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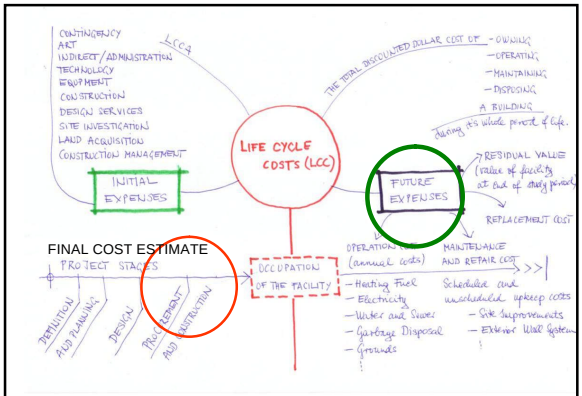
Cost calculation methods

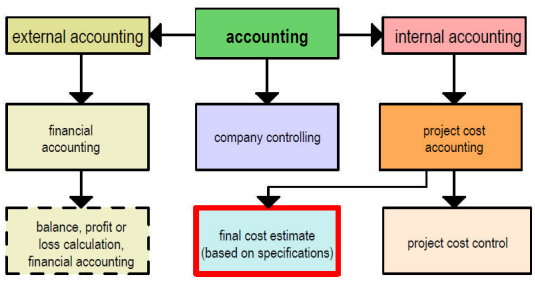
What was our topic at the last time?

- Overrun
- Examples
- Causes of Cost Overrun
- Quantitative factor
- Cost factor
- Total investment cost - budget
- Building Cost Documentation
- Sorting of the calculation methods
- System of cost management



PROJECT STAGES	EXISTING DOCUMENTS, DATA	COST ESTIMATING AND CALCULATING METHODS
1. DEFINITION	LIST OF ROOMS, FUNCTIONS, REQUIREMENTS	PRELIMINARY COST ESTIMATES
2. PLANNING, PRELIMINARY DESIGN	BUILD-UP IDEAS, SCECHES, FINAL PRELIMINARY DESIGN	
3. DESIGN AND BUILDING PERMIT	CONSTRUCTIONS, MATERIALS, DETAILS, PRESCRIPTIONS	
4. DESIGN - FINAL COSTRUCTION DRAWING	DETAILS, FINAL SOLUTIONS	FINAL COST ESTIMATE
5. COMPETITION, PUBLIC PROCUREMENT	SPECIFICATIONS, CONTRACTOR BIDDINGS	
6. CONSTRUCTION AND SUPERVISION	BILLS, DATA REALISED	COST CONTROLL based on bills
7. DOCUMENTATION		UPDATING COST DOCUMENTATION

Division of the accounting



Accounting

- **Accounting** is defined by the American Institute of Certified Public Accountants (AICPA) as "the art of recording, classifying, and summarizing in a significant manner and in terms of money, transactions and events which are, in part at least, of financial character, and interpreting the results thereof.„
- accounting is thousands of years old
- today, accounting is called "the language of business„
- ~ is a basis for making management or operating decisions

External - financial accounting

- Accounting that provides information to people outside the business entity is called financial accounting
- ~ provides information to present financial data to potential shareholders, creditors such as banks or vendors, financial analysts, economists, and government agencies
- ~ is governed by rules (Generally Accepted Accounting Principles)
- bookkeeping (e.g. double-entry *bookkeeping)*

Company controlling

Controlling is one of the managerial functions like planning, organizing, staffing and directing.

Must include the project financial management system, which is particularly important in the construction industry because of the long-term pre-financing.

Project cost accounting - internal

- It has two parts:
  - final cost estimate and
  - project cost control
- differs from financial accounting:
  - ~ is concerned with costs, man-hours, equipment-hours, and the amounts of work accomplished
  - it's main function: systematic and regular checking of costs and giving feedback information to the management
  - ~ is not governed by rules or acts
- ~ system supplements field supervision; it does not replace it.

