PRICING AND BIDDING

IYCB 1

Workbook

PRICING AND BIDDING (IYCB 1) WORKBOOK

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PREFACE

The *Improve Your Business (IYB)* approach to small enterprise development has proved its worth in many different countries, and has demonstrated the need for publications which are written simply and clearly but which can still communicate the basic management knowledge required by entrepreneurs if they are to run small businesses successfully.

Although all small businesses face some common problems and certain management principles are universal, experience has shown that a sector-specific development of the IYB approach would be widely welcomed.

This demand was particularly strong from enterprises in the construction sector, since small contractors have to cope with the special managerial problems that arise from bidding for and carrying out varied and dispersed projects and are faced with highly cyclical demand.

The ILO has responded by developing this Improve Your Construction Business (IYCB) series to suit the specific needs of small building and public works contractors. The IYCB series of three handbooks and workbooks is available either separately or as a set, and comprises:

Pricing and bidding (IYCB 1) Handbook and Workbook

Site management (IYCB 2) Handbook and Workbook

Business management (IYCB 3) Handbook and Workbook

They have been designed for self-study, but there is also an IYCB trainer's guide to assist trainers in preparing for and running seminars and workshops. As demand emerges, further handbooks and workbooks will be added to suit the specialist needs of, for example, road contractors and materials manufacturers.

The first handbook and workbook cover pricing and bidding to obtain new projects. Too many contractors produce "guesstimates"–not estimates–of project costs, so they either bid too

high and lose the contract or–often even worse–get the work at a price which is below cost. Besides taking the reader step-by-step through the preparation of the bid for a small building contract, the first handbook contains a contract glossary.

The second handbook and workbook start where the first set finishes–a potentially profitable contract has been won. The first part of these books, "planning for profit", helps the reader to prepare a realistic plan to carry out the work, while the second part, "making it happen", deals with the principles and practice of site supervision.

The third handbook and workbook cover business management. A contracting firm is not just a collection of individual contracts; it is also a business enterprise. These books focus on financial control and office administration, which are frequently neglected by contractors who are generally more interested in the technical aspects of building work.

The way the IYCB system works is that the *handbook* provides ideas and information and the *workbook* gives the reader a chance to look at his or her business in a disciplined way, and decide on action plans to make it more competitive and successful. Together, the IYCB series should enable you, as the owner or manager of a small construction enterprise, to improve *your* construction business. As joint authors with between us about a hundred years' experience of working with small contractors around the world, we understand the risky and demanding environment in which you work and hope that the IYCB series will help you and your firm to survive and prosper.

This book was prepared and edited within the ILO Construction Management Programme which was initiated within its Entrepreneurship and Management Development Branch, Enterprise and Cooperative Development Department and is now based in the Policies and Programmes for Development Branch of the Employment and Development Department.

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THE AUTHORS

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John Ward was Chief Technical Adviser to the first Improve Your Construction Business project and is now an independent consultant specializing in training for construction enterprises. He started his career as site agent and engineer with major construction companies, then ran his own small contracting business before specializing in the training of owners and managers of small construction enterprises.

ACKNOWLEDGEMENTS

The *Improve Your Business (IYB)* approach to small enterprise development was conceived by the Swedish Employers' Confederation, and has since been developed internationally by the ILO with financial assistance from the Swedish International Development Authority (SIDA) and other donors.

The Government of the Netherlands agreed to finance the first "Improve Your Construction Business" (IYCB) project, based at the Management Development and Productivity Institute (MDPI) in Accra.

Ghana proved a good choice. As a result of recent changes there is a favourable climate for private sector initiatives, and Ghanaians have a well-deserved reputation for entrepreneurial drive. The Civil Engineering and Building Contractors Association of Ghana (CEBCAG) appreciated the opportunity that the project offered for its members to improve their management skills, and worked closely with the MDPI team and the ILO chief technical adviser to ensure that the training programme met the most urgent needs of its members.

This initial IYCB project provided an opportunity to develop and test a series of *Improve Your Construction Business* handbooks and workbooks and we wish to specifically acknowledge the dedication and enthusiasm of the MDPI/CEBCAG training teams or "cohorts".[1] The project package contained a certain amount of material that was specific to operating conditions in Ghana, but this published edition has been carefully edited to meet the general needs of small-scale construction entrepreneurs for basic advice on ways to improve business performance.

[1] Yahaya Abu, Michael Adjei, Margaret Agyemang, Kofitse Ahadzi, Henry Amoh-Mensa, Ernest Asare, John Asiedu, Franklin Badu, Fidelis Baku, Siegward Bakudie, Joseph Dick, Hamidu Haruna, Mathias Kudafa, D. Nsowah, Eric Ofori, Yaw Owusu-Kumih, S. Sakyi, Harry Seglah.

CONTENTS

HOW TO USE THIS WORKBOOK

This workbook is written for *you*–the owner or manager of a small construction business. Together the three basic IYCB handbooks provide advice on most aspects of running such a business, and the three complementary workbooks give you the chance to test your management skills, assess the performance of your business in a disciplined way and develop your own action plans.

Improve Your Construction Business is material for you to work with. It is available in a series of modules which take you step-by-step through the different stages of running a small contracting business. They are best read together. We suggest you first read the chapter in the handbook, and then work through the examples in the corresponding chapter of the workbook.

The handbook

Handbook 1 contains a worked example of a simple building project, showing how to calculate costs and prepare a realistic estimate. It is both a basic textbook and a reference book, and contains many checklists which should be useful whenever you are bidding for a new project. The chapters are set out in the same order as the chapters in the workbook, so that you can easily go from workbook to handbook or from handbook to workbook.

This workbook

This workbook enables you to test your estimating skills by means of exercises in management practice. It will also make you think hard about the way you estimate costs and prepare your bids, by asking you a number of questions. In each chapter of the workbook there is a list of ten simple questions to which you

answer "yes" or "no". The answers you write will give you a quick score out of ten on the topic that is dealt with in that chapter, and will tell you about the strengths and weaknesses of your business.

If you find that you need to improve your management skills in certain areas after going through the workbook, you can turn back to the appropriate section in the handbook and make sure you understand all the items and techniques introduced there.

Where to start

We recommend that you start by reading quickly through the whole of the handbook. Then you can go back over it more slowly, concentrating on the chapters which deal with those parts of management which you think is weakest in your business.

As soon as you feel comfortable with the ideas in a particular chapter, you can try out your skills in the workbook. Together this handbook and workbook, and the others in the IYCB series, should become your "business friends".

Note: Since this book is intended for use in many different countries, we have used the term "NU" in the examples to represent an imaginary "National Unit of currency" and NS to stand for imaginary "National Standards".

THE BUILDING TEAM 1

Quick reference

Teamwork

At the start of a job all parties should have the same objective –to complete the job in a manner that gives satisfaction to all. They should be a team with one goal in mind–successful completion of the work within the time limit.

Solving problems

However, life being what it is, problems occur and mistakes are made by all parties during the period of the contract, and the contractor, the supplier, the client and the consultant should act responsibly and work together to find a fair solution.

Advice and representation by consultants

Remember that the consultant has a professional duty to help solve problems that arise from the contract as well as to look after the interests of the client. The consultant can assist you by representing your interests in dealings with the client. The consultant should be regarded as being an adviser to, and a representative of, all parties to a contract.

REMEMBER

- ❑ Both the client and the contractor have definite responsibilities.
- ❑ The consultant should ensure that those responsibilities are carried out.

- ❑ The consultant should communicate between and represent both parties.
- ❑ Problems and mistakes should be tackled at once with the aid of the consultant. They should not be hidden away.

Part 1 – Questions

This section will help you to test how well you run your business as a CONTRACTOR, and how well you work with the CLIENT, the CONSULTANT and the SUPPLIER. So there are four sets of ten questions in this chapter, set out in the same order as in the Handbook–CLIENT, CONSULTANT, CONTRACTOR, SUPPLIER. You should answer all of them, because your business will only be a success if you work well with the other members of the building team. Your score out of ten in each section will tell you how strong your business is in each area, and you should concentrate on improving those areas where your score out of ten is low.

RELATIONS WITH CLIENTS

	Yes	No
1. Do you usually have a full order book?	☐	☐
2. Do you have a list of your existing clients?	☐	☐
3. Do previous clients ask you to quote for new projects?	☐	☐
How do you obtain new clients?		
4. – open tenders?	☐	☐
5. – advertisements?	☐	☐
6. – recommendations from consultants?	☐	☐
7. – recommendations from previous clients?	☐	☐
8. – personal contacts?	☐	☐
9. Do you have a reputation for quality work?	☐	☐
10. Do you have a reputation for completing projects on time?	☐	☐

RELATIONS WITH CONSULTANTS

	Yes	No
1. Do you know the consultants in your home town?	☐	☐
2. Do consultants recommend you to their clients?	☐	☐
3. Do you instruct your site staff to work closely with the consultant?	☐	☐
4. Do you plan your work carefully and supply a job programme to the consultant?	☐	☐
5. Do you keep the programme up to date, and inform the consultant of major changes?	☐	☐
6. Do you inform the consultant promptly of extra details required?	☐	☐
7. Do you always make sure that materials and finished work are up to standard?	☐	☐
8. Do you keep a site diary and visitors' book?	☐	☐
9. Are you always on time at site meetings?	☐	☐
10. Do you prepare certificates clearly so that they can be checked easily?	☐	☐

YOUR CONTRACTING BUSINESS

	Yes	No
1. Do you know the names of your competitors?	☐	☐
2. Do you know how much work they have in hand?	☐	☐
3. Do you read professional journals or magazines?	☐	☐
4. Do you look at competitors' construction sites?	☐	☐
5. Do you ask more experienced contractors for advice?	☐	☐

	Yes	No
6. Are your actual costs usually close to your estimate?	☐	☐
7. Are you a member of a Contractors' Association?	☐	☐
8. Do you have a loyal workforce?	☐	☐
9. Do you provide training for regular staff?	☐	☐
10. Do you provide safety equipment and make sure that it is used?	☐	☐

RELATIONS WITH SUPPLIERS

	Yes	No
1. Do you have a list of regular suppliers?	☐	☐
2. Are you happy with the service of your present suppliers?	☐	☐
3. Do you obtain competitive quotations before ordering?	☐	☐
4. Do your suppliers offer competitive discounts and credit?	☐	☐
5. Do you always prepare a materials schedule showing when materials are needed on the site?	☐	☐
6. Do you make sure that orders for materials or equipment are written clearly?	☐	☐
7. Do you instruct site staff to check deliveries?	☐	☐
8. Do you always pay suppliers on time?	☐	☐
9. Can you find out quickly how much of each product you have bought in the previous six months?	☐	☐
10. Do you get good service from your suppliers in an emergency?	☐	☐

Part 2 – Business practice

This section consists of two exercises that have been designed to test your understanding of the rights and responsibilities of the client, the consultant, the contractor and the supplier.

1. WHOSE JOB IS IT?

The following table lists a series of tasks that have to be carried out during a typical building contract. Go through the tasks one by one, and put a cross in the column to show who is responsible for each activity (in some cases more than one person may be responsible so you may need to mark more than one column).

Task	Client	Consultant	Contractor	Supplier
1. Preparation of contract drawings and documents.				
2. Providing funds to pay for the work.				
3. Ordering materials.				
4. Setting out the foundations.				
5. Checking the foundations before pouring concrete.				
6. Delivering materials.				
7. Measuring the work for the stage payment.				
8. Checking and authorizing the certificate for the stage payment.				
9. Authorizing the payment of the certificate.				
10. Ensuring safe working conditions.				

2. WHO WAS TO BLAME?

Many things can go wrong on a contract if people fail to do their jobs properly. In the following examples, we would like you to decide whether it was the CLIENT, the CONSULTANT, the CONTRACTOR or the SUPPLIER who was to blame–and why.

1. There is a mistake on the drawing leading to an over-excavation of foundations. The mistake is very hard to spot.
2. A test-cube failure shows that some concrete is weak due to an excess of water being added during mixing.
3. The job has to be stopped halfway through due to lack of funds.
4. Sand delivered to site and tipped is rejected because it is full of silt and vegetable matter.

NOW CHECK YOUR ANSWERS

Our suggested answers are at the end of this workbook. We suggest you check your answers against them before deciding on your action programme. If there is any disagreement, re-read Chapter 1 of the handbook to make sure that you fully understand it.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no" for each set of ten questions.

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose

the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
Actual costs more than estimate	(a) Check the estimate for errors	Self	2 days
	(b) Get breakdown of materials costs	Suppliers	5 days
	(c) Check for overcharging by suppliers	Self	2 days
	(d) Improve site efficiency	Self	10 days
	(e) Improve estimate preparation	Self	Future

SITE INSPECTION 2

Quick reference

Site inspections cost time and money, particularly if they are a long way from your office. Even so, they are vital if you are going to get all the information you need to prepare a proper estimate. The skill is to make sure that you get all the information you need in a single visit.

This means that you must start with a "shopping list" of all the information you will need in order to make a proper estimate. Just as it is easy to forget to buy something that you really need if you just rely on memory, it is easy to forget to obtain some of the information you really need if you fail to take a checklist and tick off every item once the information has been written down in your notebook.

REMEMBER

- ❑ *ALWAYS* visit the site.
- ❑ Check the existing site plan.
- ❑ Take the equipment you will need to measure the site and to draw a sketch plan.
- ❑ This is the stage when you should write down any thoughts concerning the job.

Part 1 – Questions

		Yes	No
1.	Do you always visit the site before bidding for a job?	☐	☐

	Yes	No
2. Can you draw a clear sketch plan?	☐	☐
3. Do you know how to take levels on the site?	☐	☐
4. Do you have a standard checklist for site inspections?	☐	☐
5. Do you ask local people for advice?	☐	☐
6. Do you know how to check soil type and stability?	☐	☐
7. Do you always check water and electricity supplies?	☐	☐
8. Do you check on whether local labour can be recruited?	☐	☐
9. Do you check on the cost, quality and availability of materials from local suppliers so as to reduce transport costs?	☐	☐
10. Do you always think carefully about how you will organize the site work if you get the job, and make a special note of any unusual problems that might arise?	☐	☐

Part 2 – Business practice

The following exercise is designed to test your understanding of how to carry out a site inspection, so that you can get all the information you need during a single site visit.

