

Quantity Survey

Introduction

1.1 Definition of Quantity Survey

Quantity survey is a schedule of quantities of all the items of work in a building.

1.2 Data Required for the Preparation of an Estimate or Quantity Survey

1.2.1 Drawings

Complete and fully dimensioned drawings (i.e. plans, elevations, sections and other details) of the building or work in question are required.

1.2.2 Specifications

Detailed specifications, giving the nature, quality and class of work, materials to be used, quality of the material, their proportions, and method of preparation are required.

1.2.3 Rates

The rates of various of work, materials to be used in the construction, wages of different categories of labor (skilled or unskilled) and cost of transportation charges should be available for preparing an estimate of work cost.

1.2.4 Actual Finished Work

Quantities can be calculated from the actual work done in the project site.

- The quantities mainly can be calculated as:

Quantity = Length × Width × (Height or Thickness),

Quantity = Area of cross-section × Length,

Quantity = Length × Width,

Quantity = Length.

Quantity = Number of Units.

Quantity = Weight.

1.3 Importance of Quantity Survey

1. Quantity survey is essential to estimate before the construction starts the *probable cost* of construction for the complete work. The construction cost includes cost of materials, cost of transportation, cost of labor, cost of scaffolding, cost of tools and plants, establishment and supervision charges, cost of water, taxes and reasonable profit of the contractor, etc. The estimate is required in inviting tenders for the works and to arrange contract for a complete project.
2. Quantity survey is required to estimate the quantities of the various materials required and the labor involved for satisfactory completion of a construction project.
3. It is also useful to check the works done by contractors during and after the execution. Also the payment to the contractor is done according to the actual measurements of the completed part of each item of work.
4. A complete quantity survey or estimate is useful to provide useful advice to clients on:
 - (i) Valuation of properties (land and building) for sale, purchase and mortgage etc.
 - (ii) Fixation of standard rent.
 - (iii) For insurance and claim for damages in a building.
 - (iv) For the process of resolving disputes by referring to a third party.

1.4 Types of Estimates and Quantity Survey

1.4.1 Preliminary or Approximate Estimate

This is to find out an approximate cost in a short time. It is used to give an idea of the cost of a proposed project. This estimate helps the client or sanctioning authority to make decision of the administrative approval.

The approximate cost is prepared from the comparison with similar works. The approximate cost can be found by using methods that depends on the area or cubic content of a building and then multiplying this by an estimated rate for the unit of the area or cubic content. Approximate quantities of materials and labor required per m² of the area for a proposed building also can be found.

1.4.2 Detailed Estimate

After getting the administrative approval, this estimate is prepared in detail prior to inviting of tenders. The whole project is divided into sub-works, and the quantities of each sub-work are calculated separately. The dimensions of the required work are taken from the drawings of the project.

1.4.3 Quantity Estimates

This is a complete estimate of quantities for all items during project implementation.

1.4.4 Revised Estimate

Prepared if the estimate exceeded by 5% due to the rates being found insufficient or due to some other reason.

1.4.5 Maintenance Estimate

Estimating required quantities and cost of work to maintain a structure (road, building, etc.)

1.5 Contracts

Contract is an agreement between two or more parties creating obligations that are enforceable or recognizable at law

It establishes an obligation of each party to fulfill what it is agreed to perform.

1.5.1 Obligations of the employer

1. Appointing of the engineer to administer the contract
2. Provision of the site
3. Provision of information, permits, and approvals
4. Providing funds and making payments in accordance with the contract
5. Participation in consultations with the engineer to agree matters on claims or conflicts between parties.

