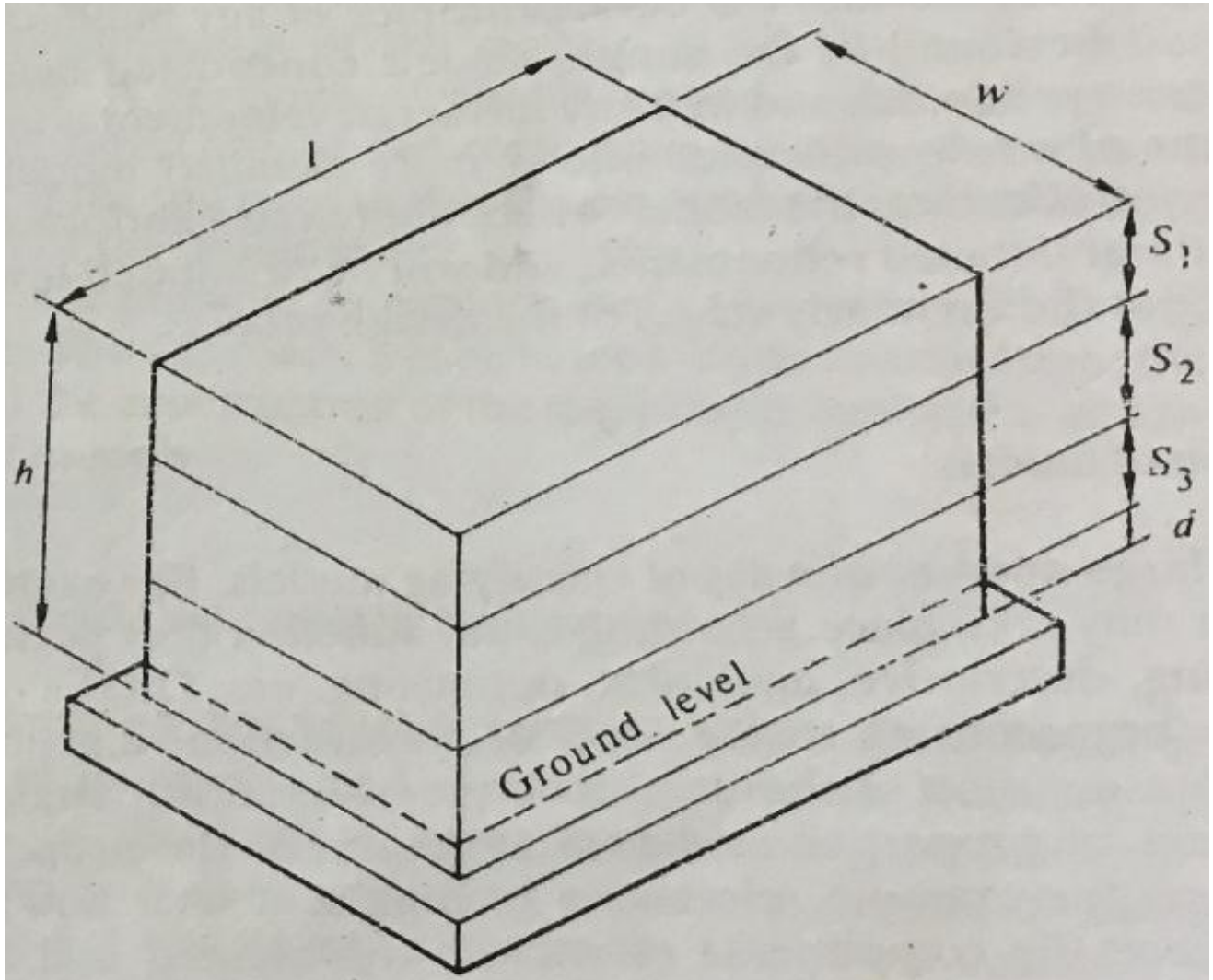
- Requires step by step compilation of the estimate based on skills, knowledge, level of experience of the estimator.
- Time consuming method.
- Degree of accuracy is low.
- Left to a single person for judgement.

2. Causal or empirical cost models

- These are **symbolic models** which are based **on relationship between the design variables and cost**, and which have been derived from observation and experiment
- It is a small step to translate the process into a general **algebraic form relating to the morphology of the building and its components, to which cost factors can be applied**

- If instead of measuring up a building and applying a unit rate to the derived quantities of each component we **express the building in algebraic terms, then we can give values to those algebraic terms, apply cost coefficients and arrive at a cost estimate.**

2. Causal or empirical cost models(Eg.)



. *Physical form of causal model example*

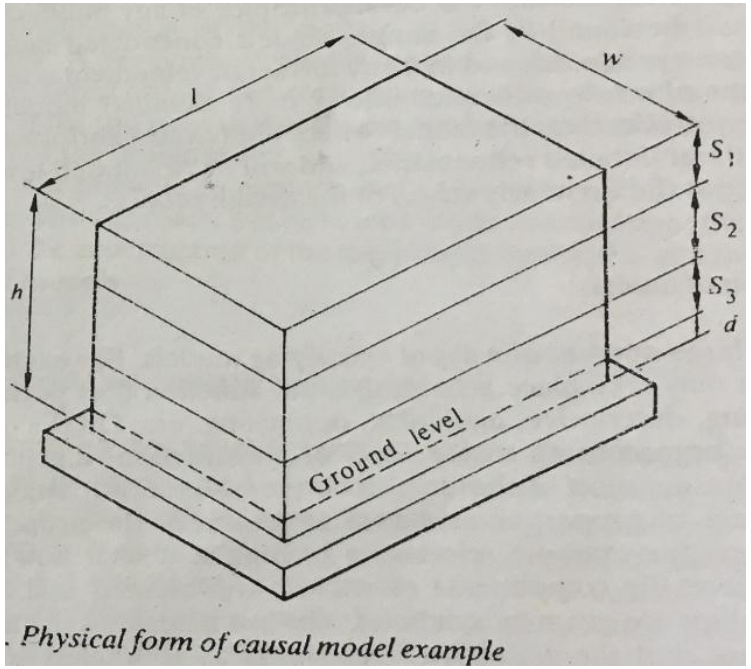
2. Causal or empirical cost models(Eg.)