1. INFORMATION GAPS!

You are going to bid for the construction of a new village primary school. As part of your training programme for a new foreman, you have asked him to visit the site, draw a sketch plan and make notes so you can prepare the bid. The site is not too far from the site on which he is working at the moment and there is some time to spare before the bid has to be prepared, so it will not be too serious in this case if a second visit has to be made.

As you can see from the following extracts from his notebook, he has done his best but there are quite a few information gaps that will have to be filled if you are going to be able to prepare an accurate bid. So look through these extracts carefully, and then make a list of all the things that he must find out when he goes back to the site.

1. The site slopes from north to south.
2. There is no water on site, or electricity.
3. The nearest town is quite far away.
4. There is a garage halfway to the town that has diesel and a workshop.
5. There is a large block and tile works in the town.
6. There is rock on the site, but it is quite soft. No need for explosives.
7. The topsoil can be stored at a farmer's field about 5km away.
8. The farmer has a sand pit.
9. The farmer will hire out his workers at cost plus 25 per cent. He will give them food but they must be transported.
10. A trial hole was not allowed.

LIST OF ADDITIONAL INFORMATION NEEDED

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....
8. .....
9. .....
10. .....

NOW CHECK YOUR ANSWERS

Our suggested answers are at the end of this workbook. We suggest you check your answers against them before deciding on your action programme. If there is any disagreement, re-read Chapter 2 of the handbook to make sure that you fully understand it.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no".

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These

may be problem or opportunity areas for your business. Choose the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
I do not have a standard checklist	Go through all the available information and make a standard checklist	Self	Before next site visit

CONTRACT DRAWINGS 3

Quick reference

You will not be able to produce an accurate estimate for the project unless you can read the contract drawings prepared by the consultant, or prepare contract drawings of your own if you are working for a private client who does not employ an architect or engineer.

If there is something on the drawings which is not clear, you should ASK the consultant rather than GUESS or ASSUME. As a professional contractor, you want to provide the building that your client is hoping for – not just a building that will be reluctantly accepted and paid for grudgingly. It is cheap to make alterations or corrections while the project is still on the drawing board, but alterations and corrections on site are costly and can harm your reputation (even if you are in the right).

REMEMBER

- ❑ The site layout should give at least as much information on plan as can be seen or discovered on site.
- ❑ The plans, elevations and sections should be drawn up to give all the information necessary to put in a bid.
- ❑ Sometimes specialist drawings are required to cover details such as electrical installation or sewerage connections. These should be available at the tendering stage.

Part 1 – Questions

	Yes	No
1. Do you have the skill to prepare an accurate drawing?	☐	☐

	Yes	No
2. Do you know how to check drawings prepared by a consultant?	☐	☐
3. Do you know how to prepare an estimate for a building?	☐	☐
4. Do you know how to prepare an estimate for a new road?	☐	☐
5. Do you know how to prepare an estimate for drainage work?	☐	☐
6. Do you know how to set out a building?	☐	☐
7. Do you know how to set out a road?	☐	☐
8. Do you know how to set out drainage work?	☐	☐
9. Do you keep records of drawings as they are received?	☐	☐
10. Do you check new drawings for possible changes in design as soon as they are received?	☐	☐

Part 2 – Business practice

1. SHARPEN YOUR PENCIL– AND START TO DRAW!

Your new foreman has made a second visit to the site, and the information is now complete based on the original extracts from his notebook.

YOUR TASK

1. Draw (on a separate sheet of paper) a site layout for the construction of four buildings, each 12 m x 4 m, which are to be sited along each of the edges of a square parking area with 15 metre sides. There will be an access road 100 m long and 4 m wide joining at one corner.

2. Draw a simple floor plan of a 12 m x 4 m building shell,

with foundations 1 m deep, 3 m from floor to eaves and a pitched roof 2 m from eaves to apex.

3. Draw a simple elevation and section of the above building.

NOW CHECK YOUR ANSWERS

Compare your drawings with the model answers at the end of this workbook. You do not necessarily need the skills of a draughtsman, but a competent contractor should be able to produce simple and clear drawings so that:

- ❑ the estimate can be prepared properly;
- ❑ the client and consultant have a clear idea of what is allowed for in the bid (so as to avoid later disputes);
- ❑ the site supervisor does not have to guess at what the contractor requires to be done.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no".

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write

in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
Drawings on one of my sites often contain errors so revisions are frequent	(a) Always point out errors to the consultant in writing	Self	As soon as noticed
	(b) Keep an up-to-date record of drawings received	Self	Immediate
	(c) Make sure to claim for extra work	Self/ foreman	As soon as noticed
	(d) Think carefully before bidding for future work from this consultant	Self	From now on

SPECIFICATIONS AND CONDITIONS OF CONTRACT 4

Quick reference

- ❑ The specifications and conditions of contract are the rules of the "contracting game". If you do not study them and understand them, you are not fit to be a spectator–let alone a player!
- ❑ Get hold of your local standard contract documents and study them thoroughly–get to know them well. Before you bid for any new contract, make sure that you know whether the standard conditions apply.
- ❑ Whenever you notice that some special conditions apply to a new contract, think carefully about any extra risks you may be running. If the conditions are not clear, ask the consultant for clarification before you start preparing your bid.

REMEMBER

- ❑ The specifications should always be read in conjunction with the working drawings.
- ❑ You should always try to achieve the standards specified.
- ❑ You may only alter the specifications if the consultant's permission and approval are obtained.
- ❑ The conditions of contract should protect all parties involved.
- ❑ Conditions of contract should always be issued, no matter how small the contract may be, together with the working drawings and the specifications.

Part 1 – Questions

	Yes	No
1. Do you have copies of standard specifications?	☐	☐
2. Do you understand all the clauses in the standard specifications?	☐	☐
3. Do you have copies of the standard form of contract?	☐	☐
4. Do you understand all the clauses in the standard contract?	☐	☐
5. Have you prepared a standard quotation form for use with private clients?	☐	☐
6. Do you always make sure that your suppliers quote for materials that match the specifications?	☐	☐
7. Do you understand the term "provisional sum"?	☐	☐
8. Do you understand the term "certificate of practical completion"?	☐	☐
9. Do you understand the contractor's responsibility for defects maintenance period?	☐	☐
10. Do you understand how to deal with disputes through arbitration?	☐	☐

Part 2 – Business practice

The following two exercises should help you to test your knowledge of standard specifications and conditions of contract, and give you practice in looking out for clauses that might cause trouble–and financial losses–if things go wrong.

1. FILL IN THE GAPS

The following text is an extract from a set of specifications and conditions of a building contract. Unfortunately the documents

have been badly copied, and only the first letter of several words can be read. Imagine that you are the builder. Read through the text clause by clause, and complete the missing words.

1. Except as expressly agreed, the builder shall provide all labour, (a) m..... and (b) e..... necessary for the proper execution of the work.
2. Where the customer specifies or supplies materials or goods which, in the opinion of the builder, are not (a) s..... for the purpose for which they are required, the (b) b..... shall accordingly notify the (c) c..... in (d) w....., setting out the reasons why such (e) m..... or (f) g..... are in his opinion (g) u.....
3. The value of any (a) v..... to the work included in the estimate ordered and authorized by the customer, whether by addition, omission or substitution of any work, should, wherever practicable, be agreed before the (b) w..... is carried out.
4. The value of all (a) v..... to the work shall be (b) a..... to or (c) d..... from the (d) p..... stated in the estimate.
5. (a) D..... which exist or may appear within three months of the (b) c..... of the works if proved to arise from workmanship or materials not in accordance with the estimate will be made good by the (c) b..... at his or her own (d) e..... . Notice in (e) w..... of such (f) d..... must be given to the (g) b..... before the expiry of the (h) p..... stated.

2. LOOKING FOR TROUBLE

You have been given a chance to bid for an attractive job, but you have not worked with this client organization before and it will be necessary to study the conditions of contract with special care. Read through the following conditions carefully, and make a note of any items that you think are ambiguous or could lead to trouble. A bidder is always entitled to ask for clarification of ambiguous clauses, and it is sometimes reasonable to submit a qualified bid if you feel the risk resulting from the proposed clauses is unreasonable (see the handbook, Chapter 8, on Qualifications).

1. Possession of the site will be given within a fixed time after the date of the quotation accepted. Such time will be decided

by the client but possession will not be unreasonably withheld (in principle) from the contractor.

2. Payment of interim accounts will be effected within 30 days of the last day of the calendar month in which the client has agreed in writing to pay the interim account.
3. Where the client provides materials or fittings to be fixed in the works, the contractor shall do so without delay or reasonable cause to refuse.
4. The contractor will be held responsible for all defects in the finished work.
5. The client shall hold in retention up to a total of 20 per cent of the value of the contract. This shall be released to the contractor upon the final acceptance of the works by the client. Such acceptance will not be unreasonably withheld.

NOW CHECK YOUR ANSWERS

Our suggested answers are at the end of this workbook. We suggest you check your answers against them before deciding on your action programme. If there is any disagreement, re-read Chapter 4 of the handbook to make sure that you fully understand it.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no".

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose

the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
I have no standard quotation form for my clients	(a) Draft a quotation form (b) Get advice on its legality (c) Always use it	Self Lawyer/QS Self	Immediate 10 days Next quotation

LISTING QUANTITIES 5

Quick reference

- ❑ As a professional contractor you should be able to make out a list of quantities yourself, if one is not provided by the consultant.
- ❑ Even if a bill of quantities is provided, it is wise to check it for errors or omissions.
- ❑ Remember that professional contractors ESTIMATE–amateur contractors GUESSTIMATE.
- ❑ In order to make out a list of quantities the job must first be broken down into all its major separate operations.

REMEMBER

- ❑ Make sure you do not overlook anything when taking off the working drawings to prepare a list of quantities.
- ❑ Items on the list of quantities should generally be written down in the same order as they would be carried out on site or in the workshop.
- ❑ Thoroughness at this stage is essential. Calculations and measurements should be written neatly, checked and perhaps even double-checked. IT IS YOUR MONEY THAT IS AT RISK.
- ❑ If a bill or list of quantities is supplied it should be thoroughly checked for mistakes or omissions.

Part 1 – Questions

	Yes	No
1. Do you always prepare a list of quantities yourself if no bill of quantities is supplied by the client?	☐	☐
2. Can you calculate the volume of excavation for foundations?	☐	☐
3. Can you calculate the length of reinforcing steel?	☐	☐
4. Can you calculate the area of formwork?	☐	☐
5. Can you calculate the volume of concrete?	☐	☐
6. Can you calculate the amounts of cement, sand and aggregate required for concreting?	☐	☐
7. Can you calculate the number of bricks or concrete blocks required for walls?	☐	☐
8. Can you calculate timber requirements for windows, doors and other joinery?	☐	☐
9. Can you calculate quantities for finishes?	☐	☐
10. Can you calculate quantities for roads and drainage?	☐	☐

Part 2 – Business practice

1. LIST THE QUANTITIES

In this exercise you will prepare a list of quantities by taking off details from the contract drawings shown at the end of the handbook.

You should fill in your answers in the table below (or draw out a similar table on a plain sheet of paper). When you have finished you will be able to check your answers against Table 3 in the handbook. That will give you an opportunity to find out whether you have really mastered the skill of listing quantities. We have also provided notes in the answers section at the end

of this workbook which explain how the figures in the handbook were calculated.

List of quantities

Item no.	Description	Unit	Quantity

2. A STORAGE SHED

You have been asked to bid for the construction of a storage shed. In this exercise, your task is to calculate the quantities for the building and list them in the table on the following page. The details of the quantities which you have to calculate are given below:

1. Strip 0.25 m thick topsoil in field 100 m long and 80 m wide, and stockpile on site.
2. Excavate 1 m deep trench to take 0.15 m diameter sewer, total length 100 m.
3. Lay, bed and haunch pvc sewer 0.15 m diameter, total length 100 m.
4. Return, fill and ram material excavated in item 2 above.
5. Construct reinforced concrete footing to support the external 0.25 m thick walls of a store shed 40 m long by 20 m wide (external measurements). Depth of foundation to be 1 m, top of foundation to be 0.5 m below ground level, foundation to extend 0.3 m each side of block wall.
6. Build reinforced blockwork walls to store. Allow for one standard roller shutter door (frame 4 m high and 3 m wide) to be built into one wall for lorry access. Height of store 6 m to eaves level and 8 m to ridge.
7. Supply and fix one standard roller shutter door and frame 4 m high and 3 m wide.
8. Supply and fix prefabricated steel roof trusses to store at 1 m centres.
9. Supply and fix corrugated steel sheet roof with 1 m overhang all round walls, including ridge, gutters, downpipes and side flashing.
10. Clean up site on completion and cart all rubbish to tip.

Note: You may find it helpful to prepare a drawing to use for your calculations, but it is not necessary to do so since all the information is given in the above list.

List of quantities

Item no.	Description	Unit	Quantity

NOW CHECK YOUR ANSWERS

Our suggested answers to Exercise 2 are at the end of this book (for Exercise 1 check against Table 2 in the handbook, and then look at our calculations at the end of this workbook if there is a disagreement between your answers and those in the handbook). We suggest that you check your answers before deciding on your action programme. If there is any disagreement, re-read Chapter 5 of the handbook to make sure you fully understand it.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no".

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
Cannot prepare a list of quantities	Practise with the handbook, and ask for assistance if necessary	Self Q S	More haste, less speed

DIRECT PROJECT COSTS 6

Quick reference

The direct project cost is the estimate of the costs of the labour, plant, material and transport that will be required to complete the work.

You should know the labour costs for your business from records kept on previous contracts. These can be modified to take account of any special conditions that may apply in the area that you would be working in, if you know that general wage levels are higher or you have to pay the transport costs of bringing in key staff. Labour constants can be used for comparison, but it is best to rely on your own records.

