The Construction Industry and Quantity Surveying

Construction Industry description:

The term "construction industry" is not well defined, and there is no common definition among those involved in this sector. Rather, there is debate about whether it is a single sector or a sector encompassing several industries, including the construction sector.

The construction industry contributes to long-term economic growth and national development and is widely recognized globally, highlighting its importance, especially for developing countries due to the uncertain conditions associated with construction projects.

Therefore, it is important to investigate the nature of the construction industry, examining the life cycle of construction projects, their basic characteristics, specific requirements, and uses, to enhance the revenues of this sector.

What is the definition of construction?

Construction is the process to build any type of structures or other engineering projects that can serve a certain purpose.

What is difference between construction and manufacturing?

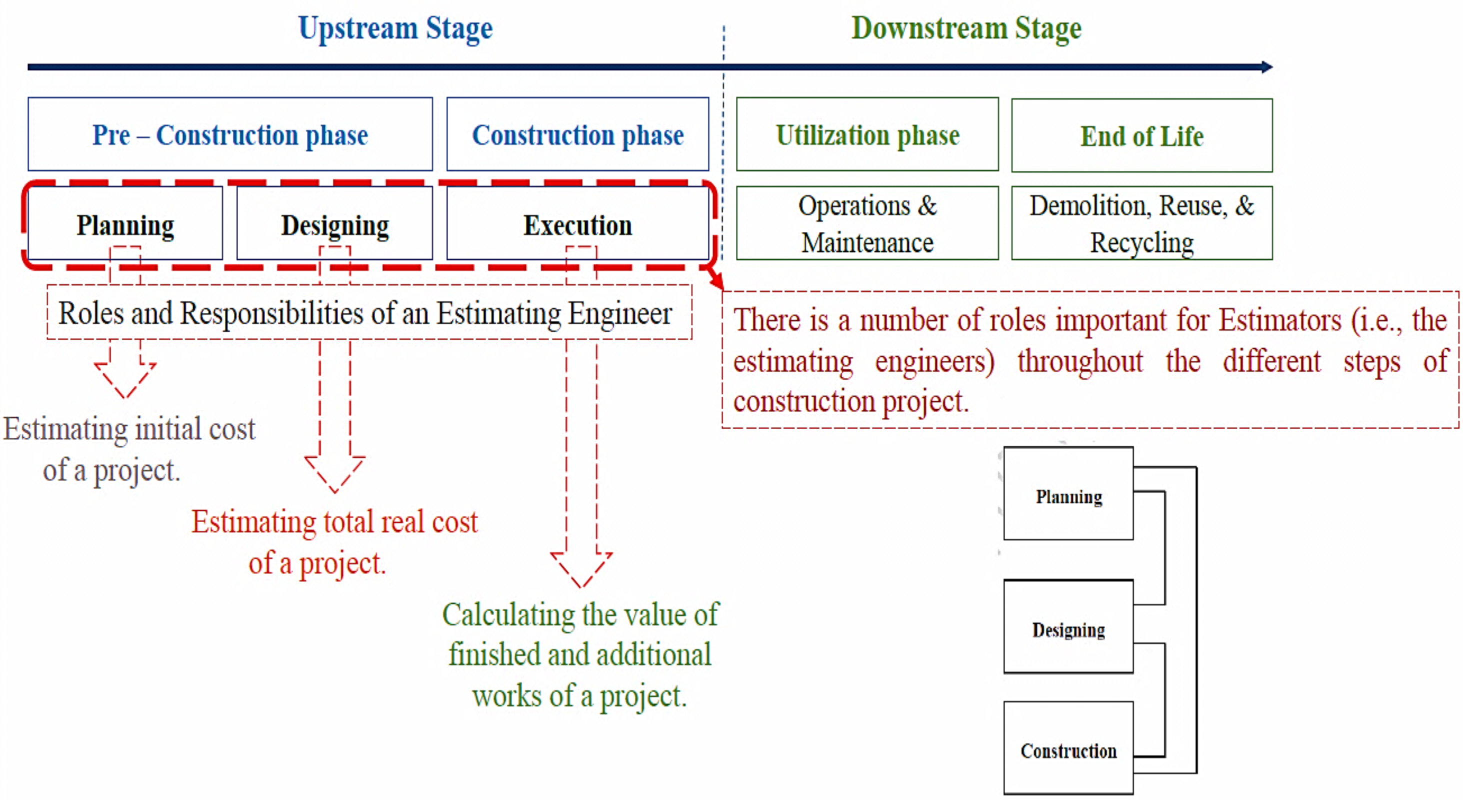
In general, the manufacturing process involves the mass production of similar items without a designated buyer, while construction usually takes place at a specific location for known customers.

