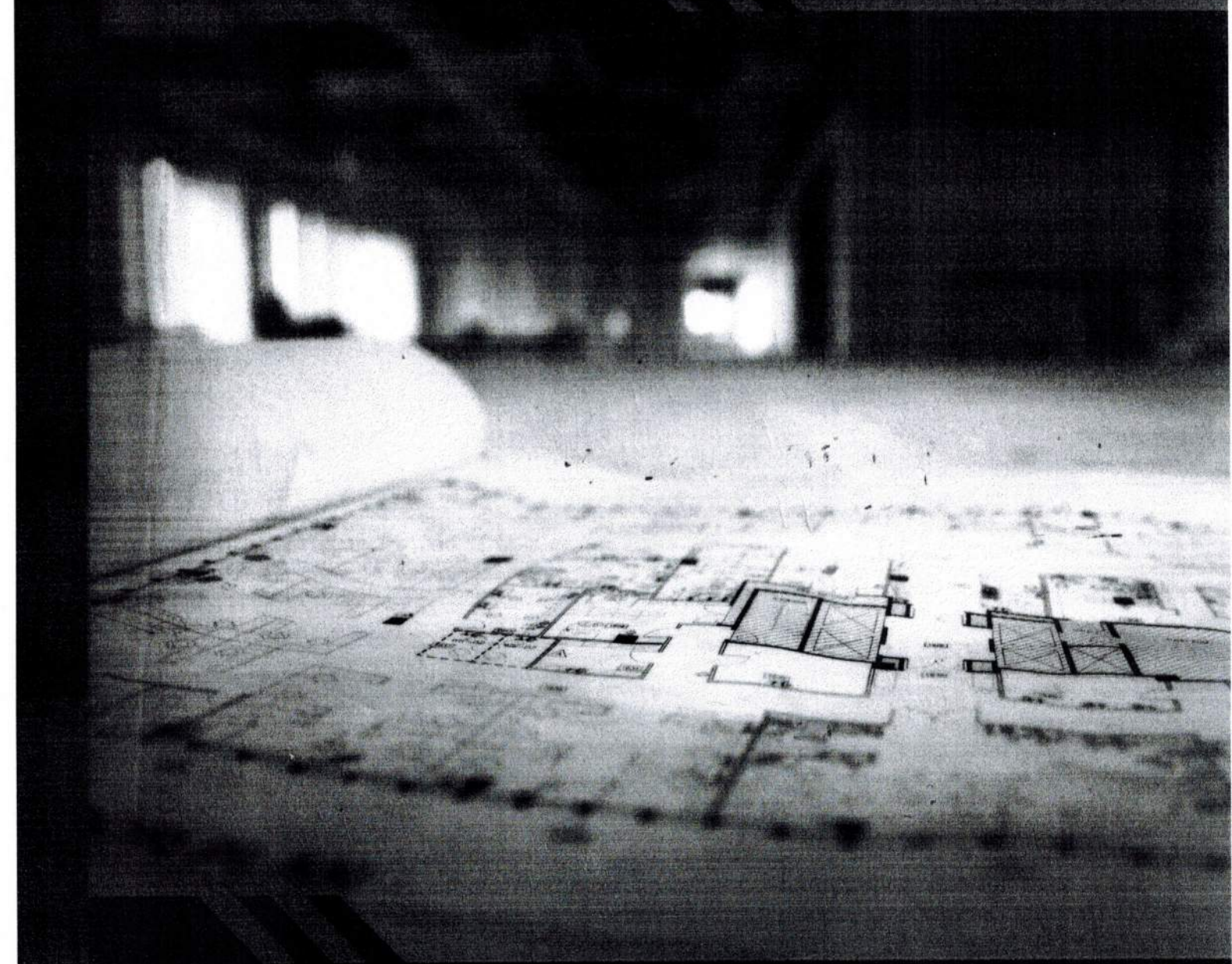
ESTIMATING
IN BUILDING CONSTRUCTION

Canadian Edition

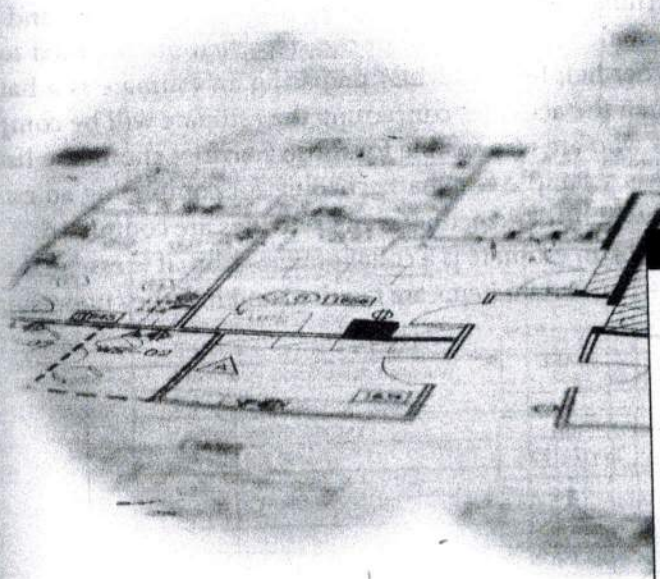
Includes actual working drawings plus
student CD-ROM with estimating worksheet



FRANK R. DAGOSTINO LESLIE FEIGENBAUM CLINT KISSOON

CHAPTER 4

The Estimate



After studying this chapter, you will be able to:

1. Identify a plan for completing a construction estimate in an organized manner.
2. Determine the factors considered by a contractor in deciding on which projects to submit a bid.
3. Outline the steps taken by an estimator in compiling a detailed estimate.
4. Provide a checklist to be used by a contractor when attending a site visit.
5. Relate the bid depository procedures for receiving trade bids.

4.1 Organization

The estimator must maintain a high degree of organization throughout the estimate development. A well-organized estimate improves the probability of getting the work and completing the work within budget, and facilitates the actual work in the field. The organization required includes a plan for completing the estimate and maintaining complete and up-to-date files. It must include a complete breakdown of costs for each project, both of work done by one's own forces and of work done by subcontractors. Using appropriate software can be an effective way to keep organized. The estimate information should include quantities, material prices, labour conditions, costs, weather conditions, job conditions, delays, equipment costs, overhead costs, and salaries of foremen/women and superintendents. All data generated during the development of the estimate must be filed in an orderly manner. Some firms put the information into a computer for quick recall, while others still manually file their data in a convenient, orderly fashion for quick reference.

The estimate of the project being bid must be systematically done and be neat, clear, and easy to follow. The estimator's work must be kept organized to the extent that in an unforeseen circumstance (such as illness or accident), someone else might step in, complete the estimate, and submit a bid on the project. If the estimator has no system, or if the work done cannot be read and understood, then there is no possible way that anyone can pick up where the original estimator left off. The easiest way for you to judge the organization of a particular estimate is to ask yourself if someone else could pick it up, review it and the contract documents, and be able to complete the estimate. Ask yourself: Are the numbers labelled? Are calculations referenced? Where did the numbers come from? What materials are being estimated?

4.2 Planning the Estimate

The need for organization during the estimating process is critical. Many decisions need to be made concerning the logistics of who will do which portion and when. Figure 4.1 is a diagrammatic representation of the steps that are required to complete an estimate. Another helpful tool when preparing an estimate is a bar chart schedule that details when the activities concerning the estimate will be completed. In addition, the persons who are responsible for those activities should be listed on the schedule. Figure 4.2 is a sample bar chart schedule for completing an estimate. The bars and milestones will be darkened in as the activities are completed.

