



UNESCO-NIGERIA TECHNICAL &  
VOCATIONAL EDUCATION  
REVITALISATION PROJECT-PHASE II



## **NATIONAL DIPLOMA IN QUANTITY SURVEYING**



### **TENDERING AND ESTIMATING II**

**COURSE CODE: QUS 210**

**YEAR 2- SEMESTER 2**

**THEORY**

**Version 1: December 2008**

## **TABLE OF CONTENTS**

### **WEEK 1:**

#### **1.0 PRICING OF PRELIMINARIES I**

- 1.1 What are Preliminary Items?
- 1.2 Estimating for Typical Preliminary Items

### **WEEK 2:**

#### **2.0 PRICING OF PRELIMINARIES II**

### **WEEK 3:**

#### **3.0 PRELIMINARIES ANALYSIS WORKSHOP**

- 3.1 Preliminary Bill
- 3.2 Class Workshop

### **WEEK 4:**

#### **4.0 PREPARATION OF TENDER**

- 4.1 Decision to Tender
- 4.2 Collection of Information
- 4.3 Enquiries and Quotations
- 4.4 Visit to Site
- 4.5 Visit to Consultants Offices
- 4.6 Receipt of quotations
- 4.7 Planning and Mid Tender Review
- 4.8 Preparation Of The Estimate
- 4.9 Final Review
- 4.10 Action after Submitting a Tender
  - 4.10.1 Action with a successful tender
  - 4.10.2 Action with an Unsuccessful Tender
- 4.11 Factors in Pricing General and Special Attendance on Subcontractors

**Course: Tendering and Estimating II**

**Course Code: QUS 210**

**Contact Hours: 2hrs**

**Course Specification: Theoretical Content**

**General Objective for Week 1: Appreciate the Build-up for Preliminary Items**

## **WEEK 1: PRICING OF PRELIMINARIES I (1.0)**

### **1.1 What are Preliminary Items?**

Preliminary items are items of cost which do not relate to any particular work section and usually listed in the first bill of quantities. Many estimators prefer to insert a lump sum for all the preliminaries usually worked out as a percentage of the total of the measured works. It is good practice however to put a price to each of the item. The price quoted should read after careful consideration of each item as it applies to the particular job at hand e.g water for the works. It will be pipe borne water readily available on site or water has to be transported to site on trucks.

### **1.2 Estimating for Typical Preliminary Items**

- (1) **Site Supervision:** These include the salaries and allowances paid to the site agent or engineer and the administrative staff on the site such as cashiers, clerks, time keepers, material checkers, store controllers etc. when this staff are sent away from the area in which they normally work and this necessitate them having to leave away from their usual place of residence for a period of time a subsistence allowance may have to be added to cover the additional expenses they will incur e.g

site agent

salary / month	=	10,000	
Housing allowance	=	8,000	
Transport allowance	=	<u>2,500</u>	
		20,500	= 20,500

Cashier

## WEEK 2: PRICING OF PRELIMINARIES II

### (6) Water For The Work

Water required for the project is provided in either of the two ways supply by water tankers if the site is far from a source or pipe bone water. In pricing consideration is given the following:

If the site is far from the source: Cost of water supply by water tanker. It may be necessary to write out an approximate estimate of the quantity of water required for the project from previous project, certain allowance can be made for concrete work 480 liters/m<sup>3</sup>

For Block work	350 liters/m <sup>2</sup>
Rendering	30 liters/m <sup>2</sup>
Workman hut	2000/day
Site accommodation	20,000/day

Based on these allowances total quantity of water can be estimated for the whole project and priced at prevailing water tanker rate for that areas.

Cost of Temporary Storage:

This include

- (a) Cost of labour and materials in constructing surface tank, overhead tank, pipe work and its pumps.
- (b) Cost of cleaning and maintaining tanks, water pipes and water pumps.
- (c) Cost of removal of water storage and temporary pipe work and making good ground disturbed
- (d) Overheads and profits

### (a) Pipe Bone Water:

Pricing will include

- (i) Cost of water connection by water board
- (ii) Cost of labour and material for laying pipes
- (iii) Cost of temporary storage

## **WEEK 3: PRELIMINARIES ANALYSIS WORKSHOP (3.0)**

### **3.1 Preliminary Bill**

The preliminaries bill gives the contractors the opportunity to price overheads which is described in the Code of Estimating Practice as “the cost of administering a project and providing general plant, site staff, facilities and site based services and other items not included in bill rates.