A typical construction project involves thousands of detailed tasks, encompassing the entire process from earlier planning and design to procurement, construction, and post-construction closeout.

These projects are complex and are limited by the scope of objectives within quality, cost, and time, as well as effective planning and management that are necessary to achieve the project goal.

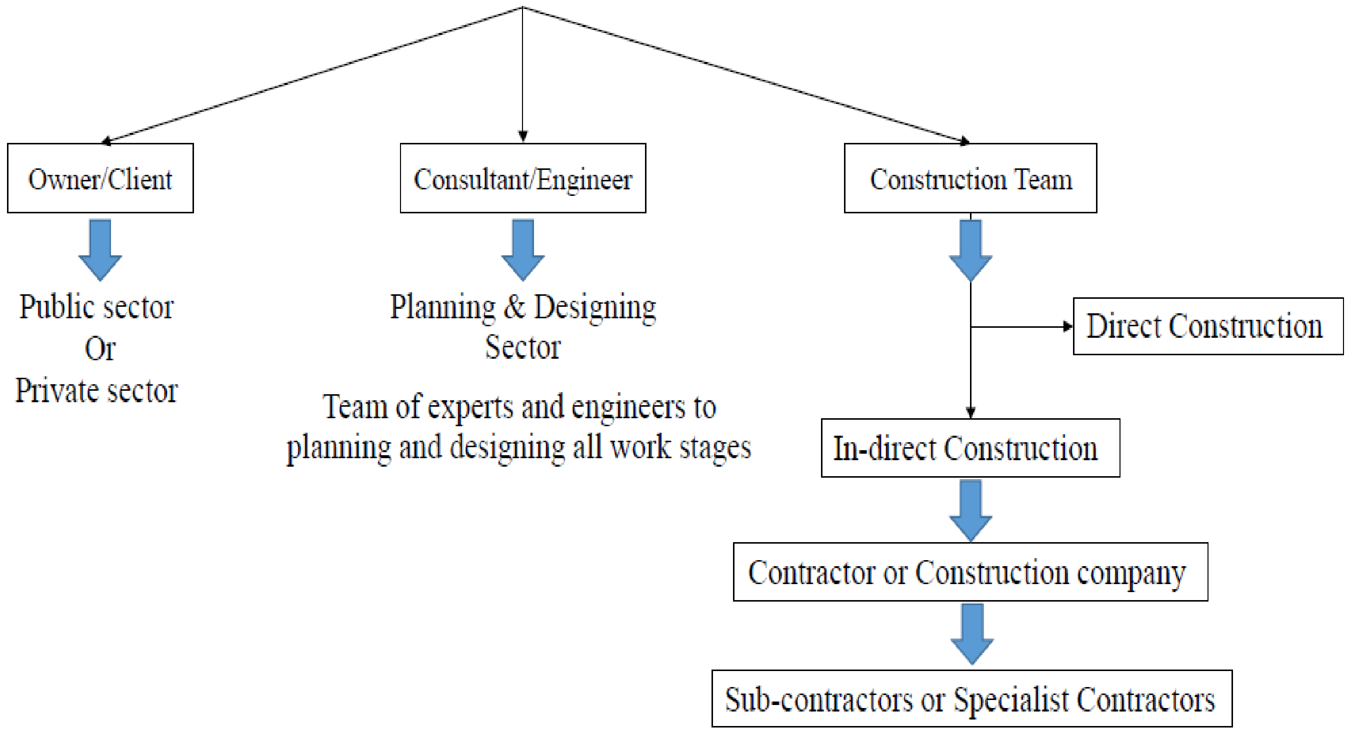
Stages/Steps of Construction Projects:

Let us look on the general life-cycle stages of construction projects that show in a below diagram:

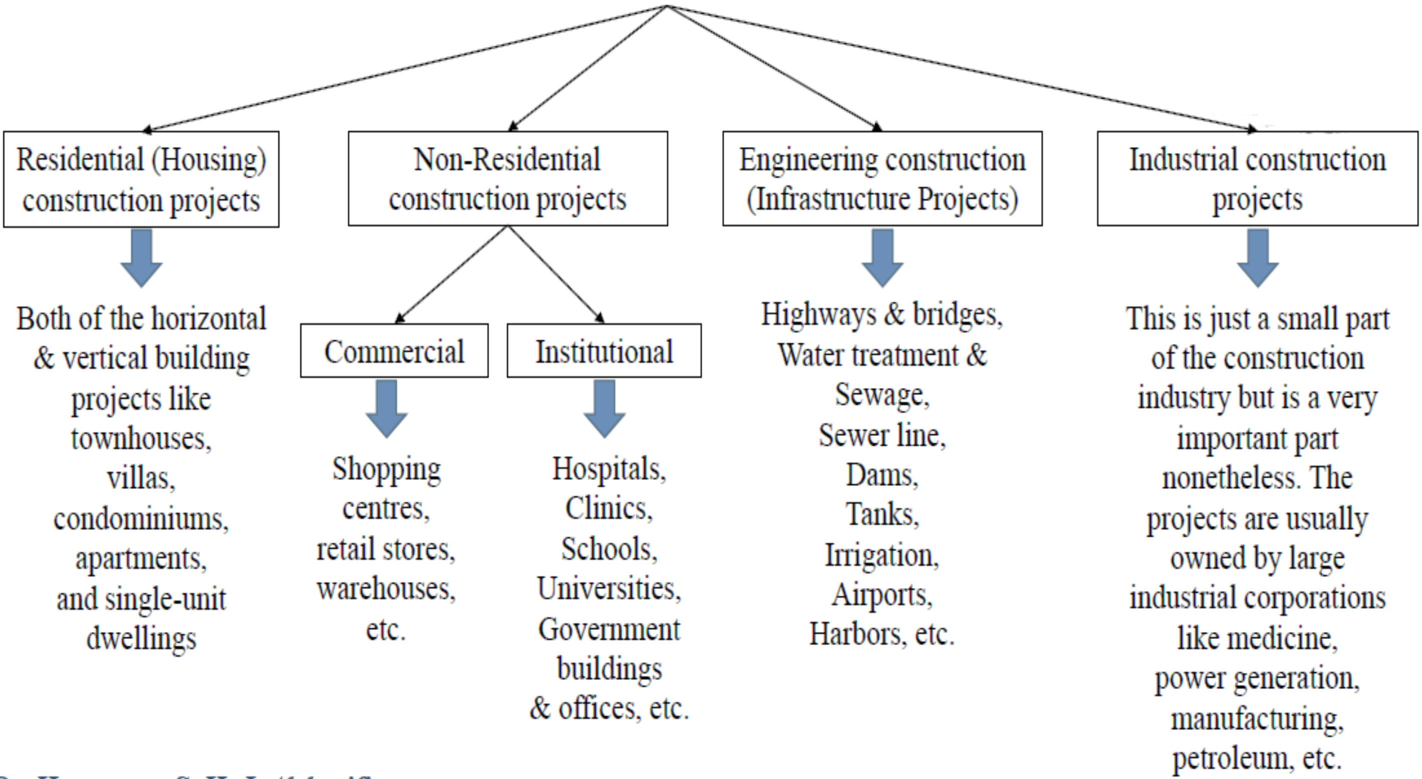


Contacts that deal with construction industry:

(The Main Stakeholders in the Construction Industry)



Types of Projects in construction industry works



What is the estimation concept?

Generally, estimation is processing to calculate the anticipated cost, time, or resources required for a project.

In the field of estimation, *different types of estimation* are used to approximate unknown values or quantities based on available information.

These estimates play an essential role in decision-making, planning, and forecasting in various disciplines such as *statistics, economics, engineering, and project management*.

The selecting of estimation method depends on the nature of the data, the desired level of accuracy, the available resources, and the specific requirements of the problem that needs to be solved.

Types of Estimation in Civil Engineering

A: Approximate estimation | B: Detaild estimation

1. Floor-area method (FAM)
2. Cubic meter method (CMM)
3. Approximate Quantities Method (AQM)

A: Approximate Estimation (Preliminary Estimation):

It called also as a rough estimate or conceptual estimate where this type of estimation is prepared in the early stages of a project when limited information is available.

It provides a broad cost range based on similar projects or historical data to give a general idea that is necessary to achieve the project's feasibility study.

Why is needed an approximate estimation?

The approximate cost of the project is prepared before the design step and the specification, for the following reasons:

1. Knowing the cost of the project quickly.
2. Doing comparative study for different methods of constructions.
3. Check the cost of the project calculated by detail estimation.

Methods used in "Approximate Estimation"

1. Floor-area method (FAM)

This method used to estimate the cost of many types of buildings (bureaus ,schools, building houses, hospital ,etc……) . It is ideal when using to estimate the building cost depend on information get from building that have been finished.