Since the preparation of an estimate is a collaborative effort, it is essential that all persons have input into when certain items are required and that they understand the

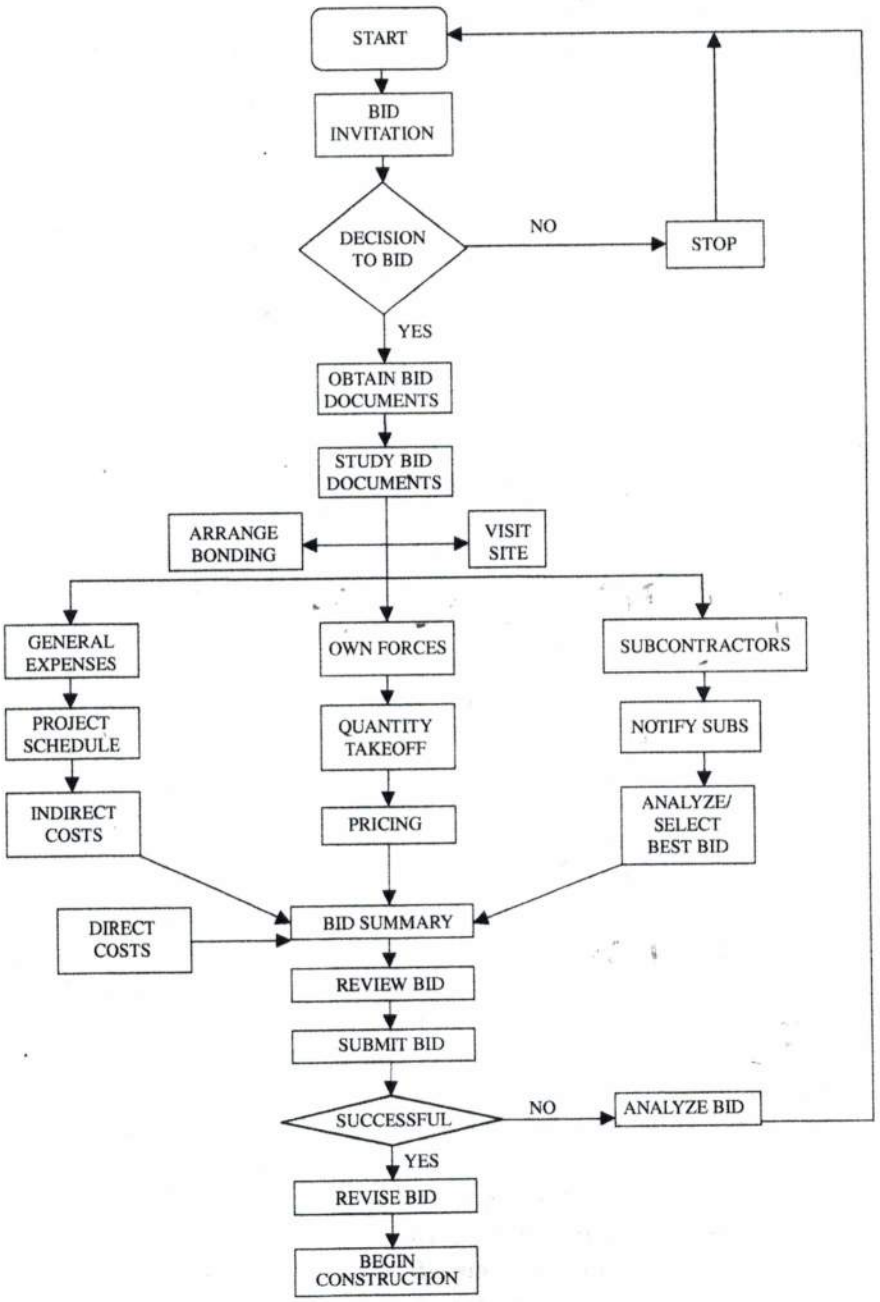


FIGURE 4.1 The Estimate Process

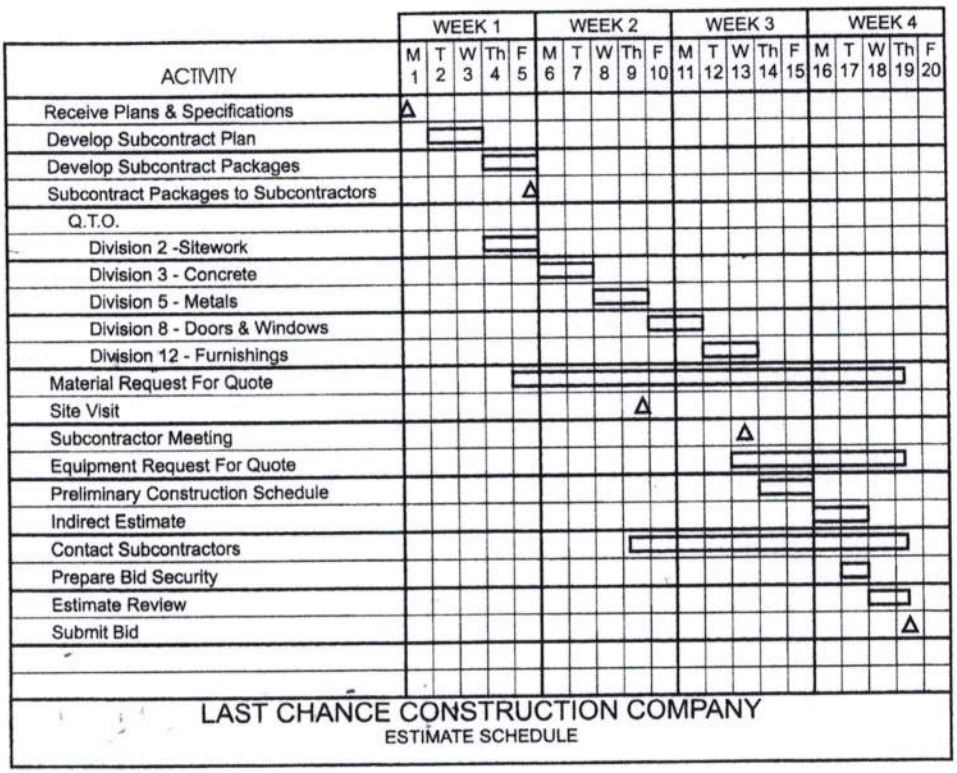


FIGURE 4.2 Sample Estimate Schedule

inter-relationships among the responsible parties. Therefore, one of the first things that needs to be done when preparing the estimate is to bring together all the estimate team members to develop the overall estimate schedule.

4.3 Assembling the Estimate

A sealed envelope with the following documentation is usually required by the Bid Calling Authority: the bid form with the requested bid bond, the agreement to bond, the appendices, and any other documentation to be submitted with the bid. Copies of all these must be duplicated for filing.

A comprehensive filing system should be kept for each estimate prepared. Figure 4.3 on page 44 is a sample file index of a contractor's estimate files. The filing index should include: the bid documents; correspondence with a list of all calls made to the designer specifying who called, who was contacted at the designer's office, the date of the call, and what was discussed; detailed quantity takeoffs; priced quantities for own forces work; general expenses for the project; quotations received from subcontractors, material suppliers, and manufacturers' representatives with an analysis of subtrade prices; and a summary of the estimate.

