BUILDING A SMALL CONCRETE HOUSE
(MATERIALS AND MANPOWER COSTING)

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This project report attached here to, entitled "Building a small concrete house: materials and manpower costing", prepared and submitted by Tan Siew Yea in partial fulfillment of the requirement for the degree of Bachelor of Engineering Civil is hereby accepted.

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Abstract

Estimation for a building construction is one of the most important phases of any contractor's business. One needs to estimate material and labor cost before a construction project start. This is to ensure the cost not out of budget. The objective of this report is to find out the material and labor cost for building a concrete house.

A bungalow, which is located at Muar, Johor is selected as the case study of this project. Measurement of the quantities of the materials is based on the drawing and the specification, with the guidance of published standard method of measurement.

Analysis of the cost of the materials and labor is based on the price in the quotations obtained from supplier and manufacturer. Labor rate is based on the rate in Malaysia.
Abstrak

Anggaran bagi projek pembinaan sebuah rumah merupakan perkara yang amat penting dalam perniagaan kontraktor. Kos bagi bahan mentah dan buruh perlu dianggarkan sebelum projek pembinaan dimulakan. In adalah untuk memastikan kos asas tidak akan melebihi kos anggaran. Matlamat utama projek penyelidikan ini adalah untuk mengkaji kos bahan mentah and buruh bagi membina sebuah rumah simen.

Subjek utama kajian ialah sebuah rumah biasa satu tingkat yang terletak di Muar, Johor. Pengiraan kuantiti bahan mentah adalah berasaskan kepada lukisan teknikal dan pengkhususan dengan mengikut teknik pengiraan yang piawai.

Analisis kepada bahan mentah dan buruh adalah berasaskan kepada harga pasaran yang dibekalkan oleh pembekal dan kilang-kilang. Kos buruh adalah mengikut kadar upah buruh di Malaysia.
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CHAPTER 1
INTRODUCTION

Estimation of a building construction is determined on the basis of construction probabilities costs for a building project. Estimation for a building construction is one of the most important phases of any contractor's business. The purposes of making estimation for a construction project are:

1.) To estimates the cost of the project for bidding purposes.
2.) To establish the budgets for construction and development.
3.) Feasibility studies of proposed development.
4.) Control of costs during the design phase of construction.
5.) Selection of alternative design proposals (based on costs and economics).
6.) Corporate mergers and purchases.
7.) Appraisals of building assets based on construction costs made for many purposes.

In a building construction, cost estimates are prepared before a project is constructed. The cost estimation of a building construction is prepared by determining the costs of the material, labor, equipment, subcontract work, overhead and profit.

To determine the costs for the material, the calculations involves two primary parts:

1. Measurement

2. Pricing

The process of the measurement begins with the analysis of the complete set of contract documents- the bidding and contract requirement, drawings and technical specifications. From that, the quantities of material are considered. The pricing is obtained from the quotations given by the supplier and manufacturers.
The method used to estimate the labor cost is in "hourly rate", where the complete cost of labor is calculated as an hourly figure. The distinction between the skilled and unskilled workers must be taken into account. The skill and the attitude of the workers will affect the duration required to complete the project.

1.1 Objectives

1.1.1 General Objectives

The aim of this report is to estimate the cost to build a concrete house.

1.1.2 Specific objectives

1. To estimate the quantities and cost of material to build one unit concrete house.

2. To estimate the cost of manpower to build one unit concrete house.

1.2 Project Background

The building for analysis is located at Mukim Kesang, Muar, Johor. This project was developed by Choon Seng Construction. This is a single-story bungalow with grid size on plan 9.45m x 11.58m and 3.35m height.
Fig 1.1  Front Elevation

Fig 1.2  Left Side Elevation
Fig 1.3  Right Side Elevation

Fig 1.4  Rear Elevation
Fig 1.5  Ground Floor Plan
1.3 Scope of Project

In the estimation, only the costs for the material and manpower are considered. The estimation costs only cover the building area and does not include the facilities. No delay work for the project due to the wet weather, financial problems or bad worker performances are assumed for the estimation.

The prices of the materials are based on the present market prices plus overhead for delivery, off-loading, storage and placing in position. Additional overhead will be made to cover wastage that may arise, such as handling breakages, site losses and cutting losses.

For estimating the labor cost, the method that will be using is in “hourly rate”. This is considered by the labor cost of the contractor for one day and divides by the working hours at that day. In the calculations, extra payments, such as intermittent responsibility, holidays and extra skill or responsibility are not taken into account. It is also assumed that no overtime work had been done.

Time, cost and manpower are related in constructing a housing project. With more manpower, the durations of the project will be shorter but the cost for the project is higher. The number of labor and working hour is estimated according to the guidance from literature reviews and from the interviews from experienced workers or contractors.
CHAPTER 2  
LITERATURE REVIEW

This chapter will discuss about the method of estimating that have been used during the past and present. Standard methods of measurement are also introduced.

2.1 Method of estimating

Before estimating the cost of a construction project, first, select the method of estimation that will be used. The accuracy of the cost depends on the method that is used.

Six methods of estimating were used during the first half of the twentieth century. Some of the methods are almost same with the methods that are used today and some are outdated.

2.1.1 Single rate method

a.) Unit of accommodation method

This method is used when we have a targeted cost and the next step needed is to consider the number of functional units which can be provided within that amount of money. Normally, national bodies use this method at the initiation stage of construction.