The unit costs of materials can be obtained from the materials suppliers.

Plant costs may be calculated from local hire rates. If your own plant is to be used, remember that there are still costs to be recovered. These can be allowed for by working out an internal hire rate for all items of plant, which will be recovered from each project according to the time worked.

To calculate transport costs, you need to know which materials have to be transported and how far. The notes made during the site inspection will help you in making this calculation.

REMEMBER

- ❑ The direct project cost is the total of the estimated costs of the labour, plant, material and transport required to complete the work.
- ❑ Direct project costs can be calculated using information obtained from the site inspection, the specification and the list of quantities.
- ❑ Most of the direct project costs can be calculated by the contractor using valuable practical experience gained on previous contracts.

Part 1 – Questions

	Yes	No
1. Do you keep accurate records of your labour costs?	☐	☐
2. Do you keep accurate records of your plant costs?	☐	☐
3. Do you keep accurate records of your materials costs?	☐	☐
4. Do you keep accurate records of your transport costs?	☐	☐
5. Do you make regular checks on the proportion of total time for which your workforce is idle?	☐	☐
6. Do you make regular checks on the proportion of total time for which your plant is idle?	☐	☐
7. Do you keep accurate records of materials in stock?	☐	☐
8. Do you work to a system in cost calculations?	☐	☐
9. Do you write figures neatly and calculate accurately?	☐	☐
10. Do you always check your calculations?	☐	☐

Part 2 – Business practice

1. THE DIRECT PROJECT COSTS CHART

Using the list of quantities taken off in Chapter 5 calculate the direct project costs for the whole of the contract and enter them on the direct project costs chart (If you have not prepared a list of quantities yourself you can use Table 3 in the handbook). For a list of unit costs, see the following pages 38-39.

DIRECT PROJECT COSTS CHART–SCHOOL								
List of quantities taken off drawings				Direct project costs (NU)				
Item No.	Description	Unit	Quantity	Labour	Plant	Materials	Transport	Total
							Final total of direct project costs	

Here is a list of the unit costs we have used when calculating our direct project costs.

Labour:	Skilled (8 hours/day, 40 hour week)		8 NU/day
	Labourers (8 hours/day, 40 hour week)		5 NU/day
Plant:	Mixer	hire rate	10 NU/day
	Vibrator	hire rate	2 NU/day
	Bowser	hire rate	4 NU/day
	Pedestrian roller	hire rate	8 NU/day
	Power float	hire rate	10 NU/day
Material:	Reinforcement steel 12 mm & 8 mm (12 mm weighs 0.89 kg/m) (8 mm weighs 0.40 kg/m)		700 NU/ton
Timber	(measurements in inches)		
	Timber 1" x 4"		0.5 NU/m
	Timber 1.5" x 4"		0.7 NU/m
	Timber 2" x 4"		0.9 NU/m
	Timber 1.5" x 8"		1.5 NU/m
	Timber 1" x 1"		0.2 NU/m
	Timber 1.5" x 6"		1.2 NU/m
	Stakes for fence		1.0 NU/m
Boards and panels			
	Woodchip/cement board		4 NU/m^2
	Window panel		75 NU/panel
	Door panel		100 NU/panel
Concrete	(weights and volumes according to table 4 in Handbook 1, Chapter 6)		
	Cement		5 NU/100 kg
	Sand		5 NU/1 000 kg
	Coarse Aggregate		4 NU/1 000 kg
Blocks	Concrete blocks (250 x 250 x 200)		0.8 NU/block
	Mortar, 1:5 (cement:sand), joints 20 mm wide		
	Plaster, calculate as mortar		
Fill	Hardcore fill (1 650 kg/m^3)		4 NU/1 000 kg
	Gravel (1 500 kg/m^3)		5 NU/1 000 kg
Tiles	Tiles (covers 200 x 400)		0.8 NU/tile
	Ridges		6 NU/m

Floor	Terrazzo floor (20 mm thickness)	100 NU/m^3
Paint	Paint	1.5 NU/m^2
Transport:	3 ton truck + driver	5 NU/hour
	Cement (5 km from site)	1 NU/1 000 kg/km
	Sand (20 km from site)	1 NU/10 000 kg/km
	Aggregate (10 km from site)	1 NU/10 000 kg/km
	Water (2 km from site)	2 NU/10 000 kg/km
	Hardcore fill (10 km from site)	1 NU/10 000 kg/km
	Gravel (10 km from site)	1 NU/10 000 kg/km
	Transport of cement blocks (1 000-5 000 No.)	150 NU
	Transport of tiles (2 000-5 000 No.)	50 NU

2. A BOUNDARY WALL

One of your clients is worried about security for his factory and has asked you to submit a price for building a 3 m high blockwork boundary wall which will have a total length of 100 m. He has supplied the following list of quantities.

Item No.	Description	Unit	Quantity
1.	Strip topsoil average depth 0.1 m and store on site	m^2	50
2.	Excavate for footing 0.2 m deep and 0.5 m wide	m	100
3.	Concrete to footings 0.3 m thick and 0.5 m wide, including reinforcement	m^3	15
4.	Reinforced blockwork wall, 0.225 m thick	m^2	300
5.	Spread topsoil around base of wall inside property and dig over as flower bed	m^3	5

You have decided to allocate labour and plant as follows:

A. *Footings*

- 2 labourers to strip topsoil in 4 working days of 8 hours (Labour rate 1 NU/hour)

- ❑ Mechanical excavator (backhoe) with one labourer to excavate the footings in 4 hours (Excavator rate 10 NU/hour. Tipper truck rate (5 m^3) 5 NU/hour)
- ❑ 5 labourers plus 2 operators (mixer and vibrator) to mix and place concrete in 24 hours (3 working days of 8 hours)

Labour rate for operators	2 NU/hour
Mixer rate (1 m^3/hour)	4 NU/hour
Vibrator rate	2 NU/hour

The cost of reinforcement is 10 NU/tonne; total needed for footings 2.2 tonnes

Concrete mix is specified as 1:2:4 by volume

Aggregate cost	10 NU/tonne
Sand cost	10 NU/tonne
Cement cost	2 NU/bag (50 kg) (delivered on site)

Sand and aggregates will be collected from contractors' pit/quarry in the 5 m^3 tipper truck (round trip takes 30 minutes). Water is supplied free of charge.

B. *Wall*

2 blocklayers and 5 labourers will be needed to mix the mortar and build the wall. The job will take 10 working days of 8 hours.

Blocklayer	3 NU/hour
Reinforcement	1.5 tonnes
Blocks (50 cm x 30 cm x 20 cm wide)	0.4 NU each (unloaded on site)
Joints 20 mm wide	
1:5 cement mortar	

C. *Spread topsoil*

2 labourers will be required for 5 days

Your task is to calculate the direct project costs and enter them in the following chart.

DIRECT PROJECT COSTS CHART–BOUNDARY WALL

List of quantities taken off drawings				Direct project costs (NU)				
Item No.	Description	Unit	Quantity	Labour	Plant	Material	Transport	Total
							Final total of direct project costs	

3. EXTRA EXCAVATION = EXTRA COST

The contract drawings of a project for which you are preparing an estimate consists of a reinforced concrete footing, 0.5 m wide x 0.5 m deep and 100 m long. The top of the footing will be 0.2 m below ground level.

During your site inspection you dig a trial hole and find that the top 0.7 m is a weak silty material which will not stand on its own while the footing is constructed. This means that you will have to excavate an additional 0.5 m on each side of the footing in order to place formwork to retain the concrete. How will you cover the cost of the additional excavation, the formwork and backfill in your bid?

NOW CHECK YOUR ANSWERS

Our suggested answers are at the end of this workbook. We suggest you check your answers against them before deciding on your action programme. If there is any disagreement, re-read Chapter 6 of the handbook to make sure that you fully understand it.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no".

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
No idea of labour costs	Keep accurate records of labour utilization on each site, collect them and analyse them in the office:		
	(a) Devise labour record sheet and distribute to site foremen	Self	Next week
	(b) Foremen fill in records	Foremen	Daily
	(c) Foremen send records to office	Foremen	Weekly
	(d) Check and analyse records	Self	Weekly

INDIRECT PROJECT COSTS 7

Quick reference

The difference between many contractors and a charity organization is that charities are set up to give money away and do it on purpose, but the contractors give money away to their clients without realizing it! Professional contractors charge their clients the proper price for the work, and save their charity for people who are really in need.

The essential skill in estimating is to make sure that *all* the costs incurred in completing a contract are recovered from the client, so that any profits that you earn are yours to keep.

If you are going to make sure that all costs are recovered, you must first find out what they are. Direct project costs are reasonably easy to recover, since you have to be really careless to miss basic costs like excavation, concreting and backfill.

Indirect project costs are a little more difficult, because costs which are not linked to a specific project activity can be overlooked.

REMEMBER

- ❑ If you want to cover *all* the costs incurred in completing a contract, you must add the indirect project cost to the direct project cost.
- ❑ Indirect project costs are:

  preliminary costs
  risk allowance
  company costs.
- ❑ Most of the indirect project cost has to be judged or assessed by the estimator, using practical knowledge and experience.
- ❑ The indirect project cost should be added to the direct project cost on a "share" basis, using the itemized list of quantities.

Part 1 – Questions

	Yes	No
1. Do you have a checklist of indirect project costs?	☐	☐
2. Do you employ experienced site supervisors?	☐	☐
3. Do you take good care of your temporary buildings?	☐	☐
4. Do you remember to allow for erection and dismantling of temporary buildings?	☐	☐
5. Do you keep expensive materials in locked sheds?	☐	☐
6. Do you prepare hard standing for aggregate stockpiles?	☐	☐
7. Do you provide fencing and other protection to trenches?	☐	☐
8. Do you plan access roads and general site layout efficiently?	☐	☐
9. Do you remember to allow for services, safety and security?	☐	☐
10. Do you obtain proper insurance cover against all main risks?	☐	☐

Part 2 – Business practice

1. DIRECT OR INDIRECT?

Some of the following costs are direct and others are indirect. Your job is to decide which is which, put a cross in the appropriate column and *for the indirect costs only* give a simple description of the type of indirect cost in the final column.

Type of cost

Description	Classification		Indirect cost description
	Direct	Indirect	
Hiring a concrete mixer for a specific contract			
Allowance for costs arising from delays due to bad weather			
Erecting a galvanized water tank on the site for the contractor's own use			
Buying a concrete mixer which will be used on other sites when the present job is finished			
Servicing and fuel for your own mixer (not hired)			
Tidying site on completion			
Transporting temporary office to site			
Erecting temporary office on site			
Main office rent and running costs			
Hiring site foreman for the job			
Security fence requested by client			
Security fence for contractor's store shed			
Shoring to 2-m deep sewer trench			
Employers' liability insurance			

NOW CHECK YOUR ANSWERS

Our suggested answers are at the end of this workbook. We suggest you check your answers against them before deciding on your action programme. If there is any disagreement, re-read Chapter 7 of the handbook to make sure that you fully understand it.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no".

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
Lost money due to site flooding after heavy storm	Take out proper insurance cover against main risks	Self/ Insurance Company	Today

8 SUBMITTING A BID

Quick reference

Preparing a bid takes time and money. All this will be wasted if you fail to win the contract, so make sure that you always submit your bids and quotations in a professional way.

The professional contractor takes time and care over presentation as well as preparation. The way you present your bid really matters because it tells the client a lot about you and your firm. If you take care over the presentation of your bid, it is reasonable to assume that you will take care over the work on site.

If this is done properly you can create a good impression with the consultant and the client. This may make all the difference between the job being awarded to you or one of your rivals if the prices are close.

REMEMBER

- ❑ Quotations should be filled out neatly and be arithmetically correct.
- ❑ Contingency sums may be added but it must be made clear to the client that the contingency sum will only be spent if authorized by the consultant or the client.
- ❑ A tender may be "qualified", but this must be done with great care to avoid contravening any regulations for or instructions to tenders that may apply. It is better to clarify any difficult issues with the consultant before submitting your bid.
- ❑ The contract is not necessarily awarded to the lowest tenderer, so contractors with a good reputation have a real advantage.

Part 1 – Questions

	Yes	No
1. Before allowing for profit, do you re-check that all work is allowed for somewhere in the estimate?	☐	☐
2. Before allowing for profit, do you re-check that the estimate is arithmetically correct?	☐	☐
3. Do you vary your calculated profit margin according to the size of your order book?	☐	☐
4. Do you vary your calculated profit margin according to the level of demand for construction work?	☐	☐
5. Do you vary your calculated profit margin according to the availability of under-utilized staff and equipment?	☐	☐
6. Do you have a trusted friend who you can ask for advice on whether your calculated profit margin is reasonable?	☐	☐
7. Do you keep a record of profit margins and success rates on past bids?	☐	☐
8. Do you give careful thought to the need for qualifications before finalizing the bid?	☐	☐
9. Do you understand the use of contingencies?	☐	☐
10. Are your quotations neatly prepared and clearly presented?	☐	☐

Part 2 – Business practice

1. JUDGE THE QUOTATION

This is an example of a quotation sent to a client. Is it a good quotation? If not, how can it be improved?

QUOTATION

Drawings supplied by client.
See list of quantities below.

Item	Description	Unit	Quantity	Rate	Amount
A	Excavation	m^3	26		1 040
B	Reinforced concrete	m^3	60		51 600
C	Roof	m^2	230		46 000
D	All panels and finishes	–	lump sum		10 000
E	External works	–	lump sum		9 300
				Final quotation submitted	117 940

LIST OF QUANTITIES

Item	Description	Unit	Quantity
A	Excavation of foundations	m^3	26
B	Foundations, columns, ring beams and floor-concrete work, including steel reinforcing formwork and finishes	m^3	60
C	Roof, including trusses, tiles and ceilings	m^2	230
D	All panels in blockwork, incl. timber and finishes	N°	36
E	All external works	–	–

2. TIME TO SPARE

You have completed your estimate and prepared your bid for a new building project with a few days to spare. In order to increase your chances of winning the contract there are a few more things that you can do. Look through the following list, and put a cross against the actions that are likely to increase the chances of your bid being chosen by the client.