Preliminaries costs vary from contract to contract depending on complexity of work, size of contract, specialist plant and equipment required, conditions imposed by the employer etc.

On relatively simple contracts preliminary costs may be in the order of 10 – 15% of the contract sum whereas on complex contracts this figure could be much higher.

A contractor must calculate the cost of the preliminary items separately for each contract, no two contracts are the same.

SMM7 recommends that fixed and time-related charges should be identified separately in a bill of quantities.

A fixed charge is defined as “the cost of work which can be considered as being independent of duration”

A time-related charge is defined as “the cost of work which is to be considered as dependant on duration”.

### **3.2 Class Workshop**

The appendix below is a summary of the bill for the case study project. Students will be expected to appreciate and be able to work out how preliminary items in the bill are priced and distributed between time or cost related and fixed charges for the purpose of monthly valuations.

#### **Procedures:**

The work book will be made available to students at the beginning of the lecture. Time will be allowed for students to read and comprehend the notes. Students will then be

## **GENERAL OBJECTIVE FOR WEEK 4:**

**Know the tendering procedures.**

## **WEEK 4: PREPARATION OF TENDER (4.0)**

Reference: CIOB (1997) *Code of Estimating Practice*, 6<sup>th</sup> Edition. Ascot: CIOB

The preparation of a tender can be divided into six stages.

### **4.1 Decision to Tender**

The tender documents arrive and the estimator records all relevant information such as:

- The time allowed for preparing the tender
- Drawings available
- The approximate value and extent of the project
- The client, Architect, Q.S and other consultant
- Value of main contractors own work
- Project Details eg phased work, conditions of contract, access to site, working conditions.
- Firm price or fluctuating price tender required
- Current workload and timetable for project

After reviewing the above information, management must decide whether to tender for the project or decline the invitation. If it is decided not to submit a price, the tender documents should be returned immediately to the architect/supervising officer. If it is decided that a tender should be submitted, the contractor move to the next stage.

### **4.2 Collection of Information**

The time allowed for preparing a tender is always limited; the estimator must plan the programme very carefully. The work which has to be undertaken in a typical 4 week tender period comprises:

- Despatching enquires
- Visit consultants offices

## **GENERAL OBJECTIVE FOR WEEK 5:**

**Know factors affecting tender figures.**

### **WEEK 5: MAJOR FACTORS AFFECTING TENDER PRICE (5.0)**

“Construction cost” is a broad phrase or term and can be interpreted to mean cost of any sort to anyone associated with construction work. It depends on the point of view let us say you are a contractor, your costs are your expenditure on labour, materials and plant. The client’s cost of land, consultant fees and so on.

The base cost of construction therefore comprises of expenditure on materials, labour and plant, the quantities of materials, labour and plant required for a job are determined & attaching prices to these defines the basic construction cost, but to these are also a variety of factors that affect this basic cost: -

#### **5.1 Factors Affecting Tender Price**

##### **(1) Market Condition:**

The volume of work in progress in the area at a given point in time affect construction cost. When the market is busy with many project, tender price list are generally high. Most consultants are busy and competition is not keen. However during lull times when there are few projects, contractors are anxious to out bid themselves so as to stay in business, so construction cost tends to be lower.

##### **(2) Availability of Materials:**

When required materials are readily available in an area where a project is to be executed, materials will be cheaper than where they are not so available. Generally, materials are cheaper where they are produced e.g if you can buy cement directly from Ashaka, the price will be a lot cheaper than in Kaduna because of transportation and profit margins of middlemen and so on. Imported materials for similar reasons are more expensive than locally produced materials.

## GENERAL OBJECTIVE FOR WEEK 6:

Use rate analysis to price items in the bill of quantities.