With this method, it is difficult to adjust the costs for specific projects, in different locations, with varying ground conditions and so on. However, this method is useful when a simple and quick cost range is needed at the beginning stage, provided there are recent comparable data available.
b.) Floor area method
This method involves determining the cost per square meter of the building floor area.
When measuring, internal dimensions are used to measure at each floor level of the building but no deductions are made for internal walls, stairs or lift zones. This method is workable for certain external work such as concrete paving and macadam surfacing but it is impractical for many buildings such as warehouse projects or open-plan offices.

c.) Building volume method
This method is using the volume of building as the yardstick for the cost. This is not widely use today.

2.1.2 Multiple-rate approximate estimating

a.) Elemental cost plans
The cost of the building is calculated from the list of the element of the building such as substructure, frame and upper floors. There are two ways to calculate the cost of each element:

1. Measure the approximate size for each element and apply a unit rate.
2. Calculate the proportion cost for the element on a similar building and use it for the proposed building element.

b.) Approximate quantities
Bill of approximate quantities is based on the drawings and specifications of the planned construction and not a previous job. Allowances are made for plan shape, height of building, type of ground, quality of finishes. There is danger that the cost
underestimation for construction will occur because approximate quantities can appear to be as accurate as a full bill of quantities based on working drawings unless generous contingency is added.

c.) Analytical estimating

This is a method for determining unit rates by examining individual resources and the amounts needed for each unit of work. According to Code of Estimating Practice (CIOB), three stages to price bills of quantities are:

1. Establish all-in rates for the individual resources in terms of a rate per hour for labor, a rate per hour for items of plant and the cost per unit of material delivered and unloaded at the site.

2. Select methods and outputs to calculate net unit rates to set against items in the bill of quantities.

3. Calculate project overheads, summarize resources and prepare report for management.

Analytical pricing of bills of quantities does not produce a unit rate with just applying resources to items of work. The constituents of a rate are inserted in the bill; and totaled for each page, each section, and carried to the summary.

d.) Operational estimation

This method is relying on a forecast of anticipated durations of activities and a resource-leveling exercise. It is a form of analytical estimation, all the resources needed for part of the construction are considered together. When estimating, it is started with an appraisal of the details on the drawings, descriptions in the specification and bill, and a study of the site conditions. It must consider the restraints
brought about by site layout, client's requirements, the design, time of year, and temporary works. The critical operation at each stage of the construction can then be plotted and the rest of the activities sketched in. Labors and plant schedules can be drawn up for direct work and specialist sub-contractors will be asked for advice about their work. The program may need changes if there are any unwanted peaks and troughs in the resources needed on site. It will then have a list of resources for each operation to calculate costs.

Fig 2.1 Estimation methods in 1930s and 1990s
2.2 Method of Measurement

Method of measurement is different from place to place according to local custom and practice but generally the units of measurement for most basic items of work are the same such as concrete footings is measured in volume.

The Method of Measurement of Construction Works, published by The Canadian Institute of Quantity Surveyors (MM-CIQS), and The Standard Method of Measurement of Building Works, published by The Royal Institution of Chartered Surveyors and The National Federation of Building Trades Employers (SMM-RICS) are the two current practices and published methods of measurement. General rules of these two published standard method of measurement is attached in the Appendix.

Nowadays, the measurement works is done by using the System International Unites (the SI system). Either use the older English method of yards, feet and inches or the SI system, it will not affect the measurement and calculations.

2.3 Checklists

Checklists are needed in estimating a construction. The purpose of checklists is to remind the estimator to include every significant item performed in the construction process. Based on the Construction Specifications Institute (CSI), checklist for a residence can be:

- Division 1: General Requirement
- Division 2: Site Work
- Division 3: Concrete
- Division 4: Masonry
- Division 5: Metals
- Division 6: Wood and Plastics

- 11 -
- Division 7: Thermal and Moisture Protection
- Division 8: Doors and Windows
- Division 9: Finishes
- Division 12: Furnishings
- Division 15: Mechanical
- Division 16: Electrical

Note: The number of division is corresponding to the division of construction activities as standardized by the Construction Specifications Institute (CSI).

2.4 Step of working up an estimate

Below are the steps of working up an estimate:

1. Carefully check the drawing and the specification. Make sure that all the drawing is a complete set.

2. Scan the drawing to get a “feel” for the building. How large is it? What shape is it? What are the principal materials? Pay particular attention to the elevation.

3. Review the floor plans, again getting the “feel” of the building. Begin to note all unusual plan features of the building, mental note of what type of walls are used and whether enlarged floor plans showing extra dimensions or whether special room layouts are required.

4. Begin to examine the wall sections for a general consideration of materials, assemblies, and make up of the building.

5. Review the structural drawings.
6. Review the mechanical drawings paying particular attention to how they will affect the general construction, underground work requirement, outlet requirement, chases in walls, and other items of this sort.

7. Take notes on all unusual items contained in the specifications.

8. Visit the site.

9. Staff Consultation – to discuss in terms of construction methods that could be followed, the most desirable equipment to use, the time schedules to be followed, and personnel needed on the project.

10. Check carefully through the General Conditions and Supplementary General Conditions, making a list of all items contained in the specification, which will affect the cost of the project.

11. Take off the quantities required. Each item must be accounted for, and the estimate itself must be as thorough and complete as possible.

12. Double-check the figure and calculation on workup sheets.

13. Having priced everything.