Every page of the estimate should be numbered and initialled by the person who prepared that portion. In addition, every page of the estimate should be checked and verified, with the checker's initials placed on the page. This procedure is required to help answer questions that may arise at a later date. When construction begins and the estimate is used to purchase materials or to assess changes to the work and there are questions concerning a specific item, an audit trail will be available to clarify any questions.

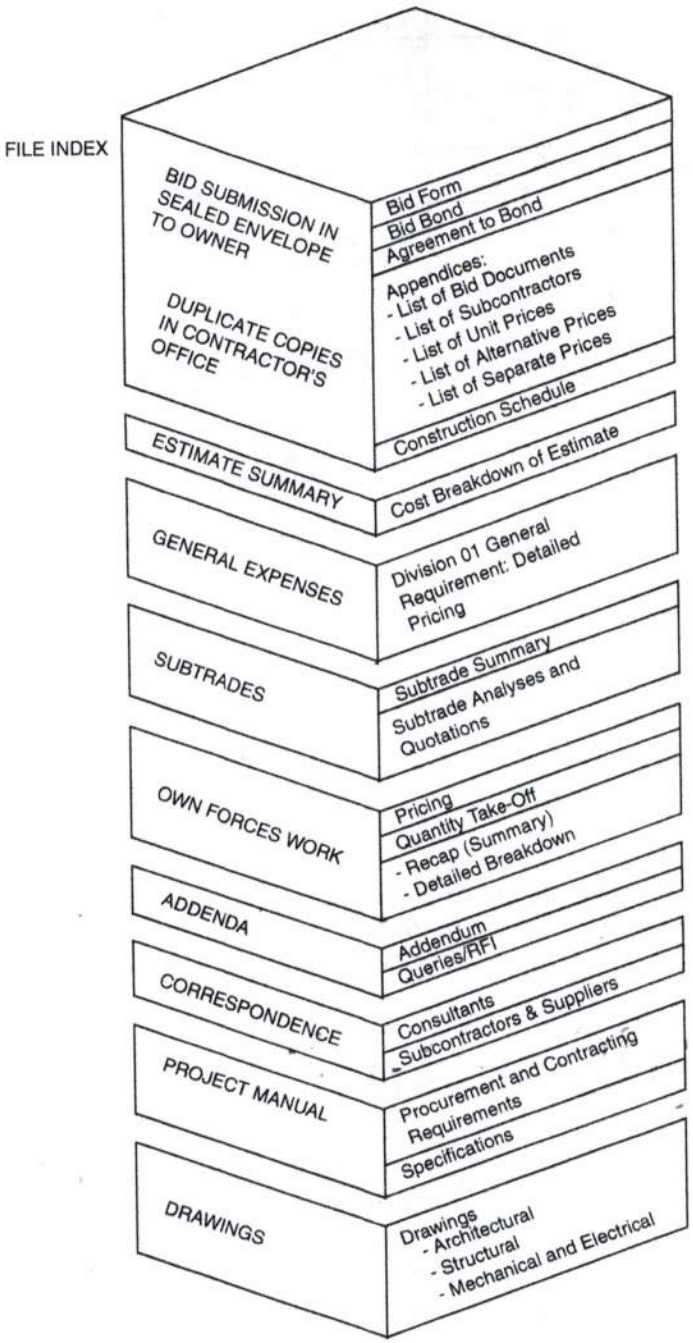


FIGURE 4.3 Contractor's Estimate Files

4.4 To Bid or Not to Bid

It is impossible for a contractor to submit a bid for every project that is tendered. Through personal contact and the reporting services, the contractor finds out what projects are out for bid and then must decide which projects to submit a proposal for. Many factors must be considered: the type of construction involved compared with the type of construction the contractor is usually involved in, the location of the project, the size of the project in terms of total cost and in relation to bonding capacity, the designer/consultant, the amount of work currently under construction, the equipment available, and whether qualified personnel are available to run the project.

There are also certain projects for which a contractor is not allowed to submit a proposal. The owners may accept proposals only from contractors who are invited to bid; other projects may have certain conditions pertaining to work experience or years in business that must be met.

4.5 Bidding Procedures

Once the contractor has decided to bid on a particular project, arrangements must be made to pick up/receive the bid documents. Then, he/she should proceed with the estimate in a manner that will achieve the greatest accuracy and completeness possible. The accuracy required must be in the range of 98 to 99 percent for all major items on the estimate.

Listed below are the steps in working up a detailed estimate. These steps should form a basis for estimating, so it is important to read and understand them.

1. Carefully check the drawings and the specifications to be sure that you have everything, including all addenda. Not all architectural and engineering offices number their drawings in the same manner, so sometimes there can be confusion as to whether you have all the drawings. Architectural drawings are usually prefixed with the letter A. Structural drawings may be prefixed with the letter S, or they may be included with the architectural drawings. Mechanical drawings may be prefixed with M, P, or HVAC. Electrical drawings typically use the designation E. Some jobs have no prefixes before the numbers, but in these circumstances, the pages are typically labelled "sheet 1 of 25." Usually, the front of the specifications contains a list of all the drawings included in the set. Check all sources to ensure that you have received all the drawings. If there are any discrepancies, check with the designer and complete your set. Follow the same procedure with the specifications. Check the list in the front of the specifications against what was received. Create a detailed list (refer to Figure 4.3) incorporating all the bid documentation. In the event you are the successful bidder, this would facilitate a careful comparison with the documents listed in the contract agreement prior to execution.
2. Scan the drawings to get a feel for the project. How large is it? What shape is it in? What are the principal materials? Pay particular attention to the elevations. At this step, it is important that the estimator understand the project. Make a mental note of exterior finish materials, the amount of glass required, and any unusual features.
3. Review the floor plans, again getting the "feel" of the project. The estimator should begin to note all unusual plan features of the building. Look it over; follow through the rooms, starting at the main entrance. Again, make a mental note of what types of walls are used. Note whether enlarged floor plans show extra dimensions or whether special room layouts are required. Calculate the gross floor area of the building so that a job unit price (cost per square metre/foot) can be established and compared with current "market" rates or the cost of similar buildings constructed by the company.
4. Begin to examine the wall sections for a general consideration of materials, assemblies, and makeup of the building. Take special note of any unfamiliar details and assemblies; circle them lightly with a red pencil so that you can refer to them readily.

5. Review the structural drawings. Note what types of structural systems are being used and what types of construction equipment will be required. Once again, if the structural system is unusual, make a mental note to spend extra time on this area.
6. Review the mechanical drawings, paying particular attention to how they will affect the general construction, underground work requirements, outlet requirements, chases in walls, and other cutting and patching items. Even under separate contracts, the mechanical portions must be checked.
7. The submitted bid is based on the drawings and specifications. You are responsible for everything contained in the specifications, as well as what is covered on the drawings. Read and study the specifications thoroughly and review them, when necessary. Take notes on all unusual items contained in the specifications.
8. Visit the site after making a preliminary examination of the drawings and specifications. The visit should be made by the estimator or other experienced persons, including members of the proposed project execution team. By including these persons on the site visit, expertise and estimate ownership will be enhanced. The information that is obtained from the site visit will influence the bidding of the project.
9. Even though estimators must rely on their own experience in construction, it is imperative to create and maintain a close liaison with the other office personnel and field superintendents. After the estimator has become familiar with the drawings and specifications, a meeting should be called with the people who would most likely hold the key supervisory positions if the bid is successful. Be sure to allow these people time before the meeting to become familiar with the project. During this meeting, the project should be discussed in terms of construction methods that could be followed, the most desirable equipment to use, the time schedules to be followed, and personnel needed on the project.
10. Check carefully through the General Conditions and Supplementary General Conditions, making a list of all the items contained in the specifications that will affect the cost of the project.
11. Send a copy of all insurance requirements for the project to your insurance company and all bonding requirements for the project to your bonding company.
12. Prepare a checklist of pertinent trades and select which subtrades will be used.
13. The estimator may now begin to do a takeoff of the quantities required. Each item must be accounted for, and the estimate itself must be as thorough and complete as possible. The items should be listed in the same manner and with the same units of measure in which the work will be constructed on the job. Whenever possible, the estimate should follow the general setup of specifications. This work is done on a workup sheet. As each item is estimated, the type of equipment to be used for each phase should be listed. The list will vary depending on the equipment owned and what is available for rent. Prices on equipment to be purchased or rented must be included.