For multi-storey building there are two proposals;

1. The cost of all storey (with roof and basement) have the same cost per 1 m2.
2. The roof and basement have a cost differ from other storey.

2. Cubic meter method (CMM)

This method is a more accurate than floor area method, since it takes into account the third dimension (height). The volume of each storey is calculated and the cost of 1 m^3 is estimated on the bases of the cost of building which has been finished. .

For multi-storey building there are two proposals;

1. The cost of all storey (with roof and basement) have the same cost per 1 m^3.
2. The roof and basement have a cost differ from other storey.

3. Approximate Quantities Method (AQM)

This method of estimating the cost of a construction project is regarded as the best because it's more accurate and more reliable than other approximate methods.

This estimate is based on measurement groups where **Bill items with the same dimensions (in metres or square metres) are grouped together**.

This essentially means that items occupying the same area or perimeter are measured together at once using a Group unit of measurement.

Structure divided into two parts

(i) Foundation including plinth

Quantities of various items are calculated per running meter

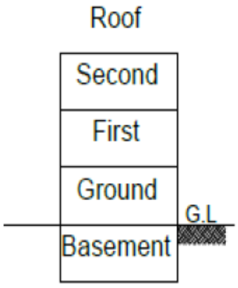
(ii) Superstructure

Quantities of brickwork, roof, flooring etc is calculated per running meter.

Case Study No. 13-1: A multi-storey building of (35*20) m plan dimensions have been constructed and have (basement ,ground ,first ,second and roof floor) The total cost of the building was 1.89*10^9 ID. Find the estimated cost per 1 m^2 on the following assumptions:

1. All the storey have the same cost.

2. The cost of basement storey is 60% of other storey and the roof cost is 40% of other storey.



Solution:
First assumption:

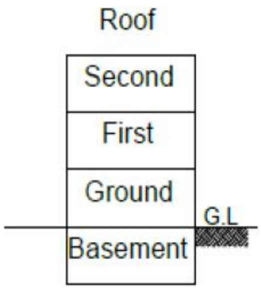
Area of basement	= 35*20=700 m^2
Area of ground floor	= 35*20=700 m^2
Area of first floor	= 35*20=700 m^2
Area of second floor	= 35*20=700 m^2
Area of roof floor	= 35*20=700 m^2
Total area	=3500 m^2

Cost per 1 m^2 =(1.89*10^9)/3500= 540000 ID

Solution:
Second assumption:

(35*20)

Area of basement	= 700*0.6=420 m^2
Area of ground floor	= 700 m^2
Area of first floor	= 700 m^2
Area of second floor	= 700 m^2
Area of roof floor	= 700*0.4=280 m^2
Total area	=2800 m^2

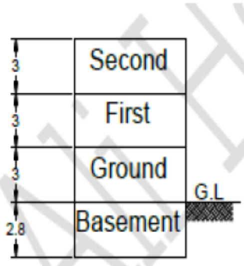


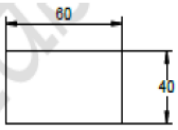
Cost per 1 m^2 =(1.89*10^9)/2800= 675000 ID

Case Study No. 13-2: A multi-storey building was constructed with a plan of dimension (40*60) m ,and it consisted of ,basement floor, ground floor , 1st floor, and 2nd floor. The height of building is 2.8 m for the basement floor and 3m for other floors. The total cost =22.5*10^9 ID. Calculate the cost of each 1 m3 by using:

A. Cost of 1 m3 is the same for all storey.

B. Cost of 1 m3 for basement =60% of other storey.





Solution:

A-Volume of basement $= 40*60*2.8=6720\ m^3$

Volume of (ground +1 st+2nd) storey $=3(40*60*3)=21600\ m^3$

Total $=28320\ m^3$

Cost per 1 $m^3 =(22.5*10^9)/28320= 794491$ ID

B- Volume of basement $= 40*60*2.8*0.6=4032\ m^3$

Volume of (ground +1 st+2nd)storey $=3(40*60*3)=21600\ m^3$

Total $=25632\ m^3$

Cost per 1 $m^3 =(22.5*10^9)/25632= 877809$ ID

Cost per 1 m^3 basement $=877809*0.6= 526685$ ID

Adjust Project Cost from Approximate Estimate:

In case of analysis of the cost of old project to estimate the cost of new project, the following points should be taken into account:

- Types of specification, finishing of the old and new project
- Date of price for the old project and the date of construction of the new one.
- Site of old and new project
- General and special specification of the old and new project
- The structure of the old and new project
- Shape and the height of the old and new project

Adjust for time factor:

Time factor is always considered positive for inflation causes ,and is calculated from the following equation:

$$F=(1+i)^{n}-1$$

- F: Time Factor
- i: Inflation Rate (decimal)
- n: Time period difference between the old and the new project

$$n=\frac{p1}{2}+d+\frac{p2}{2}$$

- p1: Period of old project
- p2: Period of the new project
- d: period between finishing old project and starting new project

Case Study No. 13-3:

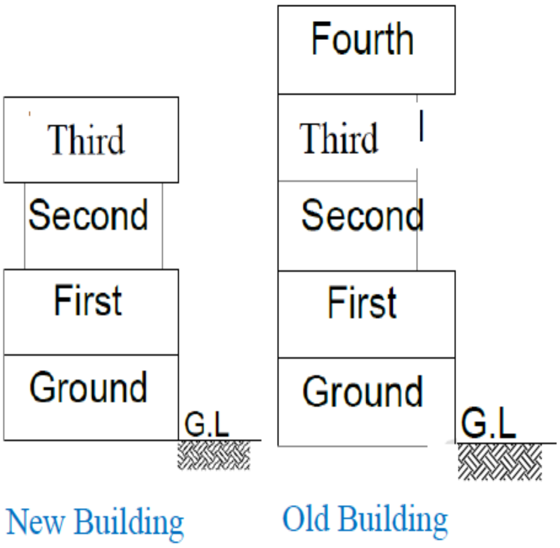
Find the approximated cost by floor area method for new building that will be constructed, which consists of, ground floor, first, and third floor of dimension (20*25)m, and second floor with dimension (20*20)m. The building will be constructed in un crowded area, with very good specifications, there is no encourage facilities for contractor. Date of construction is at beginning of 2019, date of finishing is at the end of 2020. For estimate the cost, an old building have been taken, which consist, ground floor, and other 4 floors, the dimension of the 2_{nd} and the 3_{rd} floor are (20*17)m, other floors are (20*20)m. This building was constructed in crowded area, start of construction at beginning of 2014, and finished at the end of 2016, the contractor gave encourage facilities, the specifications were good. The total cost of the old building was **500 *10^6** ID, the cost of 1 m^2 for the ground floor=1.2 of the other floors, roof floor cost = 0.3 of other floors. Time inflation rate = 4%. The differences in prices for the two buildings are as follow;

1- Changing in specifications =10%

2- Encourage facilities =5%.

3- Crowded and un crowded area =12%.

Solution:



First; old building;

Area of ground floor= 20*20*1.2= 480m^2

Area of (1st+4th) floor= 20*20*2= 800m^2

Area of (2nd +3rd) floor = 20*17*2= 680m^2

Area of floor= 20*20*0.3=120m^2

Total area=2080 m^2

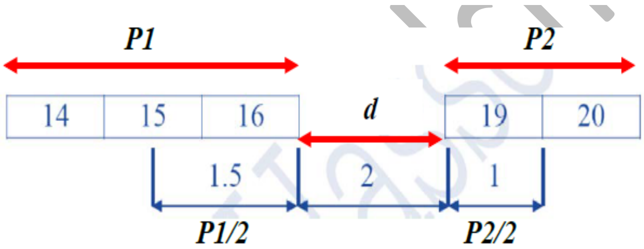
Cost of 1m^2=500*10^6/2080=240385=240.4 *10^3 ID

Cost of 1m^2 roof= 0.3 *240.4 *10^3=72.1*10^3 ID

Cost of 1m^2 ground floor= 1.2 *240.4 *10^3=288.5*10^3 ID

$$n = P1/2 + d + P2/2$$

$$n = 1.5 + 2 + 1 = 4.5$$



$$F=(1+.04)^{4.5} - 1 = 0.193 = 19.3\ \%$$

Old building	New building	Price factor
crowded	Un crowded	-12%
good specifications	Very good specifications	+10%
encourage facilities	No encourage facilities	+5%
Time factor	-----------------	+19.3

Total=+22.3

1+0.223 =1.223

New building

Cost of 1m^2 for new building=240.4*10^3*1.223=294 *10^3 ID

Area of ground +1st+3rd floor=3(20*25)=1500m^2

Area of 2nd floor=20*20=400m^2.