1) The ground floor slab.

- The cost of this component can be considered to be a function of the ground floor plan area.
- The algebraic equation is therefore:

  Area of slab = l x w.

- To this equation must be applied a cost factor (CF1) related to the cost per sq. m ground floor slab including additional items such as reduced level excavation and hardcore, which relate to this particular horizontal measurement.
- Cost of slab = **l x w x CF1**



Physical form of causal model example

2. Causal or empirical cost models(Eg.)

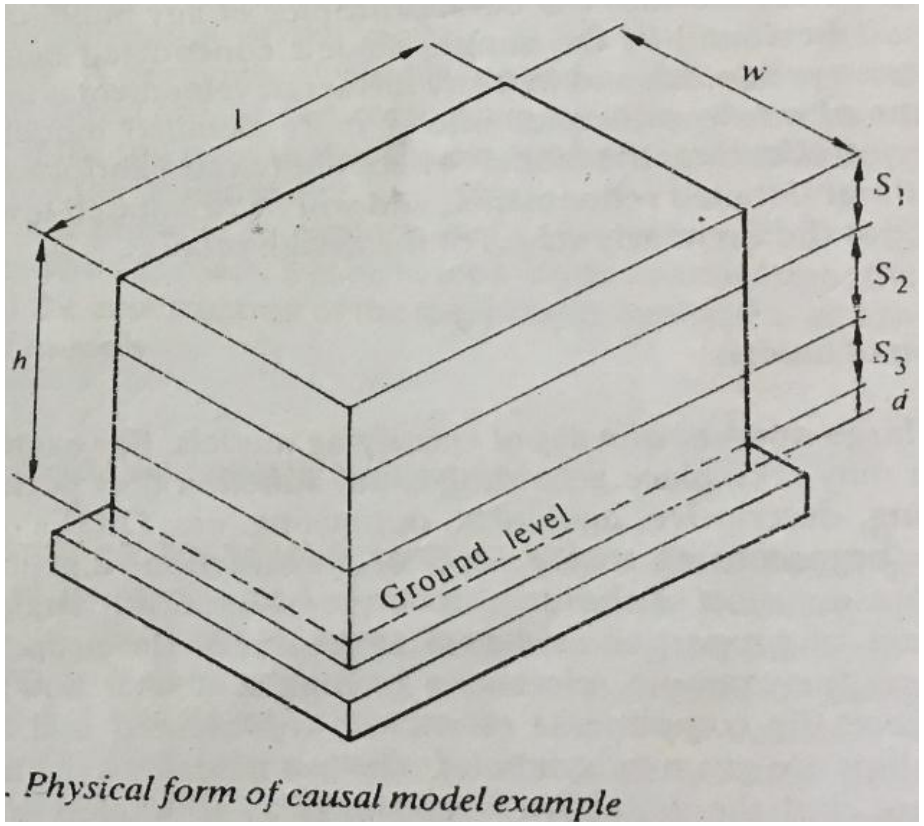
2) **The perimeter strip foundation.**

- The cost of this component is a function of its total length.
- The cost factor (CF2) for this item would include for excavation, concrete, brickwork, etc.
- Length of strip foundations

  = 2 x (l + w)

- Cost of strip foundations

  = (2 x (1 + w)) x CF2



Physical form of causal model example

3. Regression models.

- In the empirical model it is usually assumed that there is a fixed relationship between the design variable and cost, and that the **cost factor applied to the algebraic formula is constant**.
- In **regression model, the major components of construction are identified and a mathematical relationship between them, in the form of an algebraic equation is determined using the data**

3. Regression models.

- **Regression models involve the following variables:**
- The **unknown parameters**, denoted as β, which may represent a scalar or a vector.
- The **independent variables X.**
- The **dependent variable, Y**.
- In various fields of application, different terminologies are used in place of dependent and independent variables.
- A regression model relates Y to a function of X and β.
- $Y \approx f(X, \beta)$

4. Life Cycle Cost Analysis:

- **Life cycle costing, LCC, is the process of analysis to asses the total cost of ownership of a product**, including its cost of installation, operation, maintenance, conversion, and/or decommission. It takes into account all costs of acquiring, owning, and disposing of a building or building system.

- **LCCA** is especially useful when **project alternatives that fulfill the same performance requirements**, but differ with respect to **initial costs and operating costs,** have to be compared in order to select the one that maximizes net savings.

4. Life Cycle Cost Analysis:

- **Example**: LCCA will help determine whether the incorporation of a high-performance HVAC or glazing system, which may increase initial cost but result in dramatically reduced operating and maintenance costs, is cost-effective or not.

- The purpose here is **to estimate the overall costs of project alternatives and to select the design that ensures the facility will provide the lowest overall cost** of ownership consistent with its quality and function.

Costs

- There are numerous costs associated with acquiring, operating, maintaining, and disposing of a building or building system, but all of that can be broadly classified under the following:
- **Initial Costs—**
  - Design & development cost
  - Investment on asset
  - Installation cost or erection & commission(bring into working condition) cost.
- **Operation, Maintenance –**
  - Labour cost
  - Energy cost
  - Spare & maintenance cost