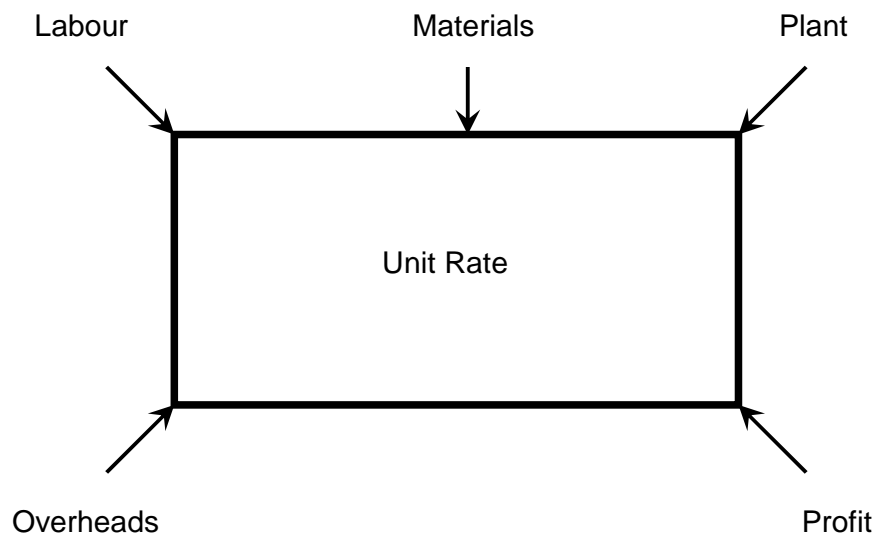
### WEEK 6: PRICIPLES OF ANALYTICAL ESTIMATING (6.0)

#### 6.1 Elements of a Unit Rate

To analyse something is to break it down into its constituent parts and study each part in detail. Therefore analytical estimating involves the analysis and costing of construction resources to produce an estimate.

The production of an estimate normally involves the calculation of *unit* rates i.e. the cost of an individual measured item for example a square metre of brickwork, a cubic metre of concrete or a metre of skirting. As found in a Bill of Quantities.

Analytical estimating is therefore the most accurate form of estimating as each resource and unit rate is analysed and costed individually. This form of estimating is used for pricing contracts with bills of quantities, specifications and drawings or where the contractor has measured and prepared their own quantities of work.





## **WEEK 7: BUILD-UP HOURLY RATE FOR PLANT & EQUIPMENT (7.0)**

### **7.1 Calculation of Unit Rates**

The following sections cover the calculation of unit rates. The process of calculating unit rates could be described as “mechanical” because you must consider each of the unit rate elements in turn. Some rates may include all elements, others only one, but you must think carefully about each element and calculation before commencing.

You may use the Wessex Price Book, or other similar price book, for information on the output/productivity of labour and plant. Materials and plant prices can be obtained from builders' merchants and plant hire firms.

*In practice estimators must always use productivity outputs analysed from site feedback and the current cost of other resources.*

*In the following unit rate calculations the hourly labour rates used are £9.50 for craft operatives and £7.00 for labour operatives.*

### **7.2 Groundworks**

#### **SAQ 2**

Explain how the following factors may affect unit rates for groundworks?

- Type of excavation e.g. trenches, pits, basements
- Ground conditions e.g. clay, sand, soil, rock
- Depth of excavation
- Ground water
- Time of year when excavating
- Mechanical or hand excavation
- Distance and availability of tips
- Estimated bulking of materials

#### **7.2.1 Hand Excavation**

Excavation work is usually measured in cubic metres (m<sup>3</sup>)

## **WEEK 8: BUILD-UP UNIT RATE FOR SURFACE EXCAVATION (8.0)**

### **8.1 Surface Excavation**

In building up rate for excavation, the following should be considered.

- (a) Types of excavation i.e surface or trench excavation
- (b) Means of excavation i.e manual or mechanical
- (c) Nature of excavation
- (d) Volume of excavation (bulking)
- (e) Distance of tipping (haulage)

#### Bulking

Sand 12.5%

Gravel 10%

Clay 133 1/3%

Rock 50%

#### Multiplier

<u>Medium</u>	<u>labour constant multiplier</u>
Sand and gravel	0.75
Natural soil	1.00
Stiff clay	1.50
Soft rock	3.00
Hard rock	8.00

#### OUTPUT

Excavation	2.5m <sup>3</sup> / labour / day
Spreading and leveling	4.5m <sup>3</sup> / labour / day
Wheeling / haulage	8.0m <sup>3</sup> / labour / day
Placing of concrete	4m <sup>3</sup> / labour / day

## WEEK 9: BUILD-UP UNIT RATE FOR CONCRETE WORK I (9.0)

### 9.1 Concrete Work

Explain how the following factors may affect unit rates for concrete work ;

- Whether ready mixed or site mixed concrete is used
- Whether concrete is reinforced
- Surcharges for part loads
- Location of mixing plant on site
- Type and size of mixing plant
- Method of transporting, hoisting, placing and compacting mixed concrete
- Cost of protecting and curing unset concrete

Operatives working with concrete receive additional payments for skill and responsibility.