14. At the time the estimator is preparing the quantity takeoff on workup sheets, the following tasks can also be ongoing:
    a. Notify subcontractors, material suppliers, and manufacturers' representatives that the company is preparing a bid for the project and ask them if they intend to submit bids on the project.
    b. Begin to make a list of all items of overhead that must be included in the project. This will speed up the future pricing of these items.
15. The information on the workup sheet is carried over to the summary sheet. Work carefully; double-check all figures. If possible, have someone go over the figures with you. The most common error is the misplaced decimal point. Other common errors include:
    a. Errors in addition, subtraction, multiplication, and division.
    b. Omission of such items as materials, labour, equipment, or overhead.
    c. Omission of transportation costs and storage costs.
    d. Errors in estimating the length of time required to complete the project.
    e. Errors in estimating construction waste.
    f. Errors in estimating quantities of materials.
    g. Errors in transferring numbers from one sheet to another.
    h. Failure to allow for weather conditions or equipment breakdowns.
    i. Inadequate provisions for escalation in labour costs and material prices.
16. Having priced everything, make one last call to the designer's office to check the number of addenda issued to be sure you have received them all. Double-check the time, date, and place that bids are being received. Double-check that all the requirements for the submission of the proposal have been followed; be sure the bid form is complete.

4.6 Site Investigation

The bid documents often stipulate that the contractor attend a mandatory site visit. The importance of the visit and the items to be checked vary depending on the type of project and its location. As a contractor expands to relatively new and unfamiliar areas, the importance of the preliminary site investigation increases, as does the list of items that must be checked. Examples of the types of information that should be collected are as follows:

1. Site access
2. Availability of utilities (electric, water, telephone)
3. Site drainage
4. Transportation facilities
5. Any required protection or underpinning of adjacent property
6. A rough layout of the site, positioning proposed storage trailer and equipment locations
7. Soil conditions, including any possible contamination

8. Local ordinances and regulations, and any special requirements (permits, licences, hoardings), by-laws regulating working hours, noise, and so on
9. The local labour situation and local union rules
10. Availability of construction equipment rentals, the types and conditions of what is available, as well as the cost
11. The conditions of the roads leading to the project, low bridges, and load limits on roads or bridges

4.7 Subcontractors

A *subcontractor* is a separate contractor hired by the prime contractor to perform certain portions of the work. The amount of work that the prime contractor will subcontract out often exceeds 80 percent. Contractors today can construct entire projects without having any forces/personnel of their own. The use of subcontractors has gained popularity as a means to reduce risk and overhead; however, the contractor gives up a substantial amount of control when subcontracting the entire project.

The contractor must be certain to notify potential subcontractors and material suppliers early in the bidding process so that they have time to prepare a complete, accurate quotation. If rushed, subcontractors tend to bid high just for protection against what might have been missed. Some contractors will review the scope of work thoroughly with the subcontractors well before the job closing and only require the price at the closing.

An estimate of the work should be prepared by the prime contractor for any subcontract sections of the work. If the subcontractor does not have that section included, then the prime contractor can insert the amount required. The bid tabulation sheet should have the scope of work broken down into sections. All subcontractors' bids (Figure 4.4) are compared with the estimator's price; it is important that

McBill Precast
1215 Miriam Rd.
Mountainville, British Columbia

May 23, 20–

Ace Construction
501 Hightower St.
Mountainville, British Columbia

RE: Cedar Hill Secondary School, Administration Building Expansion

Bids Due: May 23, 20–

Gentlemen:

We propose to furnish and install all precast double tees for the above-mentioned project for the lump sum of: $13,250

Furnish double tee fillers (for ends of tees, literature enclosed): $3.75 each

All materials are bid in accordance with the contract documents, including Addendum #1.

Sincerely,

Charles McBill

FIGURE 4.4 Subcontractor's Proposal

a subcontractor's price is neither too high nor too low. If either situation exists, and if time permits, the estimator should call the subcontractor and discuss the quotation.

The subcontractor's bid is often phoned or faxed to the general contractor's office at the last minute because of the subcontractor's fear that the contractor will tell other subcontractors the bid price and encourage lower bids. This practice, commonly referred to as bid peddling or bid shopping, is highly unethical and should be discouraged. To prevent bid shopping, subcontractors submit their final price only minutes before the bids close, which leads to confusion and makes it difficult for the estimator to analyze all bids carefully. Subcontractors who submit unsolicited bids compound this confusion. These bids come from subcontractors who were not contacted or invited to submit a bid, but they find out which contractors are bidding the project and submit a bid. Since these companies are not prequalified, there is an element of risk associated with accepting one of these bids.

In checking subcontractor bids, note especially what is included and what is left out. Each subsequent bid may add or delete items. Often, the bids set up certain conditions, such as use of water, heat, or hoisting facilities. The estimator must compare all the proposals and select the one that is the most economical.

All costs must be included somewhere. If the subcontractor does not include an item in the bid, it must be considered elsewhere. A tricky task for the prime contractor is the comparison of the individual subcontractor price quotes. Throughout the estimate process, the prime contractor should be communicating with the specific subcontractors concerning the fact that they will submit a price quote and what scope of work is be to included within that quote. However, subcontractors will include items that they were not asked to bid and will exclude items that they were asked to bid. A bid tabulation or "bid tab" is used to equalize the scope among subcontractors so that the most advantageous subcontractor's bid can be included in the prime contractor's bid. Figure 4.5 is an example of a bid tabulation form.

BID TABULATION

Project: _____ Estimate No: _____
Location: _____ Sheet No: _____
Architect: _____ Date: _____
Subcontract Package: _____ By: _____ Checked: _____

	Scope of Work	Subcontractor 1	Subcontractor 2	Subcontractor 3	Subcontractor 4	Subcontractor 5
	Base Bid					
	Adjustments					
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
	Adjusted Bids					

Comments:

FIGURE 4.5 Subcontract Bid Tabulation

4.8 Bid Depositories

Regional associations of the Canadian Construction Association (CCA) have established offices of certain local construction associations for the administration of the *bid depository*. This is a system of assembling sealed bids from trade contractors and distributing them to prime contractors, thus enabling them to obtain firm quotations in writing and in adequate time to compile their tenders. This is a fair and equitable process that is in the best interests of the owners, bid-calling authorities, and general and trade contractors.

It is a requirement of the bid depository system that general contractors enter into a contract with the selected bidders whose bids have been properly deposited and accepted for subcontract purposes. Following the submission of general contractor bids, substitution or replacement of the selected bidders is subject to specific approval of the tender-calling authority and/or the owner. The advantage in using a bid depositor is that it helps to combat the unethical practice of "bid shopping." The disadvantage is that prime contractors may not necessarily wish to work with the lowest subtrade bidder.

