2. Bill of Quantity Preparation

2.1 Introduction

Before starting any construction one has to have a thorough knowledge about the volume of the work and the probable cost that may be required for the completion of the project. Otherwise, the construction will be stopped before its completion due to shortage of money or materials.

Types of estimates

1. Approximate/Rough estimate
   - To get an idea for the probable expenditure in a short time
   - To prepare a preliminary estimate before drawing up a detailed estimate for a project

   This is made after knowing the costs of similar projects.

2. A detailed estimate

This is the best method and includes the quantities and cost of everything required for the work.

Requirements

- Drawings
- Specification

Therefore, quantity surveying may be defined as the process of calculating the quantities and cost of various works required in connection with the project.

Purposes of quantity surveying

- To know the amount of money required
- To know the quantities of materials required
- To know the tools and equipment required for the construction
- To know the different workers to be employed
- To draw up the construction schedule and program
- To fix up the completion period
- To invite tenders
- To obtain sanction of necessary funds from the concerned authority
- For valuation of an existing structure
2.2 Bill preparation

There are three processes in the preparation of the completed bill of quantities.

a) Taking-off quantities
b) Abstracting or ‘working-up’
c) Billing

2.2.1 Taking-off quantities

In the first instance quantities need to be extracted from drawings, together with an appropriate description. This process - known as booking dimensions or taking-off quantities - involves the measurer in either reading or scaling dimensions from the drawings. There are two distinct parts to this. The first involves the recording of quantities, whilst the second required a written description to accompany the quantity. The sequence adopted by measurers in this initial stage bears little relation to the eventual order of the finished bill of quantities. This is because ‘taking-off’ has been devised in order to assist the measurer with both the speed and accuracy of recording dimensions.

Dimensions are taken from a drawing and recorded on specially lined paper known as dimension paper.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
</table>

The format of standard dimension paper

The A4 page is divided vertically into two identical halves each comprising a set of four columns. These are labeled for the purpose of identifications. The extra column on the extreme left is called the binding margin and would not normally be used for recording dimensions.

The purpose of each column

*Column 1* is called the ‘timesing column’ in which multiplying figures are entered when there is more than one of the particular items being measured.

*Column 2* is called the ‘dimension column’ in which the actual dimensions, as scaled or taken direct from the drawings, are entered. There may be one, two or three lines of dimensions in an item depending on whether it is linear, square or cubic.
Column 3 is called the ‘squaring column’ in which the length, area or volume obtained by multiplying together the figures in columns 1 and 2 is recorded, ready for transfer to the abstract or bill.

Column 4 is called the ‘description column’ in which the written description of each item is entered. This column is frequently used to accommodate preliminary calculations and other basic information.

General principles of taking-off

1. Entering dimensions

   - Dimensions are entered in the dimension column in meters to two places of decimals.

   The four principal units of measurement are:
   - Enumeration (nr. or pcs.)
   - Length (m)
   - Area (m²)
   - Volume (m³)

   For enumerated items whole numbers are entered in the dimension column, with a line drawn horizontally beneath each single entry.

   - The order of recording dimensions is:
     - Length
     - Width/breadth
     - Vertical height/depth

2. Abbreviations

   Many of the words entered in the description column are abbreviated in order to save space and time in entering the item by highly skilled technical staff. Many abbreviations have become almost standard and are of general application; for this reason there is a list of the more common abbreviations.

3. Grouping of dimensions

   Where more than one set of dimensions relate to the same description, the dimensions should be suitably bracketed so that this shall be made clear.

   Where the same dimensions apply to more than one item, the best procedure is to separate each of the descriptions by an ampersand ‘&’ sign and to bracket the descriptions.
4. Adjustment of openings and voids

When measuring areas with openings or voids, the most convenient practice is usually to measure the full area in the first instance, and to subsequently adjust for any voids or openings.

5. Order of taking off

The order of taking off largely follows the order of construction to simplify the work and to reduce the risk of items being missed.