Items of plant should be priced separately.

Concrete is usually measured in m<sup>3</sup>

Site Mixed Concrete

*TQ 7*

Calculate the cost of mixing a m<sup>3</sup> of Grade 15 concrete on site using the following information ;

To produce 1m<sup>3</sup> of mixed Grade 15 concrete requires ;

250Kg of cement at £80 per tonne

600Kg of sand at £10 per tonne

1200Kg of aggregate at £9 per tonne

Waste say 5%

Concrete mixer all-in rate £2-50 per hour, output 2m<sup>3</sup> per hour

Labour rate £7.20 per hour

Labour out put 0.5m<sup>3</sup> per hour

Ready-Mixed Concrete

## **WEEK 10: BUILD-UP UNIT RATE FOR CONCRETE WORK II**

### **9.6 Concrete Work**

Explain how the following factors may affect unit rates for concrete work;

- Whether ready mixed or site mixed concrete is used
- Whether concrete is reinforced
- Surcharges for part loads
- Location of mixing plant on site
- Type and size of mixing plant
- Method of transporting, hoisting, placing and compacting mixed concrete
- Cost of protecting and curing unset concrete

Operatives working with concrete receive additional payments for skill and responsibility.

Items of plant should be priced separately.

Concrete is usually measured in m<sup>3</sup>

#### **9.6.1 Site Mixed Concrete**

##### ***TQ 7***

Calculate the cost of mixing a m<sup>3</sup> of Grade 15 concrete on site using the following information ;

To produce 1m<sup>3</sup> of mixed Grade 15 concrete requires ;

250Kg of cement at £80 per tonne

600Kg of sand at £10 per tonne

1200Kg of aggregate at £9 per tonne

Waste say 5%

Concrete mixer all-in rate £2-50 per hour, output 2m<sup>3</sup> per hour

Labour rate £7.20 per hour

## WEEK 11: BUILD UP UNIT RATES FOR REINFORCEMENT (11.0)

### 11.1 Bar Reinforcement

Most bar reinforcement is bought in straight length of about 16ft. It is usually priced in tonne (1000kg) reinforcement supplied to site in which cost of transportation is not included in the calculation for unit rate, labour cost for unloading and stacking, cutting, bending and fixing are calculated. Some times bar reinforcement can be purchased already and bend to shape e.g links and stirrups and labour cost calculated will then only include the cost of fixing on site. Allowance for bending wire at intersections has to be made.

The labour output should be taken as follows

Cutting and bending

Diameter	6	8	10	12	16	20	25	32	40	50
Hours	63	45	35	27.2	22.5	15	12.5	10	8	6

Fixing/tonne

Diameter	6	8	10	12	16	20	25	32	40	50
Hours	63	45	35	27.2	22.5	15	12.5	10	8	6

NOTE:

1. Assume 3hrs for unloading 1 tonne of reinforcement
2. Allow 5% waste for cutting form straight length
3. Allow 1% waste reinforcement already cut to shape
4. for bars in short length e.g links and stirrups, allow 33% for extra labour

Tying wire/tonne

Diameter	6	8	10	12	16	20	25	32	50
Hours	15	15	12	10	8	8	6	5	4

Allow say N1000/tonne for spacers (biscuit)

## WEEK 12: BUILD-UP UNIT RATE FOR FORMWORK (12.0)

### 12.1 Formwork

Formwork measures the actual faces of work covered or to be supplied. The following must be taken into consideration in determining the size of the formwork

1. The amount of material required
2. The kind of finishes required i.e sawn faced or smooth finish, ground finish, biscuit etc. This determine the types of materials to be used as formwork and the surface from finish required is removed.
3. the height to be supported. This determine the height of props and types of props.
4. Normal labour for fabricating, erecting and striking of formwork.
5. the number of uses required of the formwork this is usually a matter of experience.

In small contract it may be possible to reuse the same formwork twice depending on the repetitive nature of the work.