Project cost control

Controlling of previously produced works.

- cost accounting reports
  - about labor and equipment cost
  - cost report intervals: usually weekly (e.g. every Wednesday afternoon), end the payroll periods and weekly work quantity measurements are made
- labor time reporting
  - the source documents: labor – daily or weekly - time cards (the hours of labor time for every labor tradesman and the project cost codes)
- time card preparation
  - responsibility of the field supervisor (foreman), but often the project timekeeper, cost engineer, or project manager fills in the formal time cards
  - it is preferable that the labor distribution be made each day

Labor time reporting

Weekly Labor Time Card

Craft C

Name Clouten, S.
Employee No. 221
Week Ending July 21

Project Highway Bridge
Project No. 200808-05
Prepared by S.K.S.

Cost Code	Time Classification	Hourly Rate	Thursday	Friday	Monday	Tuesday	Wednesday	Total Hours	Total Cost
03157.10.3	ST	$31.00	8					8	$248.00
	OT								
03157.20.3	ST	$31.00		8	8	8		24	$744.00
	OT								
03311.10.3	ST	$31.00					8	8	$248.00
	OT								
	ST								
	OT								
	ST								
	OT								
Total Hours	ST		8	8	8	8	8	40	
	OT								
Gross Amount			$248.00	$248.00	$248.00	$248.00	$248.00		$1,240.00
Weather			Clear-hot	Clear-hot	Cloudy-gusty	Cloudy-windy	Cloudy-windy		

Project cost control

- measurement of work quantities
  - at the end of each day or each shift or at longer intervals: e.g. at the end of each weekly payroll period
  - the weekly measurement of work quantities includes all work items performed, whether accomplished by labor, equipment, or a combination of the two
  - measurement forms:
    - direct field measurement
    - estimation of percentages completed
    - computation from the contract drawings
    - use of the estimating sheets and so on
  - one convenient procedure is to mark of and dimension the work advancement in colored pencil on a set of project drawings reserved for that purpose - different cost classification is to mark off with different colors
  - field supervisor, or cost engineer, or project manager
  - weekly reports

Measurement of work quantities

Weekly Work Quantity Report

Project Highway Bridge — Project No. 200808-05
Week Ending Wednesday, July 21 (working day 27) — Prepared by S.K.S.

Cost Code	Work Type	Unit	Total Last Report	Total This Week	Total to Date
31361.10	Piling, steel, driving	lf	1,456	560	2,016
03159.10	Footing forms, strip	sf	0	360	360
03157.20	Abutment forms, place	sf	0	1,810	1,810

Project cost control

•cost records and reports: the field costs and production data are recorded, analyzed, and reported

•weekly labor reports: can be prepared on either a man-hour (production rate) or cost basis (unit prices)

•equipment cost accounting: similar to labor costs and hours

- equipment time reports
- weekly equipment cost report

•monthly cost forecast:

- all project cost must be summarized and reported at regular intervals, monthly being common
- to forecast the final total job cost (variance is the difference between the anticipated actual cost and budget)

•earned value management system (EVMS): forecasting final results, based on three fundamental variables: budgeted cost of work performed (BCWP), budgeted cost of work scheduled (BCWS), actual cost of work performed (ACWP)