2.2.2 Abstracting or ‘Working up’ bill of quantities

The sequence adopted by measurers follows construction operations as they occur on site. However, once the take-off is complete, these measured items need to be collated, like items must be merged and deduction adjustments made. This process, known as abstracting or working-up quantities, is carried out on specially lined A3 size paper.

At the head of each abstract a work section heading is recorded. Each measured item is copied from the dimension column and transferred to the abstract. In an effect to avoid double transfer, or the omission of an item, each description is lined through on the dimension sheet as it is transferred.

Descriptions are copied spanning two columns on the abstract and a horizontal line is drawn below each transferred description. The squared quantity is entered below this line, additions on the left and deductions on the right. To provide a cross-reference to the dimension page, each squared quantity is labeled with its source (i.e., the dimension page number).

Related work section items from different parts of the take-off will appear on the same abstract. The abstracted items should be well spaced apart, allowing the later insertion of omitted items. Once all measured items have been transferred to the abstract, the quantities are totaled and rounded to the nearest whole unit.

---

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|

Layout and spacing of a completed abstract
### 2.2.3 Billing

This is the final stage in the preparation of the completed bill of quantities. The effort of assembling and ordering was completed at the abstracting stage and all that remains is for the descriptions and quantities to be presented in a structured and consistent fashion.

There are three levels of heading and they have the following titles:

- **Level 1**: Group (eg. Substructure)
- **Level 2**: Sub-group (eg. Earthwork)
- **Level 3**: work section (eg. Site clearance)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td><strong>A. SUB-STRUCTURE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td><strong>1. Earthwork</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td><strong>Total carried to summary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td><strong>2. Concrete Work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td><strong>Total carried to summary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Draft bill of quantities with levels of heading
3. Mensuration in Quantities

Mensuration is the term used by mathematicians to describe the measurement of lengths, areas and volumes of different figures. It is necessary to understand the principles of mensuration before dimensions can be correctly presented and recorded on dimension paper.

Girths

One of the most frequently used techniques when booking dimensions is ‘girthing’. Most buildings are based on a square or rectangular plan shape and it is often necessary to establish the perimeter of individual rooms or whole buildings either internally or externally. Whilst the drawings will show plan dimensions, before these can be set down and recorded on dimension paper it will be necessary to build up perimeter lengths as waste calculations. This length is required for foundations, walls and associated items.

The length can be calculated by determining:
- The total internal length of the wall
- The total external length of the wall
- The center line length of the wall

Example: Determine the internal, external and centerline girths for the room plan shown below.
Exercise. Determine the different girths for the buildings layout shown below.

(a)  
(b)
a) 

**External girth**

Length \(2/20000=40000\)  
Width \(2/9000=18000\)  
Ext.gth. = 58000

**Internal girth**

Ext.gth. = 58000  
Less 8/200 = 1600  
Int.gth. = 56400

**Centerline girth**

Ext.gth. = 58000  
Less 8/(½)/200 = 800  
Centerline gth. = 57200

b) 

**External girth**

Length \(2/22000=44000\)  
Width \(2/9000=18000\)  
Add \(2/3000=6000\)  
Ext.gth. = 68000

**Internal girth**

Ext.gth. = 68000  
Less 10/200 = 2000  
Add 2/200 = 400  
Int.gth. = 66400

**Centerline girth**

Ext.gth. = 68000  
Less 10/(½)/200 = 1000  
Add 2/(½)/200 = 100  
Centerline gth. = 67100
Earthwork

It is about determining the average ground level of a sloping site.

Example: Determine the average ground level for the sloping site shown below.

![Diagram of sloping site](image)

<table>
<thead>
<tr>
<th>Average ground level</th>
<th>2.50</th>
<th>3.00</th>
<th>3.50</th>
<th>4.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/2.75</td>
<td>5.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/3.00</td>
<td>6.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/3.25</td>
<td>7.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/3.75</td>
<td>7.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4/3.25</td>
<td>13.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sum of wt. depth = 52.00

Average depth = \( \frac{52.00}{16} \) = 3.25

Pitched roofs

It is about the measurement of the roof structure and the roof covering. The actual, not the projected, lengths and areas are measured.