1.5.2 Obligations of the Contractor

1. Execution and completion of the works and remedying any defects therein.
2. Provision of:
 - a. Labor, materials, plant, and equipment needed
 - b. Preparation of progress report
 - c. Works program for execution, and updating it whenever required
 - d. Setting out of the works
 - e. Measurement and/or assisting the engineer to do so
 - f. Records of his personnel and equipment
 - g. Sample of materials specified
 - h. Testing and re-testing
 - i. Temporary works
 - j. Facilities for other contractors working on the site
 - k. Keeping the site clean, and remove rubbish
3. The contractor is required to:
 - a. Sign the contract when he is called to do so

- b. Obtain and submit securities, guarantees, and insurance policies
 - c. Ensure that his representatives will be available on site at all times
 - d. Prepare and submit the contractor's document, including "as built drawings" and manuals of operation and maintenance
 - e. Attend to the engineer's instructions
 - f. Provide access to the employer's personnel to enter the site
 - g. Prepare and submit payment statement and documentation
 - h. To uncover works for inspection when required
 - i. Rectify (Correct) defective works
 - j. Secure or compensate the employer against any claims
 - k. Submit notices to the engineer whenever he encounters circumstances that may cause future claims
 - l. Getting approval before assigning sub-contractors or partners of the works
 - m. Respond for consultation with the engineer
4. Comply with the applicable laws, labor law and other local regulations.

1.5.3 Role of the Engineer

Usually, the employer will enter into a consultancy agreement with the engineer to design and/or supervise the works.

The engineer shall have no authority to amend the contract. Engineer role can be:

1. As the employer's agent:

- a. Administration of the contract – dealing with the procedures, provision of information and interpretations, issuance of variations, approval of samples, etc.
- b. Cost accountancy and payments

2. As a supervisor:

The engineer must ensure that the work is being performed to fulfill the contract documents.

3. As a certifier:

The engineer is required to certify or approve the payments that should be paid by the employer to the contractor. Those payments should be made periodically, mostly on monthly basis, and should depend on the quantity of works finished by the contractor.

4. As a determiner:

The engineer must act as a mediator to help the parties towards agreement in issues such as claims for reimbursement of costs or extension of time.

5. Issuance of instructions and variations

Include: issuance of additional or modified drawings, actions in relation to defective works, issuance of clarifications, giving approval, and ordering variations.

1.6 Types of Contracts

1.6.1 Measured or Unit rate Contract

In this type of contract, the price is computed by multiplying quantities of work executed by the unit rate offered by the contractor in his tender. The rates are usually set out in the Bill of Quantities (BOQ).

Such contracts often used where there are significant changes in the quantities or working conditions. So, when there are certain reasonable differences of the quantities accepted by all the parties, then the contract can be paid for by multiplying the actual measured quantities by the unit rates.

Advantages:

1. Suitability: This type of contract is widely used in the execution of large projects financed by public bodies or governments. It also suits the works which can be split into separate items and the quantity of each item could be estimated with reasonable accuracy.
2. The employer pays for the actual work executed.
3. The contractor usually allows for a certain margin of variation, with a clear mechanism for valuation of such variations.
4. The engineer / employer has liberty to provide some drawings during the execution of the project, after award.

Disadvantages:

1. The employer cannot be absolutely sure of the total cost of the project until the whole work is completed. In case the quantities in the BOQ are inaccurate or roughly approximated, the value of the work may vary considerably. The contractor may try to offer an unbalanced tender on the basis of his anticipation of the uncertainty of quantities of certain items.
2. Both the engineer and the contractor have to do considerable computations and book-keeping during the progress of work.
3. Extra works or varied items of work are often a source of conflict. The contractor may press for higher rates than he would have tendered for in the beginning.

1.6.2 Lumpsum contract

In a lumpsum contract, the contractor agrees to carry out the entire work as indicated in the drawings and described in the specifications, for a specified fixed lumpsum amount.

Sometimes, the contract makes provisions to adjust the “lump sum” allowing for extra work and limited variations.

Normally, a bill of quantities is not usually included, and if included it does not form part of the "Contract Documents", but may be used just for guidance.

Instead, a schedule of rates may be of value to evaluate the cost of extras or omissions.

Advantages:

1. From the employer's stand point, and if no extras are contemplated, the tender sum tells him the exact cost of the project. Sometimes the employer will be working within a tight margin of budget.
2. From the contractor's stand point, because the design will often be prepared by him, the contractor can gain through proper planning and efficient management to increase his margin of profit and/or to control timing.
3. Both parties need less number of staff for book-keeping accounting and measurement.