Monthly cost forecast

Monthly Cost Forecast Report

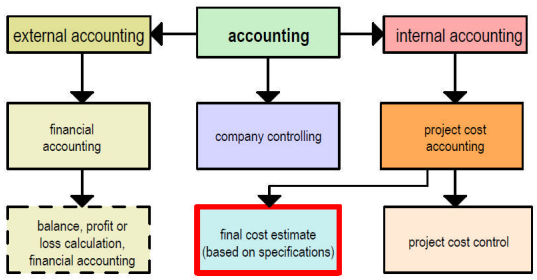
Period Ending Highway Bridge, July 31

Cost Code (1)	Description (2)	Materials Budget (3)	Materials Cost to Date (4)	Materials Est. to Complete (5)	Materials Variance (6)	Labor Budget (7)	Labor Cost to Date (8)	Labor Est. to Complete (9)	Labor Variance (10)
01	General Requirements	$0	$0	$0	$0	$12,360	$7,787	$4,248	$325
31	Sitework	$72,279	$79,176	$0	($6,897)	$23,253	$28,127	$0	$4,874
03	Concrete	$50,748	$26,201	$23,291	$1,256	$38,639	$16,856	$21,193	$590
05	Metals	$82,764	$0	$82,764	$0	$5,467	$0	$5,467	$0
09	Finishes	$0	$0	$0	$0	$0	$0	$0	$0

Project No. 200008-05
Prepared by S.K.S.

Equipment Budget (11)	Equipment Cost to Date (12)	Equipment Est. to Complete (13)	Equipment Variance (14)	Subcontracts Budget (15)	Subcontracts Cost to Date (16)	Subcontracts Est. to Complete (17)	Subcontracts Variance (18)	Totals Budget (19)	Totals Cost to Date (20)	Totals Est. to Complete (21)	Estimated Final Cost (22)	Estimated Variance (23)	Percent Complete (24)
$4,444	$3,018	$1,240	$186	$0	$0	$0	$0	$16,804	$10,805	$5,488	$16,293	($511)	66%
$13,323	$19,735	$0	$6,412	$0	$0	$0	$0	$108,855	$127,038	$0	$127,038	$18,183	100%
$9,579	$5,422	$4,082	$75	$0	$0	$0	$0	$98,966	$48,479	$48,566	$97,045	($11,921)	50%
$2,520	$0	$2,520	$0	$0	$0	$0	$0	$90,751	$0	$90,751	$90,751	$0	0%
$0	$0	$0	$0	$8,550	$0	$8,550	$0	$8,550	$0	$8,550	$8,550	$0	0%
								$323,926	$186,322	$153,355	$339,677	$15,751	55%

Division of the accounting



Final cost estimate

- final cost estimate belongs to the internal accounting
- estimating works, which will be made in the future
- ~ is prepared when finalized working drawings and specifications are available.
- ~ is based on a complete and detailed survey of work quantities
- the process involves:
  - the identification
  - compilation and
  - analysis of the many items of cost that will enter into the construction process.
- it is important to keep the database actual, to make it possible to do good cost projections

Final cost estimate

is very different from the companies operating in steady conditions, because of

- the product is always unique,
- each time a different location,
- different participants in the project (e.g. owners, designers, subcontractors, users, etc.),
- specific forms of price competition: tendering

… therefore requires a different calculation method.

There are probably as many different estimating procedures as there are estimators.

Final cost estimate

- requirement of a good estimate:
  - careful and detailed study of the design documents
  - intimate knowledge of the prices, availability, and characteristics of
    - materials
    - construction equipment and
    - labor
- functions of ~ are:
  - estimate the costs
  - fix the works to be accomplish (e.g. in a contract)
  - information on the quantity, technical content, and quality of the works
  - it provides the basis for payments

Key terms

- Costs
  - In business, retail, and accounting, a cost is the value of money that has been used up to produce something, and hence is not available for use anymore.
  - Costs are counted in the internal accounting, for example: material costs, labor costs, equipment costs, planning costs or the costs of subcontractors.
  - It is not necessary to take into account laws and other regulations at the internal accounting.
  - Typical of the costs that be expressed in some monetary unit, and internal business purposes must be paid.
  - Any expenses that is not in conjunction the forthcoming work, do not qualify as cost.

Key terms

- Profit
  - The profit included in a job bid represents the minimum acceptable return on the contractor's investment.
  - Return on investment is a function of risk, and greater risk calls for a greater profit allowance in the proposal.