Action	Improve chances	
	Yes	No
Take a holiday at the seaside		
Check all your calculations		
Look again at all unit costs and compare them with standard rates		
Write a letter to the local newspaper		
Check the contract drawings for errors or omissions		
Read a book on structural design		
Check the contract documents to see if there are any unusual provisions		
Look again at your profit margin in relation to the likely risk		
Tidy your filing cabinets		
Look again at the presentation of the bid and retype with a better layout and no spelling mistakes		

NOW CHECK YOUR ANSWERS

Our suggested answers are at the end of this workbook. We suggest you check your answers against them before deciding on your action programme. If there is any disagreement, re-read Chapter 8 of the handbook to make sure that you fully understand it.

rt 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no" for each set of ten questions.

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme below, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

hances

No

Problem	What must be done	By whom?	By when?
It is hard to judge profit margins	Keep a record of profit margins and success rates on past bids	Self	Ready for next tender bid

CONTRACT DOCUMENTS 9

Quick reference

Whenever you receive a set of contract documents, you should check to see if the contract will require you to bear any unusual risks. Even if you are preparing your own quotation, this is effectively a contract document and a mistake in drafting could lead you into special risks. The professional contractor will have a checklist of questions like:

Is this a legally binding agreement?

Does it make provision for the inspection of the works by the client's representative?

Does it safeguard the interests of the contractor?

Does it give a date for starting work or delivery or materials?

Is the method of payment properly covered to ensure prompt settlement?

Are the retention fund, retention payments and defects liability period fair to the contractor?

Does the contractor get paid enough for materials on site?

Is a mobilization fee paid?

Is there adequate provision for extra work or variations? Is payment for these guaranteed?

Is there a clause that adequately covers the contractor for price fluctuations?

What notices and/or fees must be paid to local authorities?

What insurances and indemnities have to be provided by the contractor?

Does the contract cover standards of work? Are those standards realistic in the local situation?

Is the liquidated damages clause fair to the contractor as well as to the client?

Is there a procedure laid down for claiming extensions of time? Is it a fair procedure?

Is the termination clause fair to all parties?

Is there provision for arbitration?

Can the contract be changed?

REMEMBER

- ❑ Any contract should be a legally binding agreement.
- ❑ The client's representative must always be allowed access to the works.
- ❑ The standard conditions of contract should safeguard your interests.
- ❑ The starting date of the works should not be too soon after signing the contract.
- ❑ The client should always pay promptly in accordance with the conditions of contract.
- ❑ The retention fund, retention payments and defects liability period should be equally fair to all parties.
- ❑ Materials on site should be claimable.
- ❑ *Always* get orders for extra work in writing.
- ❑ Price fluctuations should either be provided for in the contract or allowed for in the tender.
- ❑ You must obtain insurance cover.
- ❑ Bad workmanship has to be corrected at the contractor's expense.
- ❑ You should always try to finish the work on time.
- ❑ If work is delayed through no fault of your own an extension of time must be claimed by the contractor–*always* in writing and as soon as possible.
- ❑ Termination of contract is a drastic step which should only be taken as a very last resort. You should never act on this without advice.

- ❑ Try to avoid disputes with the consultant or the client. If they arise, it is better to settle them by arbitration rather than in a court of law.

Part 1 – Questions

	Yes	No
1. Do you always read documents carefully before signing?	☐	☐
2. Do you have a copy of your local standard specification?	☐	☐
3. Do you have a standard quotation form for work for private clients?	☐	☐
4. Do you have a standard plant hire form for use when hiring your plant to other contractors?	☐	☐
5. Do you ask for advice when you come across a clause in the contract which you do not understand?	☐	☐
6. Do you always check that the completion date and liquidated damages clause are reasonable?	☐	☐
7. Do you know and understand all your local health and safety regulations?	☐	☐
8. Do you generally find that you receive payments from your clients in accordance with the amounts and dates in your cash flow forecast?	☐	☐
9. Do you always ask for orders for extra works in writing?	☐	☐
10. Do you always make sure that your foreman understands the contract documents and specifications for the project?	☐	☐

Part 2 – Business practice

1. THE CONTRACT DOCUMENTS

Check your understanding of the contract documents by answering the following questions. When you have finished, you can test your answers against the descriptions in the handbook.

1. Name the five sets of formal documents that describe a **contract.**

2. Which two parties sign the **articles of agreement**?

3. The **conditions of contract** describe two things which help the contractor to measure risk. What are they?

4. Relating to the **contract period** there will be a clause which could result in considerable losses to the contractor. What is it?

5. Whose responsibility is it to prepare an account of the cost of work done as stated in the **method of payment**?

6. What document is required from the consultant when the work is finished, so that one half of the **retention money** can be released?

7. Under which three conditions can the contractor claim **payment for materials on site**?

8. What do you require in order to secure **payment for extra work or variations**?

9. What is the name of the clause which allows a contractor to claim for **price fluctuations**?

10. Name four types of **notices and fees due to local authorities.**

11. Name two types of claims which the contractor has to cover under **insurance and indemnities.**

12. Where is the amount of **liquidated damages** stated?

13. Name nine possible grounds for claiming an **extension of time.**

14. Name four grounds for **termination of contract** by the client.

15. In what part of the contract documents would you find a section on **arbitration**?

2. A CONTRACT GLOSSARY

The following definitions are taken from the contract glossary in the handbook. Test your memory by writing in the word or phrase that they refer to. When you have finished, you can check your answers against those in the handbook.

1. The time stated in the contract for completing the construction work.

_____

2. The agency or individual requiring the construction project.

_____

3. The money subtracted from the valuation of the work at interim and final payment stages and which will be kept by the client as a guarantee that the work will be properly completed and all defects rectified.

_____

4. Additions to, or subtractions from, the production information after the contract between the client and contractor has been signed.

_____

5. A guarantee for the client that the contract will be completed even if the contractor fails.

_____

6. An agreement between two or more parties. In building and civil engineering it usually means that a client agrees to pay a certain sum of money to a contractor, providing that specified construction work is completed to an adequate quality standard within a certain time.

_____

7. The extent of the works and the planned period over which it is to take place.

_____

8. A sum specified in the contract to be paid to the client by the contractor if the works are not completed within the contract period. This sum is intended to compensate the client for damages actually suffered; it is not a penalty.

_____

9. A period following the completion of the project, during which the contractor is responsible for correcting any defects in workmanship or materials.

10. A professionally qualified specialist, usually an architect, engineer or quantity surveyor, who is appointed by the client but who should also be impartial and ensure that the contractor is treated fairly in accordance with the contract documents.

11. Allowances for costs resulting from unforeseen circumstances.

12. General rules and regulations at country or regional level that all contractual parties must follow and that cannot be overruled by clauses in the contract.

13. Neglect of duty leading to liability for damages.

14. Directives issued to the contractor during the construction phase of a project and resulting from variations to, or amplification of, the information contained in the contract documents.

15. Settling disputes between the contractor and the client by appointing a reputable person who will study the problems and pass judgement.

NOW CHECK YOUR ANSWERS

In this case we suggest you check your answers against the Reference Section in the handbook before deciding on your action programme. If there is any disagreement, re-read that section of the handbook to make sure that you fully understand it.

Part 3 – Action programme

HOW TO CONSTRUCT YOUR ACTION PROGRAMME

Part 1 and Part 2 should have helped you to understand your strengths and weaknesses as the owner or manager of a construction enterprise. The general questions in Part 1 are a good guide to the strength of your business and the areas where there is most room for improvement. So look back and count the number of times you answered "yes" or "no" for each set of ten questions.

How many times did you answer "yes"? The more "yes" answers, the more likely it is that your business will do well. Now look again at those questions where you answered "no". These may be problem or opportunity areas for your business. Choose the one which is most important for your business at the present time. This is the sensible way to improve your business. Take the most urgent problem first. Don't try to solve everything at once.

Now write the problem or opportunity into the action programme opposite, as we have done with the example. Then write in *What must be done*, *By whom* and *By when* in order to make sure things improve.

Finally, go back to your business and carry out the action programme.

Problem	What must be done	By whom?	By when?
Lost money due to client applying liquidated damages clause	1. Make sure I always check the wording of this clause in future contracts	Self	From now on
	2. Keep accurate records of all causes of delay outside my control on all projects	Self/ foremen	From now on

NSWERS TO USINESS PRACTICE 1-8 10

nswers to business practice - 1

1. WHOSE JOB IS IT?

1. Consultant
2. Client
3. Contractor
4. Contractor, checked by consultant
5. Contractor and consultant, together (if possible)
6. Supplier, after confirmation with contractor
7. Contractor, checked by consultant
8. Consultant
9. Client
10. All four

2. WHO WAS TO BLAME?

1. The consultant–for issuing a drawing that has not been properly checked.
2. The contractor–for not making sure that the concrete is mixed strictly according to specification.
3. The client–for giving the go-ahead for the job to start before sufficient funds are available.

when?
om
w on
om
w on

4. The supplier–for not controlling the excavation of sand at the pit. But if the sand is used in the works, the contractor will be blamed–and will have to bear the cost of demolishing faulty work.

Remember that the contract is between the client and the contractor, so the contractor will be legally responsable for most things that go wrong. Sometimes the contractor may be able to make a secondary claim against the supplier, but never rely on this. Professional contractors make money because they get most things right first time–and are always trying to improve.

...wers to business practice - 2

1. INFORMATION GAPS

1. What is the approximate difference in level between north and south?
2. What is the nearest source of clean water?
3. How far is quite far away?
4. (& 5.) Without knowing the approximate distance from the site to the town this information is incomplete.
5. What about access to the site? Can a load of blocks be delivered and off-loaded on the site?
6. How much rock is there? Can it be broken out by hand using picks or will breakers and a compressor be required? What about transport?
7. How much will the farmer charge to store the soil? Is there reasonable access to the field? How thick is the topsoil layer?
8. Where is the sand pit? What is the quality of the sand? Has it ever been tested by a soils lab? Is it suitable for concrete?
9. Are there workers available in the area for hire directly by the contractor? What did the farmer mean by "cost plus 25 per cent" in terms of cash payment in NU? Will the workers be made available when required and do they have any experience of construction work?
10. Did the foreman ask the farmer about local ground conditions?

There are other gaps. For example, there is no description of the site boundaries, and no information on fuel deliveries or stone quarries.

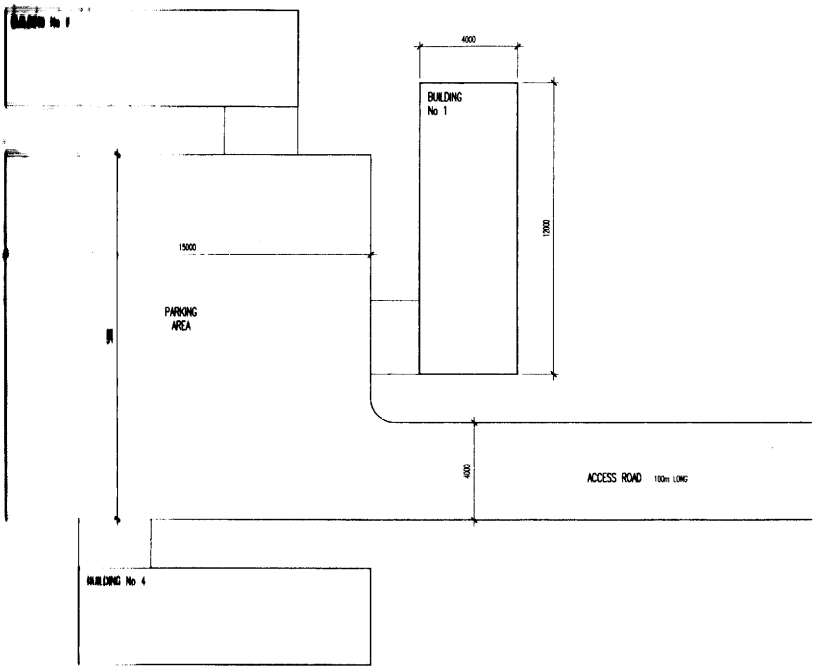
BUT REMEMBER!

Everyone has to learn. Giving your employees tasks like this will enable them to gain skills that will make them more valuable to you in the future, and will also encourage them to be more loyal

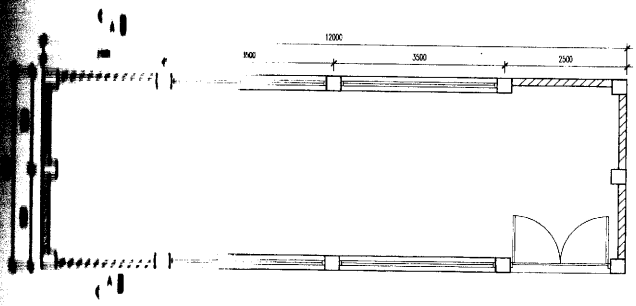
to the business. The point to remember is that learning tasks should be tasks where failure would not be a disaster. If there had been a tight deadline for this job, you would have had to do it yourself or make sure it was done right first time.