Disadvantages:

1. In lumpsum contracts, there should be a complete set of plans and specifications, or what is called "Employer's Requirements" which should be sufficiently detailed.
2. Variations in lumpsum contract may trigger conflicts about whether or not a particular item of work falls within the agreed scope of work, and whether there has been a variation to such scope.
3. This type of contract will not be suitable for works with scope and nature that cannot be predicted accurately in advance. The outcome will be unfair for the contractor to assume all risks and uncertainties, or for the employer to pay a higher cost.

1.6.3 Cost-plus contract

This type of contract differs from both the measured and the lumpsum contract in that the employer agrees to pay the contractor for the actual cost of the work plus an agreed percentage of this actual cost to cover overhead and profit.

The contractor agrees to execute the works based on the drawings and specifications and any other information that will be provided to him from time to time during progress of the works.

The percentage to be paid should not be applied on the costs of salaries of the contractor's staff, whether on-site or off-site.

Advantages:

1. Early completion of the work - The work can be started even before the design and estimates are prepared. Decisions can be taken speedily, and flexibility allows adoption of alternates for construction to suit the Employer's Requirements.

2. The quality of the work can be assured. The contractor is induced to perform the work in the best interest of the employer.
3. No conflicts will be anticipated as to extras or omissions.

Disadvantages:

1. The final cost to the employer cannot be foretold.
2. Both parties have to do a lot of accounting and book-keeping regarding labour; purchase of materials and plant and use of equipment.
3. The contractor has no incentive to economize or finish the work speedily.

Suitability:

In spite of some drawbacks in certain cases, this form of contract can be used suitably for:

- a- Emergency works that require speedy construction and where no time is available to prepare drawings for it.
- b- Construction of special or expensive projects, such as palaces, where the cost of the work is of no consequence but the materials and workmanship to be purchased are just to suit the choice and taste of the employer.

Remark:

An alternate to the cost-plus contract is the cost-plus fixed fee contract, where the contractor will be paid for the actual cost of construction plus a fixed amount of fees for his overhead and profit. The fee does not fluctuate with the actual cost of the project. This factor may overcome the possible drawback of the cost-plus contract.

1.6.4 Construction Management Contract (C.M.)

In this type of contract, the employer engages a specialized construction manager (C.M.) to provide administrative service for him and manage the work on his behalf. The (C.M.) has full control on (Cost and Time), on the budget and programming, and is usually paid on a staff-reimbursement basis.

The (C.M.) assists in choosing the design consultant and the various contractors for a project divided into packages (structural, finishes, electro-mechanical, etc.).

The technical role is kept with the design-professional, but as to control, coordination, certification and dispute resolution, the (C.M.) normally possesses the major role.

Chapter 2: Quantity Survey Items and Methods

2.1 Introduction

Quantity surveying and the estimated quantities of materials required on a project are normally determined by professional surveyor or engineer.

The estimated quantities are provided to the interested bidders on a project to provide their prices. In this method of bidding, the contractors are all bidding on the same quantities. The estimators of contractors spend time developing the unit price of the different items in a project. To win the bid, contractors will work on keeping the cost of purchasing and installing the materials as low as possible.

As the project is built, the actual quantities are checked against the estimated quantities. For example, if the estimated quantity of concrete for a wall is 23 m^3 , but the actual installed concrete is 26 m^3 , then the contractor would be paid for the additional 3 m^3 .

When there is a large difference between the estimated and actual quantities, an adjustment to the unit price can be made. Small adjustments are usually made at the same unit as the contractor bid. Large errors may require that the unit price be renegotiated.

If the contractor is aware of potential changes between the estimated quantities and those that will be required in the project, the contractor may price his or her bid to take advantage of this situation. For example, if the contractor is aware that the filling material in the project will be changed from excavated soil to base-course, then he can provide low unit price for filling with excavated soil (say 5 USD/m^3) and high unit price for the base-course (say 15 USD/m^3). If the back-fill quantities were assumed to be 2000 m^3 of soil and 100 m^3 of base-course, so the assumed total price as in the bid will be 11,500 USD. But if the quantities were changed to 100 m^3 of soil and 2000 m^3 of base-course, then the new price of the actual work because of this change will be 30,500 USD, which will provide more profit to the contractor.