A tender-calling authority using this system must include the following format and language for the bid depository section of the Instructions to Bidders.

Sample Clause

Bids for the following sections or divisions shall be submitted in accordance with the current Construction Association rules of procedure.

Division 21—Fire Suppression	Division 23—Heating, Ventilating, and Air Conditioning
Division 22—Plumbing	Division 26—Electrical

Bid depositories require trade contractors to submit their bids at a specified time, usually two days before the prime bid closing. Prior to finalizing the closing dates, it is recommended that the bid-calling authority contact the local construction association office to ensure that there are no other projects closing on the same date and that it is not a designated industry holiday or the day after a designated holiday. This will help ensure that competitive bids are received from as many contractors as possible.

General contractors must name the selected subtrade on the bid form in compliance with the following instruction to bidders:

Prime contractors shall list on the bid form the names of the proposed trade contractors for all the specified bid depository sections or divisions. Only bids that list *one* trade contractor for each section or division submitted in accordance with the bid depository rules of procedure for those sections or divisions specified shall be subject to a recommendation of acceptance from the bid-calling authority to the owner. Any other bids shall be rejected. No change of trade contractors will be allowed following the opening of bids without the written permission of the owner.

Prime contractors intending to perform any of the work on the specified bid depository sections or divisions must have complied with the requirements of the bid depository rules of procedure, and shall list their own forces for the appropriate sections or divisions on the bid form. General contractors naming their own forces shall be required to demonstrate their ability to perform the work to the owner's satisfaction.

The standard practice stipulates that Trade Bids must be submitted on the official bid form. Bids are submitted in pink and green envelopes as follows:

1. One envelope containing one of the bid forms is forwarded to the prime contractor.
2. One envelope containing one of the bid forms is retained by the bid depository.
3. All the above envelopes are sealed in a white envelope and delivered to the bid depository at the stipulated time.

The bid depository rules may vary from association to association, and the estimator must be acquainted with the rules applicable to the specific location.

4.9 Materials

The supply of material can be a major cost factor on some projects. Since the final cost of materials is subject to variances in the price and quantity used, effective cost control must be exercised in all phases of the purchasing process, including pricing, purchasing, handling, storing, use, and payment. In the event that the bid is successful, the estimator must be in a position to identify major purchases so that adequate planning with sufficient lead time for the purchase would be in place.

At the bidding stage, the contractor will request quotations from materials suppliers and manufacturers' representatives for all materials required. Although on occasion, a manufacturer's price list may be used, it is more desirable to obtain written quotations that spell out the exact terms of the freight, taxes, time required for delivery, materials included in the price, and the terms of payment (Figure 4.6). The written proposals should be checked against the specifications to ensure that the specified material was accounted for in the bid.

United Block Company
713 Charles Blvd.
Mountainville, British Columbia

May 23, 20–

Ace Construction
501 Hightower St.
Mountainville, British Columbia

Re: Cedar Hill Secondary School, Administration Building Expansion

Gentlemen

We are pleased to quote on the materials required for the above referenced project.
All the materials listed below meet the requirements as specified in the drawings and specifications.

200 × 200 × 400	Concrete Block	$1.18 ea.
200 × 100 × 400	Concrete Block	$0.82 ea.
200 × 150 × 400	Concrete Block	$0.98 ea.

All prices quoted exclude PST and GST.
Terms: 2% - 30 Days
FOB Jobsite

FIGURE 4.6 Materials Price Quote

All material costs entered on the workup and summary sheets (see Sections 4.10 and 4.11) must be based on delivery to the job site, not including tax. The total will include all necessary freight, storage, transportation insurance, and inspection costs. When dealing with material quotes, contractors must consider the provincial retail sales tax and the value-added tax.

4.10 Workup Sheets

The estimator uses two basic types of manual takeoff sheets: the workup sheet and the summary sheet. The *workup* sheet can be a variety of forms contingent upon what is being quantified. Figure 4.7 is an example of a workup sheet that could be used to quantify reinforcing steel.

ESTIMATE WORK SHEET
REINFORCING STEEL

Project Little Office Building
Location Mountainville, BC
Architect C.K. Architects
Items Foundation Concrete

Estimate No. 1234
Sheet No. 1 of 1
Date 23/12/20xx
By DCK **Checked** SRS

Cost Code	Description	Dimensions L	W	Space		Count	Bar Size	Linear Metre	kg/m		Quantity	Unit
		mm					M					
	Continuous Footings											
	Perimeter - Long Bars	102.00	4	2		8	20	816.00	2.355		1922	kg
	Perimeter - Short Bars	0.86	337	2		674	20	579.64	2.355		1365	kg
	Interior - Long Bars	23.00	3	2		6	20	138.00	2.355		325	kg
	Interior - Short Bars	0.81	76	2		152	20	123.12	2.355		290	kg
	Dowels											
	Perimeter	1.20	337	1		337	20	404.40	2.355		952	kg
	Interior	1.20	77	1		77	20	92.40	2.355		218	kg
	Foundation Walls											
	Perimeter - Long Bars	102.00	4	2		8	20	816.00	2.355		1922	kg
	Perimeter - Short Bars	1.12	336	2		672	20	752.64	2.355		1772	kg
	Interior - Long Bars	23.00	8	2		16	20	368.00	2.355		867	kg
	Interior - Short Bars	2.44	76	2		152	20	370.88	2.355		873	kg
	Spread Footings											
	Dowels	1.20	4	3		12	20	14.40	2.355		34	kg
	Column Piers - Vertical Bars	1.12	4	3		12	20	13.44	2.355		32	kg
	Column Piers - Stirrups	1.01	5	3		15	10	15.15	0.785		12	kg
	Drilled Piers											
	Vertical Bars	102.00	6	3		18	20	1836.00	2.355		4324	kg
	Horizontal Bars	6.00	31	3		93	10	558.00	0.785		438	kg
	Grade Beams											
	Grade Beams - Long Bars	21.00	6	1		6	20	126.00	2.355		297	kg
	Grade Beams - Stirrups	1.12	69	1		69	10	77.28	0.785		61	kg

FIGURE 4.7 Estimate Workup Sheet: Reinforcing Steel

The workup sheet is used to make calculations and sketches and to generally "work up" the cost of each item. Material and labour costs should always be estimated separately. Labour costs vary more than material costs, and the labour costs will vary in different stages of the project. For example, a concrete block wall will cost less for its first 1.20 metres than for the balance of its height; the labour cost goes up as the scaffold goes up, yet material costs remain the same.

When beginning the estimate on workup sheets, the estimator must be certain to list the project name and location, the date that the sheet was worked on, and the estimator's name. All sheets must be numbered consecutively and, when completed, the total number of sheets is noted on each sheet (e.g., if the total number was 56, sheets would be marked "1 of 56" through "56 of 56"). The estimator must account for every sheet because if one is lost, chances are that the costs on that sheet will never be included in the bid price. Few people can write legibly enough for everyone to easily understand what they have written; it is, therefore, suggested that the work be printed. If a computer spreadsheet program is being used, contractors must be very careful to verify that all formulas are correct and that the page totals are correct. Errors in spreadsheet programs can be costly. Sophisticated estimating software with versatile spreadsheets and reporting capabilities offers tremendous assistance to the estimator. Never alter or destroy calculations; if they need to be changed, simply draw a line through them and rewrite. Numbers that are written down must be clear beyond a shadow of a doubt. Too often a "4" can be confused with a "9" or "2" with a "7" and so on. All work done in compiling the estimate must be totally clear and self-explanatory. It should be clear enough to allow another person to come in and follow up on all work completed and all computations made each step of the way.