...vers to business practice - 3

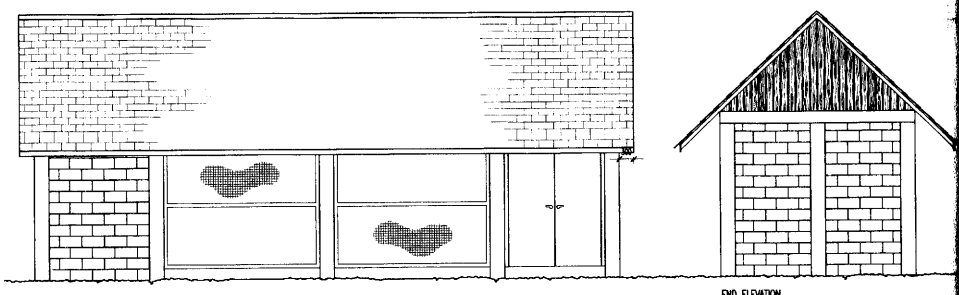
1. DRAWINGS



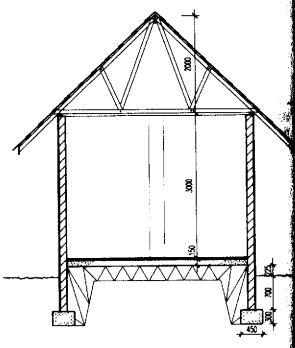
...layout



...Plan of standard building unit



END ELEVATION



SECTION A–A

C. *Front elevation*

wers to business practice - 4

1. Fill in the gaps:

1. (a) materials (b) equipment
2. (a) suitable (b) builder (c) customer (d) writing
   (e) materials (f) goods (g) unsuitable
3. (a) variations (b) work
4. (a) variations (b) added (c) deducted (d) price
5. (a) defects (b) completion (c) builder (d) expense
   (e) writing (f) defects (g) builder (h) period

2. Looking for trouble:

1. The contractor will have possession of the site when the client is ready. The "fixed time" is not specified and the introduction of "in principle" within the brackets qualifies and reduces the value to the contractor of the term "will not be unreasonably withheld". It will be very difficult to prepare a plan for this project, so you will not be able to schedule your labour and equipment resources or pre-order materials.

2. This puts all the power of deciding when you will be paid into the hands of the client. It could be a delaying tactic–payment could be delayed by as much as 90 days after submission of the certificate.

3. If the client provides materials or fittings of poor quality, the contractor will find it difficult to refuse to fix them by proving "reasonable cause". The problem is that the contractor takes overall responsibility for the works, and may be liable for damages from a subsequent failure.

4. If this clause and No. 3 appear in the same contract, the contractor is really in trouble. It is very dangerous to accept unlimited liability for failure when you have only limited control over the decisions and actions that could lead to that failure.

5. 20 per cent is a very high retention rate. As in No. 2, this clause puts all the power of deciding when you will be paid

into the hands of the client. The inclusion of this clause suggests that the client may be a poor payer, and you may not see that 20 per cent of your contract sum for two years or more.

wers to business practice - 5

1. LIST THE QUANTITIES

The following calculations explain how we calculated the figures shown in table 3, Handbook 1.

Item 1: Clear site

No quantity calculated

Item 2: Excavate top soil

Unit: square metre (m^2)

Buildings: 3 buildings each 5 x 10 m

$3 \times 5 \times 10 = 150\ m^2$

Parking area: $10 \times 10 = 100\ m^2$

Paths: $24 \times 2 = 48\ m^2$

Altogether: $150 + 100 + 48 = 298\ m^2$, say $300\ m^2$

Item 3: Excavate foundations

The quantities for this item are calculated in detail in Handbook 1, Chapter 5

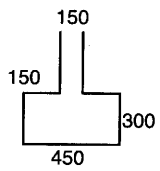
Item 4: Supply and fix steel to foundations

These quantities are calculated in detail in Handbook 1, Chapter 5

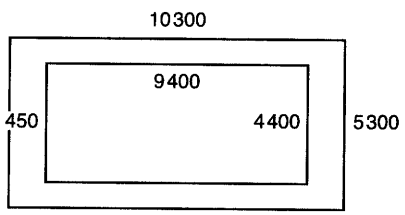
Item 5: Fix formwork to foundations

Sketches showing dimensions in millimetres (not to scale):

Section foundation



One building



Unit: square metre (m^2)

Outside: $10.3 \times 2 = 20.6$ m

$5.3 \times 2 = 10.6$ m

Inside: 9.4 x 2 = 18.8 m
4.4 x 2 = 8.8 m

Altogether: 20.6 + 10.6 + 18.8 + 8.8 = 58.8 m

Foundation is 300 mm high: 58.8 x 0.3 = 17.6 m^2, say 18 m^2

3 houses: 3 x 18 = 54 m^2

Item 6: Pour concrete to foundations

Same dimensions as for formwork, item 5

Unit: cubic metre (m^3)

10.3 x 0.45 x 0.3 x 2 = 2.78 m^3

4.4 x 0.45 x 0.3 x 2 = 1.19 m^3

Altogether: 2.78 + 1.19 = 3.97 m^3, say 4.0 m^3

3 houses: 3 x 4.0 = 12.0 m^3

Item 7: Supply and fix steel to columns

See project drawings supplied at end of Handbook 1.

Unit: linear metre (m)

Height of columns: 3 000 + 1 000 – 300 = 3 700 mm

A. 12 mm bars:

Length of 12 mm bars from foundation to ring-beam:
3 700 – 50 (cover) = 3 650 mm

3.65 x 4 x 12 = 175 m

Add 500 mm lap for each bar: 4 x 12 x 0.5 = 24 m

L-bars at the top column/ringbeam: 4 x 4 x 2.0 m = 32 m

Altogether 12 mm bars: 175 + 24 + 32 = 231 m

B. 8 mm bars:

Height of columns: 3 700 – 300 (ring-beam) = 3 400 mm

Stirrups in columns 500 mm centres: 3 400 / 500 = 6.8
i.e. we need 7 stirrups per column

each stirrup: 200 x 4 + 100 = 900 mm

0.9 m x 7 x 12 = 76 m

3 houses: 12 mm bars: 231 x 3 = 693 m
8 mm bars: 76 x 3 = 228 m

Item 8: Fix formwork to columns

Dimensions as under Item 7

Unit: square metre (m^2)

Height of columns: 3 400 mm

3.4 x 0.3 x 4 x 12 = 49 m^2

3 houses: 49 x 3 = 147 m^2

Item 9: Pour concrete to columns

Dimensions as under Item 7

Unit: cubic metre (m^3)

3.4 m x 0.3 m x 0.3 m x 12 = 3.67 m^3, say 3.7 m^3

3 houses: 3.7 x 3 = 11.1 m^3

Item 10: Concrete block walls up to floor

Dimensions, see project drawings supplied at end of Handbook 1.

Unit: square metre (m^2)

Height of wall: 1 000 + 225 + 150 – 300 = 1 075 mm

House is 10 000 x 5 000 mm

10 x 1.075 x 2 = 21.5 m^2

5 000 – 150 – 150 = 4 700 mm

4.7 x 1.075 x 2 = 10.1 m^2

Altogether: 21.5 + 10.1 = 31.6 m^2, say 32 m^2

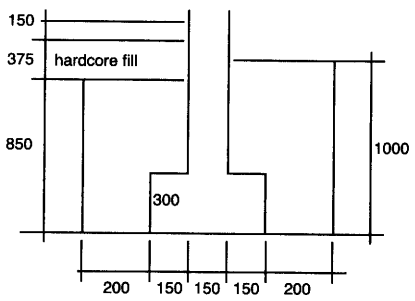
3 houses: 32 x 3 = 96 m^2

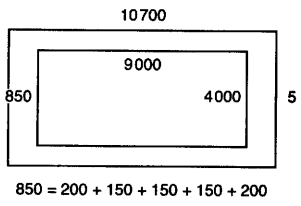
Item 11: Return fill and ram excavated material around foundations

Sketches showing dimensions (not to scale):

Section foundation wall and floor

One building





Unit: cubic metre (m^3)

Outside wall:

10.7 m x 0.2 m x 1.0 m x 2 = 4.28 m^3

5.3 m x 0.2 m x 1.0 m x 2 = 2.12 m^3

10.3 m x 0.15 m x 0.7 m x 2 = 2.16 m^3

5.0 m x 0.15 m x 0.7 m x 2 = 1.05 m^3

Inside wall:

9.7 m x 0.15 m x 0.55 m x 2 = 1.60 m^3

4.4 m x 0.15 m x 0.55 m x 2 = 0.73 m^3

9.4 m x 0.2 m x 0.85 m x 2 = 3.20 m^3

4.0 m x 0.2 m x 0.85 m x 2 = 1.36 m^3

Altogether: 4.28 + 2.12 + 2.16 + 1.05 + 1.60 + 0.73 + 3.20 + 1.36 = 16.5 m^3, say 17 m^3 per house

3 houses: 17 x 3 = 51 m^3

Item 12: Hardcore fill

Unit: cubic metre (m^3)

Length between insides of wall: 9 700 mm

Width between insides of wall: 4 700 mm

9.7 x 4.7 x 0.375 = 17.1 m^3

3 houses: 17.1 x 3 = 51.3 m^3, say 52 m^3

Item 13: Mesh to floor

Unit: square metre (m^2)

Dimensions as in Item 12

9.7 x 4.7 = 45.6 m2

Add 10 % for laps: 1.1 x 45.6 = 50.2 m^2, say 51 m^2

3 houses: 51 x 3 = 153 m^2

Item 14: Concrete to floor

Unit: cubic metre (m^3)

Dimensions as in Item 12

9.7 x 4.7 x 0.15 = 6.8 m^3

3 houses: 6.8 x 3 = 20.4 m^3

Item 15: Concrete block walls above floor

Unit: square metre (m^2)

Height: 3 000 – 300 – 225 – 150 = 2 325 mm

Width between columns: 2 500 – 300 – 150 = 2 050 mm

2.325 x 2.050 x 7 = 33.4 m^2, say 34 m^2

3 houses: 34 x 3 = 102 m^2

Item 16: Soffit forms to ring-beam over openings

Unit: square metre (m^2)

Dimensions as in Item 15

2.05 x 0.30 x 5 = 3 m^2

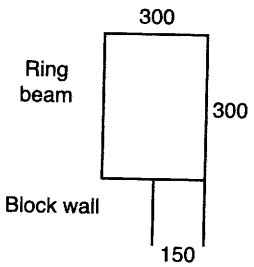
3 houses: 3 x 3 = 9 m^2

Item 17: Soffit forms to ring-beam over infill panels

Unit: square metre (m^2)

Dimensions as in Item 15

Sketch showing dimensions:



2.05 x 0.15 x 7 = 2.2 m^2

3 houses: 2.2 x 3 = 6.6 m^2, say 7 m^2

Item 18: Sideforms to ring-beam

Unit: square metre (m^2)

Outside:

10 m x 0.3 m x 2 = 6.0 m^2

5 m x 0.3 m x 2 = 3.0 m^2

Inside:

9.4 m x 0.3 m x 2 = 5.6 m^2

4.4 m x 0.3 m x 2 = 2.7 m^2

Altogether: 6.0 + 3.0 + 5.6 + 2.7 = 17.3 m^2, say 18 m^2

3 houses: 18 x 3 = 54 m^2

Item 19: Supply and fix steel to ring beam

Unit: linear metre (m)

Dimensions, see project drawings supplied at end of Handbook 1.

A. 12 mm bars

10 000 – 50 (cover) – 50 (cover) = 9 900 mm

9.9 x 4 x 2 = 79.2 m, say 80 m

4.9 x 4 x 2 = 39.2 m, say 40 m

Altogether: 80 + 40 = 120 m

Add 20 % for laps: 1.2 x 120 = 144 m

B. 8 mm bars

Stirrups: length as for columns 900 mm

10 m sides: 10 000 – 300 – 300 = 9 400 mm

Number of stirrups: 9 400 / 500 = 18.8; 20 x 2 = 40

5 m sides: 4 400 / 500 = 8.8; 10 x 2 = 20

Altogether: (40 + 20) x 0.9 m = 54 m

3 houses: 12 mm bars 144 x 3 = 432 m

8 mm bars 54 x 3 = 162 m

Item 20: Pour concrete to ring beam

Unit: cubic metre (m^3)

10.0 x 0.3 x 0.3 x 2 = 1.80 m^3

4.4 x 0.3 x 0.3 x 2 = 0.79 m^3

Altogether: 1.80 + 0.79 = 2.59 m^3, say 2.6 m^3

3 houses: 2.6 x 3 = 7.8 m^3

Items 21 and 22: Fabricate and fix roof trusses

Unit: Number (No.)

Trusses at 1 m centres: 10 000 / 1 000 = 10,
i.e., 11 per house

3 houses: 11 x 3 = 33

Item 23: Roof tile battens

Unit: linear metre (m)

Length of each: 10 000 + 300 + 300 = 10 600 mm

According to drawing, 10 on each side makes 20 per

house: 10.6 x 20 = 212 m

3 houses: 3 x 212 = 636 m

Item 24: Tile roof

Unit: square metre (m^2)

Area of roof: 3.70 m x 10.60 m x 2 = 78.5 m^2

Add 100 mm on each side for ridges. 0.2 m x 10.6 m = 2.12 m^2

Altogether: 78.5 + 2.12 = 80.6 m^2, say 81 m^2

3 houses: 81 x 3 = 243 m^2

Item 25: Timber to gable end

Unit: square metre (m^2)

Area each house: 1.175 m x 5.0 m x 0.5 (triangle) x 2 (two ends) = 5.9 m^2, say 6 m^2

3 houses: 6 x 3 = 18 m^2

Item 26: Form eaves

Unit: linear metre (m)

Horizontal: 10.6 x 2 = 21.2 m

Gable ends: 3.7 x 2 x 2 = 14.8 m

Altogether: 21.2 + 14.8 = 36 m

3 houses: 36 x 3 = 108 m

Item 27: Supply and fix ceiling boards

Unit: square metre (m^2)

Area: 9.4 x 4.4 = 41.4 m^2, say 42 m^2

3 houses: 42 x 3 = 126 m^2

Item 28: Prefabricated window panels

Unit: number (No.)

See drawings, 4 windows per house

3 houses: 4 x 3 = 12

Item 29: Prefabricated door panels

Unit: number (No.)