2.2 Bill of Quantities BOQ

PROJECT NAME:

DATE:

#	Description	Unit	Qty	Price \$	Amount \$
	<u>Important Notes:</u>				
	<p>1-The Bills of Quantities are part of the tender documents and shall be read and construed in association and conjunction with the Drawings, Specification and Method of Measurement.</p> <p>2-The Contractor shall refer to the Technical Specifications provided for this project.</p> <p>3-All materials and Supplies shall be subjected to Laboratory testing and have the Country-of-Origin Certificate. The Contractor shall bear all related costs.</p> <p>4-All materials and supplies shall be subjected to the Engineer's Approval before start the Works.</p> <p>5-It is the responsibility of the Contractor to conduct any test for structural materials upon request of the Engineer, the Contractor shall bear all costs related to such tests.</p> <p>6-The Contractor shall provide break down analysis for the BOQ items (all or selected items) required by the Employer at the tendering stage.</p> <p>7-Prior to commence the Work, Contractor shall verify all existing conditions on site and secure necessary permits for construction.</p> <p>8- The Contractor shall submit shop drawings and sample of all materials and colors for the Employer's Approval.</p>				
	<u>Site Works, as per DWG (A-004) and DWG (A-4803)</u>				
2.2	<u>SECTION 02700 - Asphalt, as per Site Plan (A-004)</u>				
2.2.1	Construction of asphalt roads and parking within the site borders, including excavation, embankment, subgrade and topping, aggregate base and sub-base courses, bituminous tack and prime courses, bituminous wearing and binder courses, all as per drawings and specifications and the Engineer's instructions & approval.	m ²	2,100		0
2.3	<u>SECTION 02763 – Pavement Marking</u>				
2.3.1	Supply and apply thermoplastic reflectorized paint (TRP) traffic lines marking applied with approved motorized equipment or truck- mounted units, including surface preparation, all as per drawings and specifications and the Engineer's instructions & approval.	L.M	215		0
2.4	<u>SECTION 02775 – Stone curbs</u>				

2.4.1	Precast concrete curbs, grade 25 N/mm ² concrete bed and backing, mortar, pointing; expansion joints (joint filler board, backer rods and sealants) at curbs and bed and backing concrete, excavation, backfilling and removal of excess and/ or unsuitable excavated material from site and all required to complete the job as per drawings and specifications.	L.M	750		0
2.5	<u>SECTION 02780 - Unit Pavers</u>				
2.5.1	Supply and install precast concrete cement interlocking floor tiles, comprehensive strength 25N/mm ² at 28 days, including cement and sand mortar bed, sand fill, cutting, fittings, fixing, grouting, complete as per drawings, specifications and the Engineer's instructions.				
a.	Interlocking concrete tiles, 80mm thick as per DWG (A-004) and DWG A(4803), at side walk and entrances.	m ²	1,900		0
Buildings Works					
2.6	<u>SECTION 02315 - Structural Excavation and Backfill as per DWGs (S-101 to S-127)</u>				
2.6.1	Excavations from natural levels in any kind of soil, concrete or asphalt, trees or stonewalls ...etc. to the required depth as extracted from the drawings and according to specifications. Price to include dewatering, back-filling in (200 mm) thick layers, watering, compacting to 95% according to the modified field density test using suitable approved excavated materials, as well as removal of the extra and unsuitable materials outside the site to the locations approved by the authorities. All as per drawings, specifications and the Engineer's instructions.				
	Note: The Contractor shall be responsible for the stability of all excavations and embankments and shall provide all necessary planking, strutting or other temporary works required to maintain the stability of earthworks. The Contractor shall provide all measures and precautions necessary to prevent settlement or damage of adjacent existing or new construction.				
	Quantities based on estimate natural ground level				
a.	Structural excavation for footing, foundation, slab on grade for oncology building, service building, septic tanks, all site works and wherever required	m ³	40,000		0
2.6.2	Supply and install Imported selected backfilling compacted materials, 200mm layers laid and compacted in layers, using selected fill materials compacted to 95%, according to specification and drawings, to be used when the excavated materials are unsuitable for backfilling and after approval of the Engineer, the Contractor should test the backfill by approved laboratory.				
a.	Structural backfilling, around and above foundation	m ³	7,100		0