When "taking off" the quantities, contractors must make a point to break each item down into different sizes, types, and materials, which involves checking the specifications for each item they are listing. For example, in listing concrete blocks, they must consider the different sizes required, the bond pattern, the colour of the unit, and the colour of the mortar joint. If any of these items varies, it should be listed separately. It is important that the takeoff be complete in all details; for example, do not simply write "wire mesh," but write "welded wire mesh 152 × 152 MW9.1 × MW9.1," as the size and type are very important. If the mesh is galvanized, it will increase the material cost by about 20 percent, so this should be noted on the sheet. Following the CSA/CSI format helps organize the estimate and provides a checklist.

4.11 Summary Sheet

All costs contained in the workup sheets are condensed, totalled, and included on the summary sheet. All items of labour, equipment, material, plant, overhead, and profit must likewise be included. The workup sheets are often summarized into summary sheets that cover a particular portion of the project. Figure 4.8 on page 54 is an example of a summary sheet used to summarize the cost of concrete to be used in a project. Every item on this page is supported by workup sheets.

In addition to summarizing portions of the project, it is helpful to summarize the entire estimate onto a single page. This will be further discussed and illustrated in Chapter 18, Bid Closing.

ESTIMATE SUMMARY SHEET

Project: Little Office Building
Location Mountainville, BC
Architect C.K. Architects
Items Foundation Concrete

Estimate No. 1234
Sheet No. 1 of 1
Date 23/12/2xxx
By C.K. **Checked** D.K.

Cost Code	Description	Q.T.O.	Waste Factor	Purch. Quan.	Unit	Crew	Prod Rate	Wage Rate	Work Hours	Unit Cost Labour	Unit Cost Material	Unit Cost Equipment	Labour	Material	Equipment	TOTAL
			%													
	Continuous Footings 20M Bars															
	(1922 +1365 +325+ 290)/1000	3.90	10	4.29	Tonne		15	25.50	58.50	382.50	950.00		1,491.75	4,075.50		5,567.25
	Dowels From Ftg to Wall															
	(952+218)/1000	1.17	10	1.29	Tonne		15	25.50	17.55	382.50	950.00		447.53	1,225.50		1,673.03
	Foundation Walls															
	(1922 +1772 +867+ 873)/1000	5.43	10	5.97	Tonne		11	25.50	59.73	280.50	950.00		1,523.12	5,671.50		7,194.62
	Spread Footing w/Dowels															
	(34)/1000	0.03	10	0.03	Tonne		15	25.50	0.45	382.50	950.00		11.48	28.50		39.98
	Column Piers															
	10 M Bars	0.01	10	0.01	Tonne		24	25.50	0.24	612.00	950.00		6.12	9.50		15.62
	20 M Bars	0.03	10	0.03	Tonne		24	25.50	0.72	612.00	950.00		18.36	28.50		46.86
	Drilled Piers															
	10 M Bars	0.44	10	0.48	Tonne		24	25.50	10.56	612.00	950.00		269.28	456.00		725.28
	20 M Bars	4.32	10	4.75	Tonne		24	25.50	103.68	612.00	950.00		2,643.84	4,512.50		7,156.34
	Grade Beams															
	10 M Bars	0.06	10	0.07	Tonne		22	25.50	1.32	561.00	950.00		33.66	66.50		100.16
	20 M Bars	0.30	10	0.33	Tonne		22	25.50	6.60	561.00	950.00		168.30	313.50		481.80
	TOTALS								**259.35**				**6,613.44**	**16,387.50**		**23,000.94**

FIGURE 4.8 Estimate Summary Sheet (Portion)

4.12 Errors and Omissions

No matter how much care is taken in the preparation of the contract documents, it is inevitable that certain errors will occur. Errors in the specifications were discussed in Section 3.13, and the same note-taking procedure is used for all other discrepancies, errors, and omissions. The Instructions to Bidders or Supplementary General Conditions ordinarily state that if there are discrepancies, the specifications take precedence over drawings and dimensioned figures, and detailed drawings take precedence over scaled measurements from drawings. All important discrepancies (those that affect the estimate) should be checked with the designer's office. Figure 4.9 is an example of a sample query directed to the designer.

May 23, 20–

PROJECT: Cedar Hill Secondary School, Administration Building Expansion

LOCATION: 7723 Nissa Street, Mountainville, BC

Request for information/clarification:

1.Q Ref.: Division 05 21 00 – Steel Joists of the Project Manual. The drawings and the specifications do not indicate the manufacturer of the OWSJ. Please specify the manufacturer so that the appropriate weight per metre can be determined.

2.Q In the table of contents the item steel deck is numbered 05 31 15. In the specifications Steel Deck is referred to as 05 31 10. Please clarify if there is an item "05 31 15" missing from the specs or if it was a clerical mistake in the table of contents.

A timely response will be greatly appreciated.

Yours truly,

Dorothy Kison CEC

D.K. Construction

FIGURE 4.9 Sample Query List

4.13 Perimeter and Area

Throughout the estimate, some basic information is used repeatedly. The perimeter of a building is one such basic dimension that must be calculated. The perimeter is the distance around the building; it is the total length around the building expressed in metres.

EXAMPLE 4.1 Perimeter Calculations

Find the perimeter of the building shown in Figure 4.10. Start in the upper left corner of the building and proceed clockwise:

$$25.90 + 7.60 + 4.50 + 10.70 + 9.10 + 3.00 + 9.10 + 3.00 + 12.20 + 18.30 = 103.40 \text{ m}$$

As an alternative to the above "piecemeal" approach, a faster and reliable way of measuring the perimeter of any rectangular building is to apply the following formula:

$$P = 2\,(l + w + r)$$

where l is the extreme length, w is the extreme width, and r is the depth of recess.

This "primary" perimeter can be used to calculate any "secondary" perimeter along the exterior girth of the building. Any perimeter (larger) outside the primary can be calculated by applying the formula $P_e = P + 8d$, where d is the horizontal distance from where P was calculated to where the new perimeter is to be calculated. Any perimeter (smaller) inside the primary perimeter can be calculated by applying the formula $P_i = P - 8d$.

The above calculation principle to obtain the primary perimeter or exterior face of the building shown in Figure 4.10 can be applied as follows:

$$\text{Perimeter of exterior wall face} = 2\,[(25.90 + 4.50) + 18.30 + 3.00]$$
$$= 103.40 \text{ m}$$

Assuming a 250 mm total wall thickness, the above perimeter can be used to calculate the perimeter (smaller) to the interior wall face.

$$\text{Perimeter of interior wall face} = 103.40 - (8 \times 0.25)$$
$$= 101.40 \text{ m}$$