1 door per house and 3 houses: 3

Item 30: Terrazzo floor

Unit: square metre (m^2)

Area: 9.4 x 4.4 = 41.4 m^2

Add area between columns: 2.05 x 0.15 x 7 (no panels) = 2.15 m^2

Altogether: 41.4 + 2.2 = 43.6 m^2, say 44 m^2

3 houses: 44 x 3 = 132 m^2

Item 31: Bagwash walls and columns

Unit: square metre (m^2)

Dimensions, see drawings:

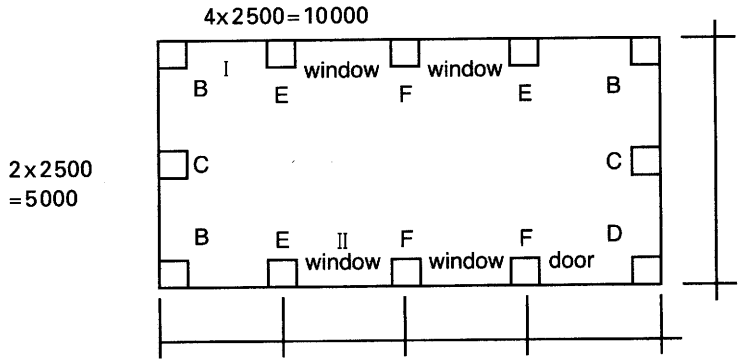
Height: 3 000 – 225 – 150 – 300 = 2 325 mm

A. Walls:

Between columns: 2.05 x 2.325 x 7 = 33.37 m^2

B. Columns:

Sketch of one house showing columns (not in scale):



Columns type B (corner, 3 No.): 0.3 m x 2.325 m x 3 = 2.09 m^2

Columns type C (2 No.): 0.6 m x 2.325 m x 2 = 2.79 m^2

Column type D (1 No.): 0.15 m x 2.325 m = 0.35 m^2

Columns type E (3 No.): 0.45 m x 2.325 m x 3 = 3.14 m^2

Columns type F (3 No.): 0.3 m x 2.325 m x 3 = 2.09 m^2

C. Ring beam:

Bottom of ring beam

Type I (8 No.): 2.05 m x 0.15 m x 8 = 2.46 m^2

Type II (4 No.): 2.20 m x 0.15 m x 4 = 1.32 m^2

Altogether: 33.37 + 2.09 + 2.79 + 0.35 + 3.14 + 2.09 + 2.46 + 1.32 = 47.61 m^2, say 48 m^2

3 houses: 48 x 3 = 144 m^2

Item 32: Paint walls and ceiling

Unit: square metre (m^2)

Area equals area of ceiling boards + area bagwashed: 126 + 144 = 270 m^2

Item 33: External paths and parking

Unit: square metre (m^2)

Dimensions same as under Item 2.

100 + 46 = 146 m^2

Item 34: Spread topsoil to landscape site

Unit: square metre (m^2)

Measure on project drawings supplied at end of Handbook 1.

Total area:
(10 m x 41.5 m) + (10 m x 5 m x 0.5) + (10 m x 3.6 m x 0.5) + (41.5 m x 6.2m x 0.5) = 587 m^2

Area of houses + path + parking: 296 m^2

587 – 296 = 291 m^2, say 300 m^2

Item 35: Perimeter fence

Unit: linear metre (m)

Measure on project drawings supplied at end of Handbook 1.

50 + 11 + 37 + 17 = 115 m

Item 36: Dispose of surplus material off site

Unit: cubic metre (m^3)

Volume excavated for foundations minus return fill: 75 m^3 – 50 m^3 = 25 m^3

Excavate top soil: assume approximately 200 mm thick: 0.2 x 300 = 60 m^3

Appreciate approximately 20 m^3 used for landscaping.

25 + 60 – 20 = 65 m^3

2. A STORAGE SHED

List of quantities

Item No.	Description	Unit	Quantity
1.	Strip topsoil average depth 0.25 m and store on site	m^2	8 000
2.	Excavate sewer trench 0.5 m wide average 1 m depth to take 0.15 m diameter sewer	m	100
3.	Lay, bed and haunch 0.15 m diameter sewer	m	100
4.	Return, fill and ram material excavated under Item 2 above	m^3	50
5.	Reinforced concrete footing	m^3	125
6.	Reinforced blockwork walls (less door)	m^2	808
7.	Supply and fix standard roller shutter door in accordance with specification, complete with frame	No.	1
8.	Supply and fix prefabricated steel roof trusses in accordance with specification	No.	41
9.	Supply and fix corrugated steel sheet roof with 1 m overhang all round walls, including ridge, gutters, downpipes and side flashing	m^2	941
10.	Clean up site on completion and cart all rubbish to tip	Item	

Notes:

Item 2 : 50 m^3 is an equally good answer (can be measured linearly or by volume since cross section of trench is constant).

Item 5 : No formwork but assume 100 mm extra on each side to prevent sides of trench from falling in.

Length	= 40.0 + 0.1 + 0.3 + 0.1 + 0.3 = 40.8 m
Width of footing	= 0.25 + 0.30 + 0.30 + 0.1 + 0.1 = 0.85 m
Depth of footing	= 1 metre
40.8m x 1.05m x 1m x 2No.	= 85.7 m^3
Width	= 20.8 – 1.05 – 1.05 = 18.7 m
18.7m x 1.05m x 1m x 2No.	= 39.3 m^3
So volume = 85.7 + 39.3	= 125 m^3

Item 6 :

Height of wall to eaves	= 6.0 + 0.5 (below ground level) = 6.5 m
Total length of walls	= (40 + 20) x 2 = 120 m
Gross wall area to eaves	= 120 x 6.5 =780 m^2
Eaves to ridge	= 20 x 2 x 1/2 x 2 = 40 m^2

So gross area is 820 m^2
Now deduct door opening 3 x 4 = 12 m^2, so net area = 808 m^2

Item 9 : First calculate the length of the sloping face, which is the hypotenuse of a triangle with sides 10 m x 2 m plus 1 m overhang. The square root of 10 squared plus 2 squared (104) is 10.2 m, so the length of the sloping face is 11.2 m. The length of the building is 40 m and the roof overhangs 1 m at each end, so the length of the roof is 42 m.

Thus the surface area of the roof is 11.2 x 42 x 2 = 941 m^2.

Answers to business practice - 6

1. THE DIRECT PROJECT COSTS CHART

DIRECT PROJECT COSTS CHART								
List of quantities taken off drawings				Direct project costs (NU)				
Item No.	Description	Unit	Quantity	Labour	Plant	Materials	Transport	Total
1.	Clear site	–	–	20	–	–	10	30
2.	Excavate top soil	m^2	300	125				125
3.	Excavate foundations	m^3	75	375				375
4.	Steel to foundations 12 mm	m	900	234		622	7	863
	8 mm		216					
5.	Formwork to foundations	m^2	54	156		118	10	284
6.	Concrete to foundations	m^3	12.0	84	24	309	60	477
7.	Steel to columns 12 mm	m	693	312		495	7	814
	8 mm		228					
8.	Formwork to columns	m^2	147	312		245	15	572
9.	Pour concrete to columns	m^3	11.1	336	96	284	54	770
10.	Concrete block walls up to floor	m^2	96	279		1 196	90	1 565
11.	Return fill and ram excavated mtl. around found.	m^3	51	117				117
12.	Hardcore fill	m^3	51	252	72	372	31	727
13.	Mesh to floor	m^2	153	156		324	4	484
14.	Concrete to floor	m^3	20.4	504	144	524	92	1 264
15.	Concrete block walls above floor	m^2	102	279		1 280	99	1 658
16.	Soffit forms to ring beam over openings	m^2	9	78		15	2	95
17.	Soffit forms over infill panels	m^2	7	78		12	2	92
18.	Sideforms to ring beam	m^2	54	234		90	5	329
19.	Supply and fix steel 12 mm	m	432	234		315	7	556
	to ring beam 8 mm		162					
20.	Pour concrete to ring beam	m^3	7.8	336	96	201	36	669
21.	Fabricate roof trusses	No.	33	312		733	20	1 065
22.	Fix roof trusses	No.	33	156		51	3	210
				Total forward (points 1-22)				13 141

DIRECT PROJECT COSTS CHART								
List of quantities taken off drawings				Direct project costs (NU)				
Item No.	Description	Unit	Quantity	Labour	Plant	Materials	Transport	Total
23.	Roof tile battens	m	636	39		140	5	184
24.	Tile roof (incl. ridge)	m^2	243	207		2 881	50	3 138
25.	Timber to gable end	m^2	18	78		132	5	215
26.	Form eaves Horizontal and gable ends	m	108	78		146	2	226
27.	Supply and fix ceiling boards	m^2	126	54		555	15	624
28.	Prefabricated window panels	No.	12	08		900		1 008
29.	Prefabricated door panels	No	3	54		300		354
30.	Terrazzo floor	m^2	132	108	30	300	4	442
31.	Plaster walls and columns and ringbeam	m^2	144	156		75	18	249
32.	Paint walls and ceilings	m^2	270	126		405	15	546
33.	External paths and parking	m^2	146	115	40	340	79	574
34.	Spread topsoil to landscape site	m^2	300	60				60
35.	Perimeter fence	m	115	92		316	10	418
36.	Dispose of surplus material off site	m^3	65	80			49	129
				Final total of direct project costs				21 308

The following calculations show how the figures in the Direct Project Costs Chart above were calculated.

Item 1: Clear site

Labour: Assume it will take 4 labourers 1 day
4 x 5 NU/day = 20 NU

Plant: Only hand tools needed => 0

Material: –

Transport: Assume one load has to be sent away. Altogether 2 hours
Truck + driver 5 NU/hour => 2 x 5 = 10 NU

Item 2: Excavate top soil

Labour: Rate from previous projects: 1.5 m^2/h
300 / 1.5 = 200 h
200 h / 8 (h/day) = 25 days
25 days => 25 x 5 = 125 NU

Transport: Top soil stored on site
Transport, see separate item No. 36

Item 3: Excavate foundations

Labour: Rate from previous experience 1 m^3/day per worker
5 NU/day x 75 days = 375 NU

Transport: See separate item No. 36

Item 4: Steel to foundations

Labour: 1 house
Two skilled for 3.0 days $2 \times 3.0 \times 8 = 48$ NU
Two unskilled for 3.0 days $2 \times 3.0 \times 5 = 30$ NU
48 + 30 = 78 NU
3 houses: 78 NU x 3 = 234 NU

Material:

12 mm	*8 mm*
0.89 kg/m	0.4 kg/m

900 m x 0.89 = 801 kg
216 m x 0.40 = 87 kg
801 + 87 = 888 kg
Steel = 700 NU/tonne
0.888 x 700 = 622 NU

Transport: Assume a 3-tonne truck is needed for 4 hours to transport all reinforcement to the site.
About a third of all reinforcement under Item 4.
1/3 of a 3-tonne truck for 4 hours
4 x 5 NU/hour x 1/3 = 7 NU

Item 5: Formwork to foundations
One house = 18 m^2

Labour: Two qualified + two labourers for 2 days
2 No. x 2 days x 5 NU/day = 20 NU
2 No. x 2 days x 8 NU/day = 32 NU
20 + 32 = 52 NU
3 houses: 3 x 52 = 156 NU

Material: Timber 1" x 4": foundations 300 mm height
=> need 3 widths on each side.
Per house:
Length outside of foundations: (10.3 x 2) + (5.3 x 2) = 31.2 m
Length inside of foundations: (9.4 x 2) + (4.4 x 2) = 27.6 m
31.2 + 27.6 = 58.8 m, add 10 % for wastage
3 widths x 58.8 m x 1.1 (wastage) x 0.5 NU/m = 97 NU
Pegs – outside: 11 x 2 + 6 x 2 = 34 No.
– inside: 10 x 2 + 5 x 2 = 30 No.

34 + 30 = 64 No.
Assume each peg 0.50 m long: 64 x 0.5 m = 32 m
32 m x 0.5 NU/m = 16 NU
Nails: 5 NU
Altogether: 97 + 16 + 5 = 118 NU
3 houses, but timber can be used 3 times => 3 x 118 x 1/3 = 118 NU

Transport: 10 NU

Item 6: Concrete to foundations

Calculations in Handbook 1, Chapter 6

Item 7: Steel to columns

Labour: Per house:
Two skilled 4 days: 2 x 4 x 8 = 64 NU
Two unskilled 4 days: 2 x 4 x 5 = 40 NU
64 + 40 = 104 NU
3 houses: 104 x 3 = 312 NU

Material:

12 mm	*8 mm*
0.89 kg/m	0.40 kg/m

616 + 91 = 707 kg ; 700 NU/tonne
0.707 X 700 = 495 NU

Transport: 1/3 of a 3-tonne truck for 4 hours (incl. off-loading)
4 h x 5 NU/hour x 1/3 = 7 NU

Item 8: Formwork to columns

Labour: One house: 49 m^2
Assume it takes 2 qualified + 2 labourers 4 days
2 x 4 x 8 = 64 NU
2 x 4 x 5 = 40 NU
64 + 40 = 104 NU
3 houses: 104 x 3 = 312 NU

Material: Timber 1" x 4" is 0.5 NU/metre.
4" wide means we need 10 widths to cover a metre, i.e.
0.5 NU/m => 5 NU/m^2
147 m^2 and 5 NU/m^2 => 147 x 5 = 735 NU
Assume we can use timber 3 times => 245 NU

Transport: A truck for 3 hours
3 x 5 (NU/hour) = 15 NU

Item 9: Concrete to columns

Labour: This will take 2 days per house

Mixing 2 labourers
1 mixer operator
Placing 4 labourers – barrow
2 labourers – place
1 vibrator operator

8 x 2 x 5 = 80 NU
2 x 2 x 8 = 32 NU
80 + 32 = 112 NU
3 houses: 3 x 112 = 336 NU

Plant: Mixer: 2 x 10 = 20 NU
Vibrator: 2 x 2 = 4 NU
Bowser: 2 x 4 = 8 NU
20 + 4 + 8 = 32 NU
3 houses: 32 x 3 = 96 NU

Material: See Item 6 in Handbook 1, Chapter 6
11.1 x 1.1 = 12.2 m^3

308 x 12.2 =	3 758 kg	=> 187 NU
685 x 12.2 =	8 357 kg	=> 42 NU
1 132 x 12.2 =	13 879 kg	=> 55 NU
		284 NU