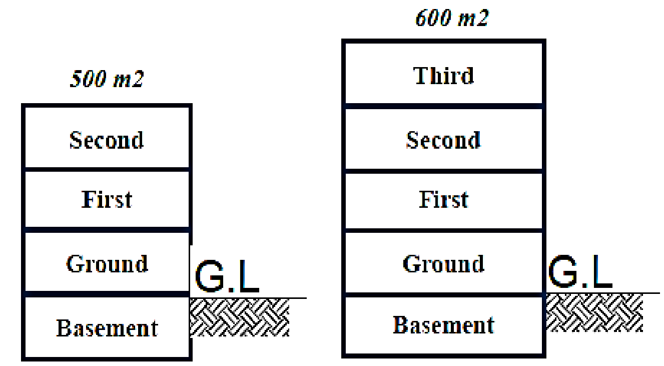
Area of roof= 20*25=500m^2.

Total area=2400m^2.

The total cost= 2400*294000= 705.6 * 10^6 ID

Case Study No. 13-4:

Find the total cost for a new building by using the information from an old building by floor-area method?



Old Building   New Building

Item	Specification	Old building	New building
1-	No. of storey.	Basement, ground, 1st, 2nd and roof. 500m² for each storey, all heights are the same.	Basement, ground, 1st, 2nd, 3rd and roof. 600m² for each storey, all heights are the same.
2-	Cost of basement.	90% of other storeys	100% of other storeys.
3-	Cost of roof.	80% of other storeys	100% of other storeys.
4-	Site of project 4%.	Not crowded.	Crowded.
5-	Construction specification 6%.	Ordinary specification.	Good specification.
6-	Structure and shape 2%.	Ordinary.	Complex.
7-	Encourage facilities 4%.	None	Yes.
8-	Inflation 5%.	None	Yes.
9-	Period.	Three years from the beginning of 2015.	Two years from the beginning of 2019.
10-	Cost ID.	1.7×10^9 ID.	?

Solution:

1. Old building:-

Basement area $= 500 \times 0.9 = 450\ m^2$

(Ground, 1st and 2nd) area $= 500 \times 3 = 1500\ m^2$

Roof area $= 500 \times 0.8 = 400\ m^2$

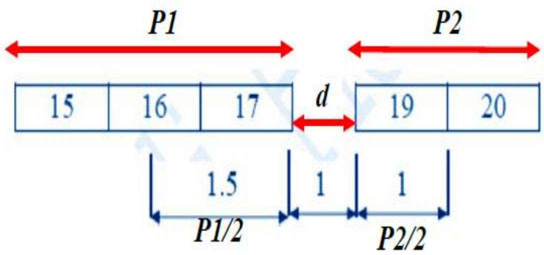
Total area $= 2350\ m^2$

Total Cost

$$1m^2 \text{ cost} = \frac{1.7 \times 10^9}{2350} = 723404 \text{ ID}$$

$1m^2$ cost of the basement $= 0.9 \times 723404 = 651064$ ID

$1m^2$ cost of the roof $= 0.8 \times 723404 = 578723$ ID



$$n = 1.5 + 1 + 1 = 3.5$$

$$F = (1 + 0.05)^{3.5} - 1 = 0.186 = 18.6\%$$

Specification	*Old building*	*New building*	*Price factor %*
Site of project	Not crowded	Crowded	+ 4
Construction specification	Ordinary	Good	+ 6
Structure and shape	Ordinary	Complex	+ 2
Encourage facilities	None	Yes	- 4
Time Factor			+ 18.6
Total			+ 26.6

1+0.266 =1.266

2. New building:-

$1m^2\ cost = 723404 \times 1.266 = 915829$

Area of the new building = 6 * 600 = 3600 m^2

Total cost = 3600 * 915829 = 3.297 *10^9 ID.

B: Detailed Estimation:

In civil engineering, this term refers to the precise calculation of the volumes and quantities of construction works and materials, along with the specification of quality and cost, including the costs of labor and machinery used in the various construction phases of the project, based on plans and site details, as well as related indirect costs, which is prepared during the later stages of project planning when more specific information is available, in order to provide a more accurate cost projection and are used for budgeting, tendering, and contract purposes.

Its importance lies in:

- *Calculating the quantities and estimated costs of construction projects and preparing bills of quantities used in contract documents for tenders.*
- *Auditing bills of quantities for the work executed in projects.*
- *Monitoring and controlling the actual costs of implementing various works in the project.*
- *Preparing timetables for implementing the various construction tasks of the project.*
- *It serves as the reference in the event of requests from the implementing entity to calculate quantities for additional work.*