#### Materials

Materials	Unit	Rate
1 x 12 x 12 sawn	Length	130
1 x 12 x 12 wrought	Length	230
2 x 4 x 12	Length	120

## WEEK 13: BUILD-UP UNIT RATE FOR ROOFING (13.0)

### 13.1 Roofing

Corrugated roofing sheet, operation output /gang / day

Aluminium of galvanized iron	unloading + fixing	40m <sup>2</sup>
	Fixing ridge cap	35m
	Raking and cutting	30m
	Straight cutting	30m

Asbestors	unloading + fixing	30m <sup>2</sup>
	Fixing ridge cap	20m
	Raking + cutting	25m
	Straight + cutting	25m

Felt roofing	unloading + laying of layer	120m <sup>2</sup>
	Spreading bitumen primer	80m <sup>2</sup>
	Spreading bitumen	80m <sup>2</sup>
	Spreading chips	100m <sup>2</sup>
	Laying gutters < 1m girth	20m
	Raking cutting	90m

#### TASK I

0.7mm thick corrugated aluminium long span roof covering fixed to timber purlins (m.s) @900mm c/c with 50mm galvanized drive screw with felt and metal washer including 100mm side laps (measured net) in m-square i.e (100mm<sup>2</sup>)

## WEEK 14: BUILD UP UNIT RATE FOR MASONRY (14.0)

### 14.1 Guide to Using this Student Learning Pack

Throughout this and the series of learning packs you will find, extensive notes on the various aspects of work you will be measuring followed by a series of three tasks. These tasks are designed to increasingly develop your skills in the aspect of measurement covered by the learning pack, and will include, one basic task, which requires you to copy down a worked example, using the correct measurement layouts. The second and third tasks form the second section of the class, where the class develops into a tutorial based

### 14.2 Masonry works

Before we look at the process for estimating unit rates for Masonry works, we must understand that our final unit rate will be influenced by several variables.

#### Task One

In the box below, finish the list of possible variables which could impact on the eventual cost for masonry works.

1. Quality of finished works
2. Type of work ( i.e. straight walls, curved walls, foundations etc)
3. Working overhand, at height
4. Type of pointing

### 14.3 Fact and Figures

#### Bricks:

The number of metric (215 x 65 x 102.5mm) bricks required per m<sup>2</sup> of half brick thick (102.5mm) wall is 59, proven thus.

$$\underline{1.000\text{m} \times 1.000\text{m}} \quad = \quad 59 \text{ nr bricks}$$



## WEEK 15: PRACTICE QUESTIONS FOR TUTORIAL CLASS (15.0)

### 15.1 Questions

Q1. Calculate the difference in cost per metre (m) for laying 100mm diameter flexible jointed clay drain pipes and the cost per metre (m) for laying 100 flexible jointed uPVC drain pipes in runs not exceeding 5.00m

#### Labour:

Productivity rate: 0.20hrs / m for 100mm diameter flexible jointed clay drainage. And 0.14hrs/m for 100mm diameter flexible jointed PVCu drainage. All - in rate £8.01 per hour plus £2.03 / hour enhancement for additional skill and responsibility.

#### Materials:

100mm diameter flexible jointed clay drain pipe cost £5.50 each and are 1.60m long. 100mm diameter flexible jointed PVC drain pipe costs £21.00 each and are 3.0m long. Flexible joints cost £4.23 each assume one joint for every 1.4m for clay drainage and one joint for every 2.0m of pipe for uPVC drainage.

#### Waste

Allow 10% waste on pipes and 5% waste on couplings

Q2. Calculate the unit rate / m<sup>2</sup> for earthwork support in moderately firm earth not exceeding 2.0m apart and a maximum of 2.0m deep. As illustrated in the sketch, given:

#### Labour:

Productivity rate 1.28hrs / m<sup>2</sup>, Unloading timber 1.00hrs / m<sup>3</sup>. All - in rate £8.01 per hour plus £2.03 / hour enhancement for additional skill and responsibility.

#### Materials:

Timber supply price is £325.00 / m<sup>3</sup> therefore:

100 x 100	Costs £3.25	150 x 100	Costs £4.88
150 x 150	Costs £7.31	200 x 50	Costs £3.25

#### Additional Information

Allow 5% waste on materials and allow for all materials to be used Eight times

Q3. Calculate the gross rate per square metre (m<sup>2</sup>) for brick wall: half brick thick skim of hollow walls built entirely of concrete common bricks in mortar (1:1:6) pointed with bucket handle joint using directly employed labour given:

#### Labour:

2 + 1 gang – Bricklayers £11.53 per hour & Labourers £8.68 per hour