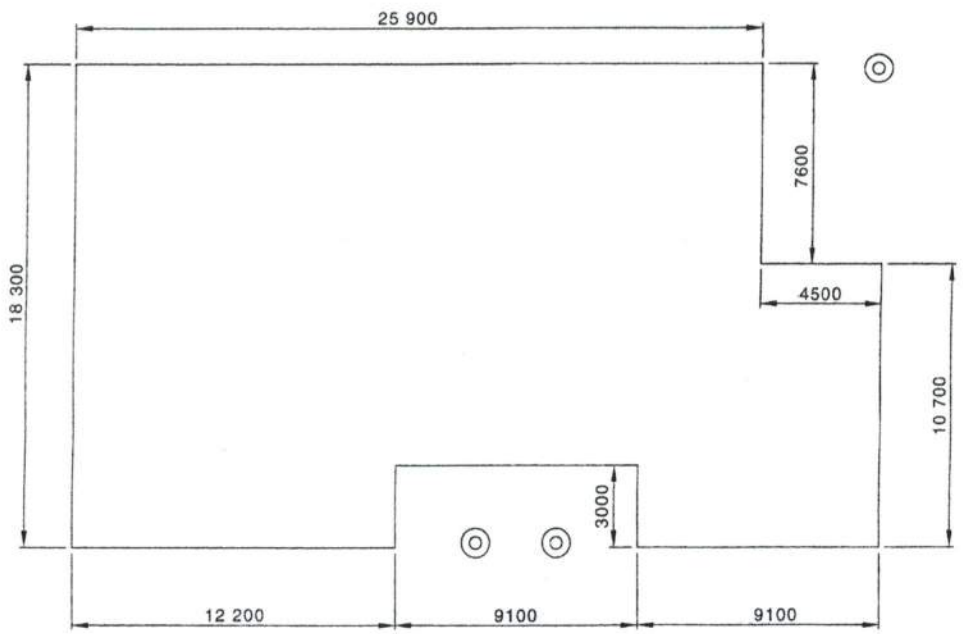


FIGURE 4.10 Sample Perimeter and Area Calculations

Generally, the costs of building projects are summarized on a cost per square metre (foot) basis; therefore, the Gross Floor Area (GFA) measurement is another calculation estimators must perform with a high degree of accuracy. To determine the GFA, measure the *outside face* of the *enclosing wall* for the area on each floor without any deductions for openings within the floor area.

EXAMPLE 4.2 Building Area

Find the area of the building shown in Figure 4.10.

Extreme plan area	30.40 × 18.30	556.32m^2
Deduct: Area at set-back	9.10 × 3.00	−27.30m^2
Cutout	4.50 × 7.60	−34.20m^2
Gross building area		494.82m^2

Web Resources

McGraw-Hill Construction Online	www.construction.com	General Information on Bidding
e-Builder	www.e-builder.net	General Information on Bidding
RSMeans	www.rsmeans.com	General Information on Bidding
Design Cost Data	www.dcd.com	General Information on Bidding
Craftsman Book Company	www.costbook.com	General Information on Bidding
Frank R. Walker Company	www.frankrwalker.com	General Information on Bidding
Corecon Technologies Inc.	www.corecon.com	General Information on Bidding
BidNavigator.com	www.bidnavigator.com	Section 4.4
Canadian Construction Association	www.cca-acc.com	Section 4.8

Review Questions

1. Why should a project file on the estimate be kept? What items should be kept in it?
2. Why might a contractor decide not to bid a particular project?
3. Why should estimators check carefully to be certain that they have all the documents before bidding on a project?
4. One of the requirements of most bid documents is that the contractor visit the site. Why is the site investigation important?

5. Explain what a subcontractor is and the subcontractor's relationship to the owner and to the general contractor.
6. Why should material quotes be in writing? What items must be checked in these proposals?
7. What is the difference between workup sheets and summary sheets?
8. Examine the plan and section on Figure 4.11 and calculate the following:
   a. the external face length of the wall
   b. the centreline length of the wall