Transport: Cement : 19 NU
Sand : 17 NU
Stone : 14 NU
Water : 2 NU
Off-loading : 2 NU
Altogether: 19 + 17 + 14 + 2 + 2 = 54 NU

Item 10: Concrete block walls up to floor

Labour: Rate from previous contracts (skilled: 0.19 work days/m^2) =>
18 work days = 6 days per house
Assume two masons for 3 days per house
2 x 8 x 3 = 48 NU
3 unskilled for 3 days
(1 mixing, 2 transport)
3 x 5 x 3 = 45 NU
Altogether: 48 + 45 = 93 NU
3 houses: 93 x 3 = 279 NU

Material: *Blocks* – Size 250 X 250 X 200 mm
Joints 20 wide
(0.250 + 0.020) x (0.250 + 0.020) = 0.072 m^2

96 m^2 / 0.072 m^2 = 1 333 blocks
Add 5 per cent for waste => 1.05 x 1 333 = 1 399
say 1 400
1 400 x 0.8 NU/block = 1 120 NU

Mortar– Volume per block
(0.25 + 0.25) x 0.2 x 0.02 = 0.002 m^3
1 400 x 0.002 = 2.8 m^3; add 10 per cent wastage
=> 3.08 m^3
=> 3.1 m^3 (mortar/m^2 wall 0.032/m^3/m^2 wall)
Assume 1:5 cement: mortar is required
One m^3 of mortar contains
Cement: 1/5 m^3 Sand 1 m^3 (1 m^3 of cement weighs 1 400 kg and 1 m^3 of sand 1 600 kg)
Cement: 1/5 x 1 400 x 3.1 = 870 kg;
add wastage 10 per cent => 957 kg, say 960 kg
960 x 5.0 NU/100 kg = 48 NU
Sand: 1 600 x 3.1 = 4 960 kg, add wastage 10 per cent
=> 5 456 kg, say 5 460 kg
5 460 x 5.0 NU/1 000 kg = 28 NU
Altogether, Mortar: 48 + 28 = 76 NU
Material: 1 120 + 76 = 1 196 NU

Transport: 960 kg cement: 960 for 5 km at 1NU/1 000 kg/km : 5 NU
5 460 kg sand: 5 460 for 20 km at 1/NU/10 000 kg/km: 11 NU
Water say : 1 NU
Off-loading cement say : 1 NU
18 NU

(Compare Item 15. Concrete blocks above floor;
102 m^2 => 1 417; wastage => 1 489 say 1 500;
1 500 + 1 400 = 2 900 No.)
The company we are buying the blocks from offer to transport and unload them at the site for 150 NU
1 400/2 900 x 150 = 72.4 => 72 NU
Transport: 72 + 18 = 90 NU

Item 11: Return fill and ram excavated material around foundation
One house = 17 m^3

Labour: Assume 1 skilled and 1 unskilled for 3 days
1 x 3 x 8 = 24 NU
1 x 3 x 5 = 15 NU
Altogether: 24 + 15 = 39 NU
3 houses: 39 x 3 = 117 NU

Item 12: Hardcore fill

One house = 17 m^3

Labour: Assume 1 skilled and 4 unskilled for 3 days
1 x 3 x 8 = 24 NU
4 x 3 x 5 = 60 NU
Altogether: 24 + 60 = 84 NU
3 houses: 3 x 84 = 252 NU

Plant: Pedestrian roller for 3 days
Rate: 8 NU/day x 3 days x 3 houses = 72 NU

Material: 17 m^3 x 1.10 (waste) = 18.7 m^3
Weight of hardcore 1650 kg/m^3
18.7 x 1 650 kg = 30.9 tonnes
4 NU/1 000 kg => 124 NU x 3 = 372 NU

Transport: Distance is 10 km
Rate 1 NU/10 000 kg/km
30 900 kg/10 000 kg = 3.09
3.09 x 10 x 1 = 31 NU

Item 13: Mesh to floor

One house 51 m^2

Labour: 2 skilled and 2 unskilled for 2 days
2 x 2 x 8 = 32
2 x 2 x 5 = 20
Altogether: 52 NU
3 houses: 3 x 52 = 156 NU

Material: Assume 8 mm c 300
Number of bars: 9 700 mm/300 mm = 33 => No. of bars 34
4 700 mm/300 mm = 16 => 17 bars
Total length
(34 x 4.7 m) + (17 x 9.7 m) = 325 m
Add 10 per cent for waste
325 x 1.1 = 358 m
Weight: 0.4 kg/m x 358 m = 143 kg = 0.143 tonne
0.143 x 700 NU/tonne = 100 NU
Add: binding wire 8 NU => 108 NU
3 houses: 3 x 108 = 324 NU

Transport: 1/5 of a 3-tonne truck for 4 hours => 1/5 x 4 x 5 = 4 NU

Item 14: Concrete to floor

One house 6.8 m^3

Compare with calculations done under Item 6 in Handbook 1, Chapter 6.

Labour: 3 days per house

Mixing	2 labourers	2 x 3 x 5 = 30 NU
	1 mixer operator	1 x 3 x 8 = 24 NU
Placing	6 labourers	6 x 3 x 5 = 90 NU
1 vibrator operator		1 x 3 x 8 = 24 NU

Altogether: 30 + 24 + 90 + 24 = 168 NU
3 houses: 3 x 168 = 504 NU

Plant:
Mixer: 3 x 10 = 30 NU
Vibrator: 3 x 2 = 6 NU
Bowser: 3 x 4 = 12 NU
Altogether: 30 + 6 + 12 = 48 NU
3 houses: 3 x 48 = 144 NU

Material: All 3 houses
Wastage: 20.4 x 1.1 = 22.4 m3
Cement: 308 kg/m^3 x 22.4 m^3 = 6 899 kg
Sand: 685 kg/m^3 x 22.4 m^3 = 15 344 kg
Aggregate: 1 132 kg7 m^3 x 22.4 m^3 = 25 357 kg
Cement: 6 899 kg x 5 NU/100 kg = 345 NU
Sand: 15 344 kg x 5 NU/1 000 kg = 77 NU
Aggregate: 25 357 kg x 4 NU/1 000 kg = 102 NU
Altogether: 345 + 77 + 102 = 524 NU

Transport:
Cement: 6.899 x 5 km = 35 NU
Sand: 1.5344 x 20 km = 31 NU
Aggregate: 2.5357 x 10 km = 26 NU
Altogether: 35 + 31 + 26 = 92 NU

Item 15: Concrete block walls above floor

34 m^2/house

Labour: 2 masons and 3 unskilled for 3 days
2 x 8 x 3 = 48 NU
3 x 5 x 3 = 45 NU
Altogether: 48 + 45 = 93 NU
3 houses: 3 x 93 = 279 NU

Material: Compare Item 10
102 / 0.072 = 1 417 No.
Add for 5 per cent waste => 1 488 say 1 500 No.
1 500 x 0.8 NU = 1 200 NU
Mortar: 102 x 0.032 m^3/m^2 wall = 3.3 m^3
Assume 1:5 cement mortar
Cement 1/5 x 1 400 x 3.3 = 924 kg
Sand 1 600 x 3.3 = 5 280 kg
Cement: 924 x 1.1 (wastage) x 5 NU/100 kg = 51 NU

Sand: 5 280 x 1.1 (wastage) x 5 NU/1 000 kg = 29 NU
Altogether: 1 200 + 51 + 29 = 1 280 NU

Transport: Compare Item 10
Blocks: (1 500/2 900) x 150 = 78 NU say 80 NU
Mortar:

Cement: 1.017 x 5 km	=	5 NU
Sand: 0.5808 x 20 km	=	12 NU
Water say	=	1 NU
Off-loading say	=	1 NU
		19 NU

Altogether: 80 + 19 = 99 NU

Item 16: Soffit forms to ring beam over openings
One house 3 m^2

Labour: 1 skilled and 1 unskilled for 2 days
2 x 5 x 1 = 10 NU
2 x 8 x 1 = 16 NU
Altogether: 10 + 16 = 26 NU
3 houses: 3 x 26 = 78 NU

Material: See Item 8
3 m^2 x 5 NU/m^2 (see Item 8) x 3 houses = 45 NU
Use timber 3 times => 45/3 = 15 NU

Transport: Say 2 NU

Item 17: Soffit forms to ring beam over infill panels
One house = 2.3 m^2

Labour: 1 skilled and 1 unskilled for 2 days
2 x 5 = 10 NU
2 x 8 = 16 NU
Altogether: 10 + 16 = 26 NU
3 houses: 26 x 3 = 78 NU

Material: Compare Item 16: 2.3 m^2 x 5 NU/m^2 x 3 = 34.5 NU
Use 3 times => 12 NU

Transport: Say 2 NU

Item 18: Sideforms to ringbeam
One house: 18 m^2

Labour: 2 skilled and 2 unskilled for 3 days
2 x 3 x 5 = 30 NU
2 x 3 x 8 = 48 NU
Altogether: 30 + 48 = 78 NU
3 houses: 3 x 78 = 234 NU

Material: See Item 8
$18\ m^2 \times 5\ NU/m^2 \times 3$ houses = 270 NU
Use 3 times => 90 NU

Transport: Say 5 NU

Item 19: Steel to ring beam

Per house

Labour: Two skilled for 3 days $2 \times 3 \times 5 = 30$ NU
Two unskilled for 3 days $2 \times 3 \times 8 = 48$ NU
Altogether: 30 + 48 = 78 NU
3 houses: $3 \times 78 = 234$ NU

Material: Compare Item 4
12 mm: $432 \times 0.89 = 385$ kg
8 mm: $162 \times 0.40 = 65$ kg
385 + 65 = 450 kg
700 NU/tonne => $0.450 \times 700 = 315$ NU

Transport: See Item 4
7 NU

Item 20: Pour concrete to ring beam

One house: 2.6 m^3
Compare with calculations done under Item 6 in Handbook 1, Chapter 6.

Labour: 2 days needed per house
Mixing: 2 labourers and 1 mixer operator
Placing: 6 labourers and 1 vibrator operator
$8 \times 2 \times 5 = 80$ NU
$2 \times 2 \times 8 = 32$ NU
Altogether: 80 + 32 = 112 NU
3 houses: $3 \times 112 = 336$ NU

Plant: Mixer: $2 \times 10 = 20$ NU
Vibrator: $2 \times 2 = 4$ NU
Bowser: $2 \times 4 = 8$ NU
Altogether: 20 + 4 + 8 = 32 NU
3 houses: $3 \times 32 = 96$ NU

Material: Wastage: $7.8 \times 1.1 = 8.6\ m^3$
Cement: $308 \times 8.6 = 2\,649$ kg
Sand: $685 \times 8.6 = 5\,891$ kg
Aggregate: $1\,132 \times 8.6 = 9\,735$ kg
Cement: 2 649 kg x 5 NU/100 kg = 132 NU
Sand: 5 891 kg x 5 NU/1 000 kg = 30 NU
Aggregate: 9 735 kg x 4 NU/1 000 kg = 39 NU
Altogether: 132 + 30 + 39 = 201 NU

Transport: Cement: 2.6490 x 5 = 14 NU
Sand: 0.5891 x 20 = 12 NU
Aggregate: 0.9735 x 10 = 10 NU
Altogether: 14 + 12 + 10 = 36 NU

Item 21: Fabricate roof trusses

11 per house

Labour: Assume 2 carpenters and 2 labourers for 4 days
2 x 4 x 8 = 64 NU
2 x 4 x 5 = 40 NU
Altogether: 64 + 40 = 104 NU
3 houses: 3 x 104 = 312 NU

Material: See drawings at back of Handbook 1

	1 truss	*1 house (11 trusses)*	*3 houses*	*incl. wastage 10 per cent*
A-D 1.5" x 4" (2.75) x 2	11.00	121.0	363 m	400 m
F-C 2" x 4" (3.70)	7.40	81.4)		
C-E 2" x 4" (1.40)	2.80	30.8)	386 m	425 m
B-E 2" x 4" (0.75)	1.50	16.5)		
1.5" x 8" at joint C	1.0	11.0	33 m	37 m

Timber 1.5" x 4" – 0.7 NU/m 400 x 0.7 = 280 NU
2" x 4" – 0.9 NU/m 425 x 0.9 = 382 NU
1.5" x 8" – 1.5 NU/m 37 x 1.5 = 56 NU
Nails: = 15 NU
Altogether: 280 + 382 + 56 + 15 = 733 NU

Transport: 20 NU

Item 22: Fix roof trusses

11 per house

Labour: Assume 2 carpenters and 2 labourers for 2 days
2 x 2 x 5 = 20 NU
2 x 2 x 8 = 32 NU
Altogether: 20 + 32 = 52 NU
3 houses: 3 x 52 = 156 NU

Material: See drawings at the back of Handbook 1
Timber 1.5" x 4": 2 x 10 m = 20 m
0.7 NU/m x 20 x 1.1 (wastage) x 3 houses = 46 NU
Nails: 5 NU
Altogether: 46 + 5 = 51 NU

Transport: 3 NU

Item 23: Roof tile battens

One house 212 m

Labour: 1 carpenter and 1 unskilled for 1 day
1 x 1 x 8 = 8 NU
1 x 1 x 5 = 5 NU
Altogether: 8 + 5 = 13 NU
3 houses: 3 x 13 = 39 NU

Material: Timber 1" x 1" : 3 x 212 m = 636 m
636 m x 1.1 (wastage) x 0.2 NU/m = 140 NU

Transport: 5 NU

Item 24: Tile roof

81 m^2 per house

Labour: 1 skilled and 3 unskilled for 3 days
1 x 3 x 8 = 24 NU
3 x 3 x 5 = 45 NU
Altogether: 24 + 45 = 69 NU
3 houses: 3 x 69 = 207 NU