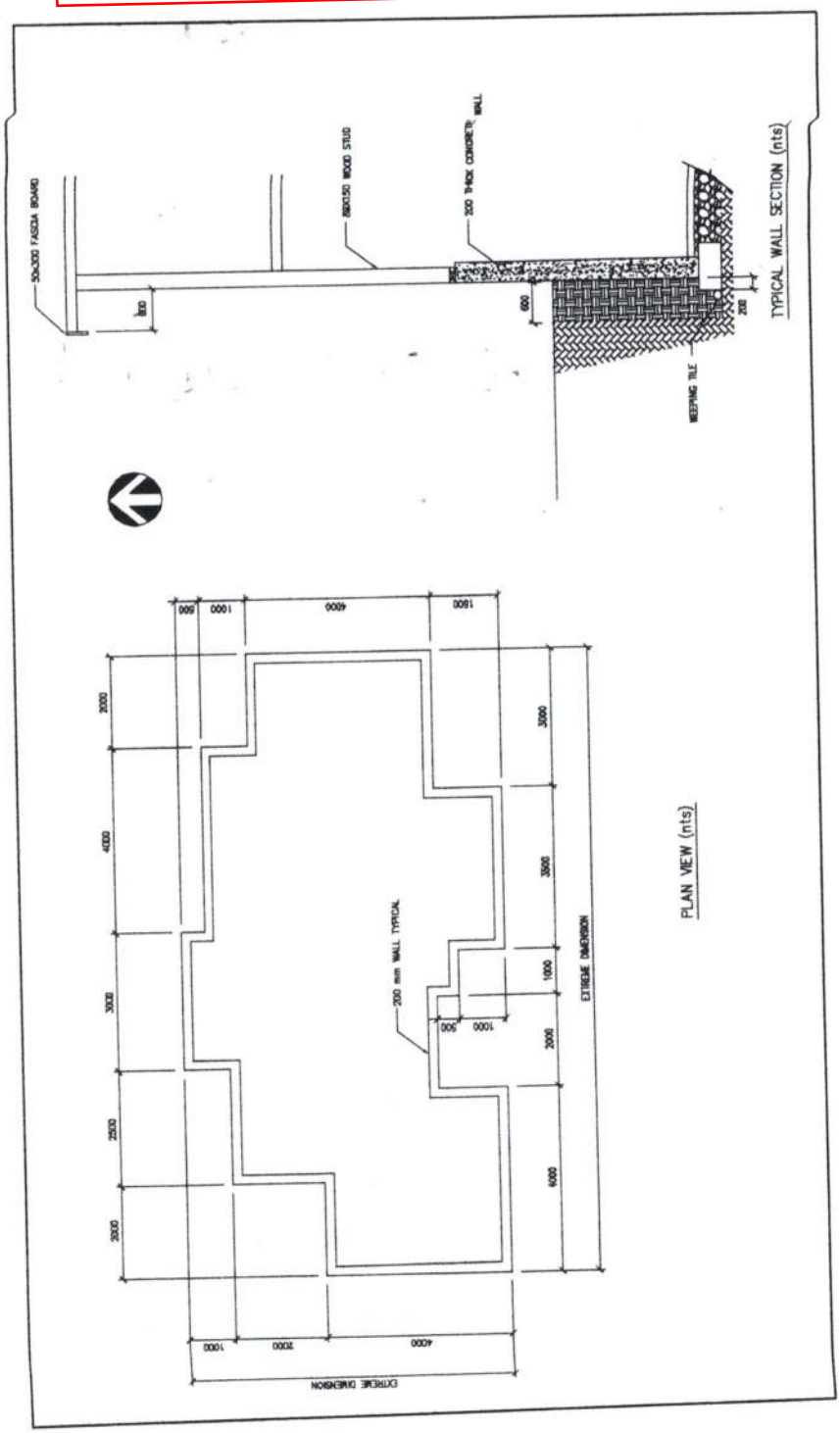


FIGURE 4.11

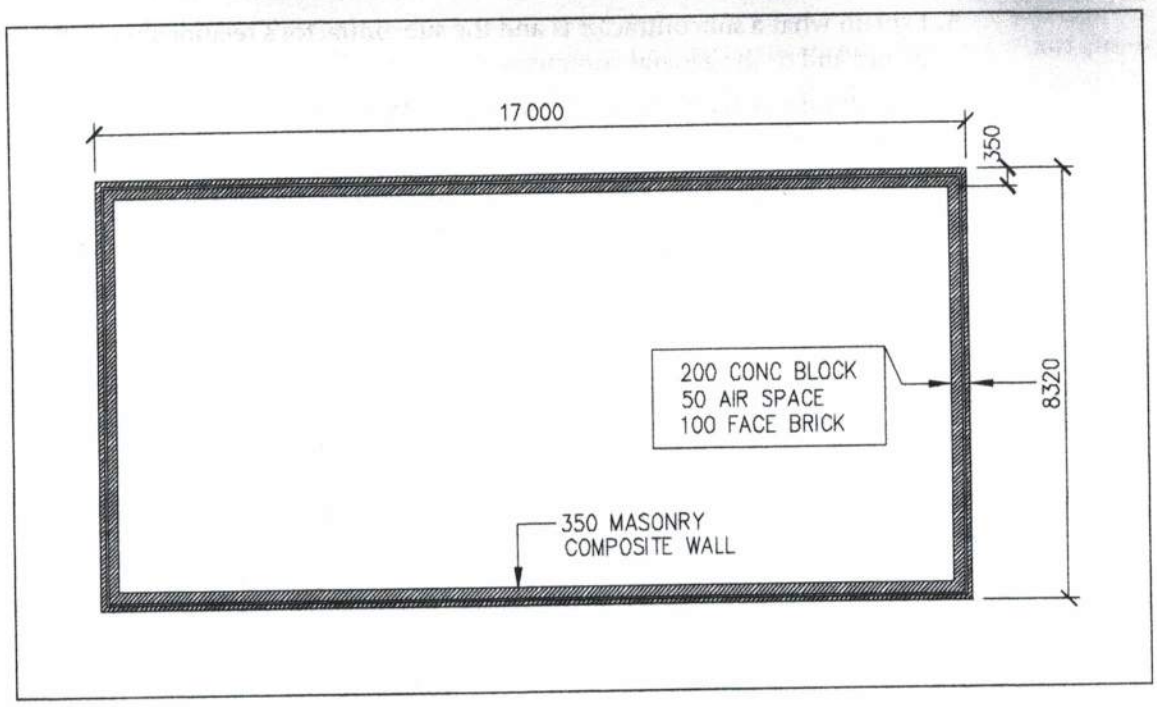


FIGURE 4.12

c. the centreline length of the 600-mm-wide backfill to the foundation wall

d. the centreline length of the weeping tile (assuming that the mid-point of the weeping tile is 100 mm from the edge of the footing)

e. the centreline length of the wood stud wall

f. the centreline length of the insulation within the wall

g. the centreline length of the roof soffit

h. the centreline length of the fascia board (note that the 600 mm overhang dimension is taken to the inside of the fascia)

i. the centreline length of the 12.5 mm interior drywall to the wall

9. Examine the plan Figure 4.12 and calculate the following:

a. the gross floor area

b. the internal floor area

c. the centreline length of the composite wall

d. the centreline length for the following:

i. face brick

ii. concrete block

10. Examine the plan Figure 4.13 on page 59 and calculate the following:

a. the gross floor area

b. the internal floor area

c. the centreline length of the composite wall

d. the centreline length for the following:

i. face brick

ii. concrete block

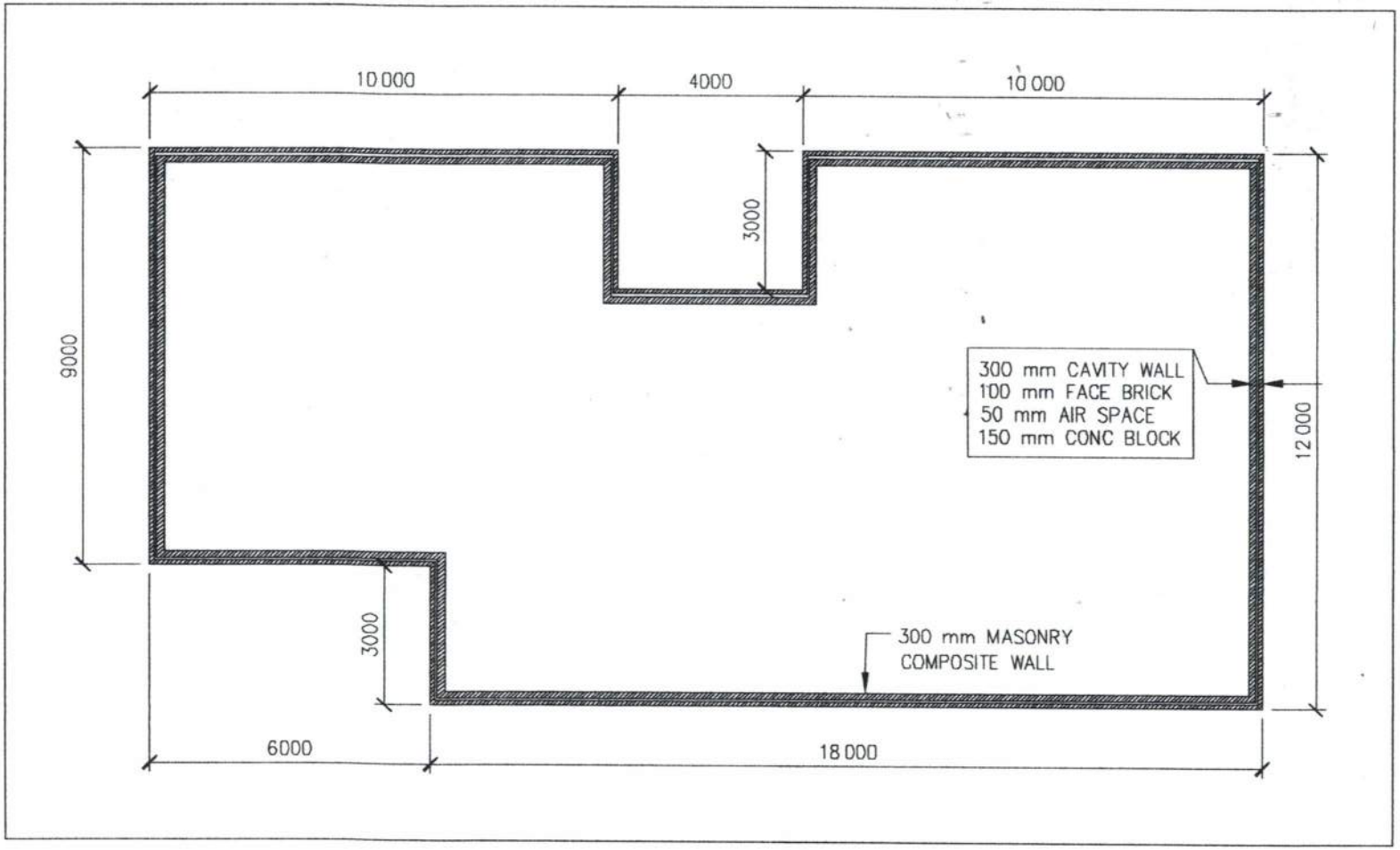

10 000
4000
10 000
3000
9000
300 mm CAVITY WALL
100 mm FACE BRICK
50 mm AIR SPACE
150 mm CONC BLOCK
12 000
3000
300 mm MASONRY
COMPOSITE WALL
6000
18 000

FIGURE 4.13