Material: Tiles: Width 10.6 m => 10 600/200 (every tile covers 200) = 53 tiles
Length 3 800 m => 3 800/400 = 9.5 => 10 tiles
53 x 10 x 2 sides = 1 060 tiles/roof
1 060 tiles/roof x 1.05 (wastage) x 3 houses =
= 3 339 tiles
0.8 NU/tiles => 3 339 x 0.8 NU/tile = 2 671 NU

Ridges: 10.6 m x 3 houses x 1.1 (wastage) = 35.0 m
6 NU/m => 6 x 35.0 m = 210 NU

Altogether: 2 671 + 210 = 2 881 NU

Transport: The supplier delivers the tiles on site for an extra 50 NU

Item 25: Timber to gable end

6 m^2 per house

Labour: 1 carpenter and 1 unskilled for 2 days
1 x 2 x 5 = 10 NU
1 x 2 x 8 = 16 NU
Altogether: 10 + 16 = 26 NU
3 houses: 3 x 26 = 78 NU

Material: See Item 8
Timber 1" x 4": 0.5 NU/m => 5 NU/m^2
6 m^2 x 1.3 (wastage*) x 5 NU/m^2 = 39 NU

* High percentage because of difficult shape with additional wastage

Nails: appreciate 5 NU
Altogether: 39 + 5 = 44 NU
3 houses: 3 x 44 = 132 NU

Transport: Say 5 NU (part of timber transport)

Item 26: Form eaves

One house 36 m

Labour: 1 carpenter and 1 unskilled for 2 days
1 x 2 x 5 = 10 NU
1 x 2 x 8 = 16 NU
Altogether: 10 + 16 = 26 NU
3 houses: 3 x 26 = 78 NU

Material: Timber 1.5" x 6" : 36 m long; cost 1.2 NU/m
36 x 1.1 (wastage) x 1.2 x 3 houses = 143 NU
Nails say 3 NU
Altogether: 143 + 3 = 146 NU

Transport: Say 2 NU

Item 27: Supply and fix ceiling boards

One house 42 m^2

Labour: 1 carpenter and 2 unskilled for 1 day
2 x 1 x 5 = 10 NU
1 x 1 x 8 = 8 NU
Altogether: 10 + 8 = 18 NU
3 houses: 3 x 18 = 54 NU

Material: Woodchip/cement board 4 NU/m^2
42 m^2 x 1.1 (wastage) x 4 NU/m^2 = 185 NU
3 houses: 3 x 185 = 555 NU

Transport: Say 15 NU

Item 28: Prefabricated window panels

One house: 4 panels

Labour: 1 carpenter and 2 unskilled for 2 days
2 x 2 x 5 = 20 NU
1 x 2 x 8 = 16 NU
Altogether: 20 + 16 = 36 NU
3 houses: 3 x 36 = 108 NU

Material: 4 panels : 75 NU/panel
4 x 75 = 300 NU
3 houses: 3 x 300 = 900 NU

Transport: Delivered on site, no charge

Item 29: Prefabricated door panels

One house: 1 door

Labour: 1 carpenter and 2 unskilled for 1 day
2 x 1 x 5 = 10 NU
1 x 1 x 8 = 8 NU
Altogether: 10 + 8 = 18 NU
3 houses: 3 x 18 = 54 NU

Material: 1 panel 100 NU/panel
1 x 100 x 3 houses = 300 NU

Transport: Delivered on site, no charge

Item 30: Terrazzo floor

One house: 44 m^2

Labour: 1 skilled and 2 unskilled for 2 days (incl. sanding)
2 x 2 x 5 = 20 NU
1 x 2 x 8 = 16 NU
Altogether: 20 + 16 = 36 NU
3 houses: 3 x 36 = 108 NU

Plant: Power float. Hire 1 day; Daily rate 10 NU/day
3 houses: 10 NU x 3 houses = 30 NU

Material: Thickness: 20 mm
Volume: 44 m^2 x 0.02 m x 1.1 (wastage) = 0.97 m^3 say 1 m^3
100 NU/m^3 => 100 NU/m^3 x 1 m^3 x 3 houses = 300 NU

Transport: Say 4 NU

Item 31: Bagwash walls, columns and ring beam

One house: 48 m^2

Labour: 1 mason and 1 unskilled for 4 days
1 x 4 x 5 = 20 NU
1 x 4 x 8 = 32 NU
Altogether: 20 + 32 = 52 NU
3 houses: 3 x 52 = 156 NU

Material: Say 20 mm thick
Total volume of plaster: 48 m^2 x 0.02 m = 0.96 m^3 say 1.0 m^3
Compare Item 9 under mortar
Cement: 1/5 x 1 400 kg/m^3 x 1.0 m^3 x 1.1 (wastage) = 308 kg
308 x 5.0 NU/100 kg = 16 NU
Sand: 1 x 1 600 kg/m^3 x 1.0 m^3 x 1.1 wastage = 1 760 kg
1 760 kg x 5.0 NU/1 000 kg = 9 NU

Altogether: 16 + 9 = 25 NU
3 houses: 3 x 25 = 75 NU

Transport: Cement: 308 kg x 3 houses = 924 kg
Rate 1 NU/1,000 kg/km
5 km away => 0.924 x 1 x 5 km = 5 NU
Sand: 1 760 x 3 = 5 280 kg
Rate 1 NU/10 000 kg/km
20 km away => 0.528 x 1 x 20 = 11 NU
Water say 1 NU
Off loading say 1 NU
Altogether: 5 + 11 + 1 + 1 = 18 NU

Item 32: Paint walls and ceilings

One house: 90 m^2

Labour: 2 painters and 1 unskilled for 2 days
2 x 2 x 8 = 32 NU
1 x 2 x 5 = 10 NU
Altogether: 32 + 10 = 42 NU
3 houses: 3 x 42 = 126 NU

Material: Experience from previous projects 1.5 NU/m^2 =>
90 m^2 x 1.5 NU/m^2 x 3 houses = 405 NU

Transport: Say 15 NU

Item 33: External paths and parking

Excavation see Item 2

Labour: Assume 1 skilled plus 3 unskilled for 5 days
1 x 5 x 8 = 40 NU
3 x 5 x 5 = 75 NU
Altogether: 40 + 75 = 115 NU

Plant: Pedestrian roller for 5 days; 8 NU/day
8 x 5 days = 40 NU

Material: A: Parking area 100 m^2
B: Paths 46 m^2
A + B (parking and paths): Assume 10 cm of gravel
Volume: 14.6 x 1.1 (wastage) = 16.1 m^3
1.5 tonne/m^3 => 16.1 x 1.5 = 24 tonnes
5 NU/tonne => 24 x 5 = 120 NU
A: Hardcore for parking: Assume 30 cm thickness
0.3 m x 100 m^2 x 1.1 (wastage) = 33 m^3
1.65 tonne/m^3 => 33 x 1.65 = 55 tonnes
4.0 NU/tonne => 4 x 55 = 220 NU
Altogether: 120 + 220 = 340 NU

Transport: Distance for both gravel and hardcore 10 km
Rate: 1 NU/10 000 kg/km
Gravel: (24 000 kg x 1 NU x 10 km) / 10 000 kg = **24 NU**
Hardcore: 5.5 x 1 NU x 10km = 55 NU
Altogether: 24 + 55 = 79 NU

Item 34: Spread topsoil to landscape site

Area except houses, path and parking area: 300 m^2

Labour: 4 labourers for 3 days
4 x 3 x 5 = 60 NU

Item 35: Perimeter fence

Labour: 1 skilled and 3 unskilled for 4 days
1 x 4 x 8 = 32 NU
3 x 4 x 5 = 60 NU
Altogether: 32 + 60 = 92 NU

Material: See drawing at the back of Handbook 1
wooden stakes + 3 strands of wire
Stakes: Assume 3 m between stakes => 115 / 3 = 38 say 40 stakes
Each stake 2.0 m long: 2 x 40 x 1.1 (wastage) = 88 m
Cost 1.0 NU/m => 88 x 1.0 = 88 NU
Wire: 3 x 115 x 1.1 (wastage) = 379.5, say 380 m
Cost 0.6 NU/m => 0.6 x 380 = 228 NU
Altogether: 88 + 228 = 316 NU

Transport: Say 10 NU

Item 36: Dispose of surplus material off site

Labour: Rate from previous projects: 4 m^3/day =>
65/4 = 16 work days
Assume 4 unskilled for 4 days
4 x 4 x 5 = 80 NU

Transport: Pit is 5 km away
Assume 1 m^3 = 1.5 tonne => 65 x 1.5 = 98 tonnes
3-tonne lorry => 98 / 3 = 33 loads
1.0 NU/10 000 kg/km => 9.8 x 1.0 NU x 5 km = 49 NU

2. A BOUNDARY WALL

DIRECT PROJECT COSTS CHART								
List of quantities taken off drawings				Direct project costs (NU)				
Item No.	Description	Unit	Quantity	Labour	Plant	Materials	Transport	Total
1.	Strip topsoil	m^2	50	64				64
2.	Excavate for footing	m	100	4	50		25	79
3.	Concrete	m^3	15	216	144	526	20	906
4.	Block wall	m^2	300	880		964	10	1 854
5.	Topsoil	m^3	5	80				80
							Final total of direct project costs	2 983

Notes:

Item 1 : 2 x 4 x 8 = 64 hours @ 1 NU/hour.

Item 2 : Labour = 4 hours @ 1 NU/hour.
Backhoe = 5 hours @ 10 NU/hour.
Tipper = 5 hours @ 15 NU/hour.
(Allowing 2 x 1/2 hour travelling time for backhoe and tipper)

Item 3 : Labourers = 24 hours @ 5 x 1 = 120 NU
Operators = 24 hours @ 2 x 2 = 96 NU
Total labour = 216 NU
Mixer + Vibrator = 24 hours @ (4 + 2) = 144 NU
Allow 10 per cent wastage of materials, so calculate for 16.5 m^3.
Cement: 308 x 16.5 = 5 082 kg. 102 bags @ 2 NU = 204 NU
Sand: 685 x 16.5 = 11 303 kg. 11.3 @ 10 NU = 113 NU
Aggreg.: 1 132 x 16.5 = 18 678 kg. 18.7 @ 10 NU = 187 NU
Reinforcement = 2.2 tonnes @ 10 NU = 22 NU

Total materials = 526 NU

Volume of sand = 16.5 x 0.428 = 7.1 m^3
Volume of aggregate = 16.5 x 0.858 = 14.2 m^3
So will need 2 trips for sand + 3 trips for aggregate.
5 trips at 30 minutes.
Total transport Say 1/2 day (4 hours) @ 5 NU = 20 NU

Item 4 : 2 cm joints between blocks, so area taken by typical block plus mortar = 0.52 m. x 0.32 m. = 0.167 sq.m.
Total wall area = 300 m^2, so number of blocks required
$= \frac{300}{0.167} = 1\,796$
Allowing 5 per cent wastage, total number of blocks to be purchased will be 1 900 at a cost of 1 900 x 0.4 NU/block = 760 NU

Cost of mortar: See also calculations under Question 1, Item 10
Volume per block (0.50 + 0.30) x 0.20 x 0.02 = 0.0032 m^3
1 797 x 0.0032 x 1.1 (wastage) = 6.3 m^3
Cement: (1/5) x 1 400 x 6.3 x 1.1 (wastage) = 1 940 kg; 39 bags
39 x 2 = 78 NU
Sand: 1 600 x 6.3 x 1.1 = 11 088 kg; 11.1 x 10 = 111 NU
Mortar: 78 + 111 = 189 NU
Reinforcement: 1.5 x 10 NU = 15 NU
Thus total cost of *materials* = 760 + 189 + 15 = 964 NU
Labour: Blocklayers 80 x 2 x 3 = 480 NU
Labourers 80 x 5 x 1 = 400 NU
Total 880 NU
Transport: volume of sand: 7 m^3
we will need 2 trips: 2 x 5 = 10 NU

Item 5 : 2 x 5 x 8 = 80 NU

3. EXTRA EXCAVATION = EXTRA COST

The extra cost because of the weak silty material will have to be included in your rate. Look at what was said in Handbook 1 on calculating different quantities, QS and Builder's quantities. Your rate must take the extra cost into account.

Answers to business practice - 7

1. DIRECT OR INDIRECT?

Type of cost

Description	Classification		Indirect cost description
	Direct	Indirect	
Hiring a concrete mixer for a specific contract	×		
Allowance for costs arising from delays due to bad weather		×	Risk allowance
Erecting a galvanized water tank on the site for the contractor's own use		×	Services
Buying a concrete mixer which will be used on other sites when the present job is finished		×	Plant and tools
Servicing and fuel for your own mixer (not hired)	×		
Tidying site on completion		×	Site clearance*
Transporting temporary office to site		×	Transport
Erecting temporary office on site		×	Site offices*
Main office rent and running costs		×	Company costs
Hiring site foreman for the job		×	Supervision*
Security fence requested by client	×		
Security fence for contractor's store shed		×	Security
Shoring to 2-m deep sewer trench	×		
Employers' liability insurance		×	Insurance bonds

* These could be direct costs if allowed for in the bill of quantities.

Answers to business practice - 8

1. JUDGE THE QUOTATION

The bid may be accurate, but it has been poorly presented and gives the reader an impression of carelessness. The client might decide not to risk dealing with a firm that is not very interested in the project.

If the contractor has spent time in calculating the final figures it is not clear from the presentation, so the client might think this is an opening offer and try to negotiate a lower figure.

The quotation could be improved by itemizing the descriptions in greater detail, thereby presenting the bid in a more professional way.

2. TIME TO SPARE

Action	Improve chances	
	Yes	No
Take a holiday at the seaside		×
Check all your calculations	×	
Look again at all unit costs and compare them with standard rates	×	
Write a letter to the local newspaper		×
Check the contract drawings for errors or omissions	×	
Read a book on structural design		×
Check the contract documents to see if there are any unusual provisions	×	
Look again at your profit margin in relation to the likely risk	×	
Tidy your filing cabinets		×
Look again at the presentation of the bid and retype with a better layout and no spelling mistakes	×	

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