Key terms

- Expenses - Income
  - Expenses: used for material goods and services at an accounting period (financial accounts)
  - Income: sold work for construction in the market (delivery), expressed in monetary units (financial accounts)
- Expenditure - Revenue
  - expenditure: financial payments, which occur at intervals, e.g. loan or purchase materials
  - revenue: earned money by the company, e.g. a bill or invoice

Key terms

- Depreciation (amortization)

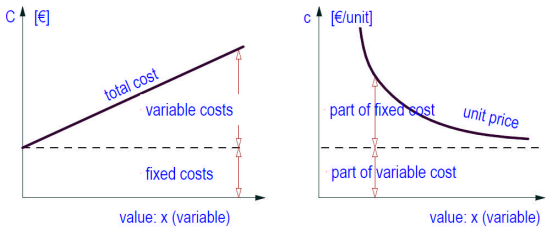
  refers to prorating a tangible asset's cost over that asset's life.

  For example, an office building can be used for a number of years before it becomes run down and is sold (salvage value).

  The cost of the building is spread out over the predicted life of the building, with a portion of the cost being expensed each accounting year.
  - depreciation is used in financial accounts: Depreciation of the purchase price
  - depreciation is used in the project cost accounting: Depreciation of the replacement price

Key terms

- Fixed and variable costs



Changes of the unit price depending on the produced quantity

Key terms

- Tender documentation
  - Based on specifications
    - 1. Part : information and knowledge relating to the bidding
    - 2. Part : text information on the project bill of quantities (specifications), technical description
    - 3. Part : drawing information on the investment (plans, designs)
  - Definition of the requirements (building program)

Key terms

- Quantity survey

The works of a project are divided into many different work types or classifications. (usually ~ belongs to the bidding document)

Classifications per bid items:

- Number
- Cost code (Project number, Area code, Work type code, Distribution code; Work Breakdown Strukture - WBS)
- Text: long text (with specifications), short text
- Unit
- Quantity
- Material cost per unit
- Labor cost per unit

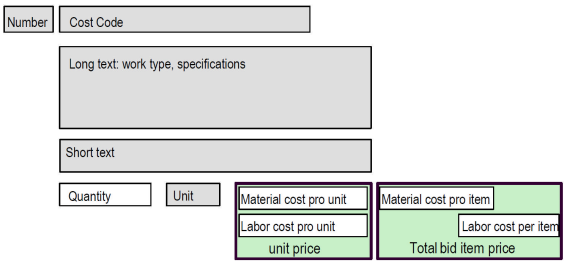
→ Unit Price

- Total material cost per item
- Total labor cost per item

→ Total Bid Item Price

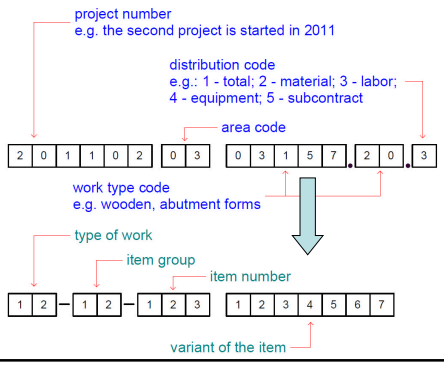
Key terms

- Quantity survey



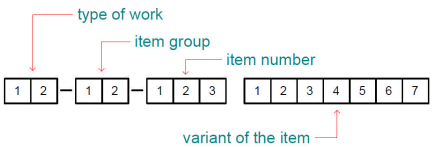
Key terms

- Project cost code



Key terms

- WBS – Work Breakdown Structure



- Cost codes are derived from the WBS.
- Each level of the WBS constitutes a cost code grouping as shown above.
- Cost codes can be developed at the lowest WBS level and then summarized at any level within the WBS hierarchy.

Key terms

- Units

For instance:

making load-bearing wall	m^3
making formwork	m^2
steel, reinforcing, place	t, kg
placement of prefabricated elements	piece
making canal	m

Key terms

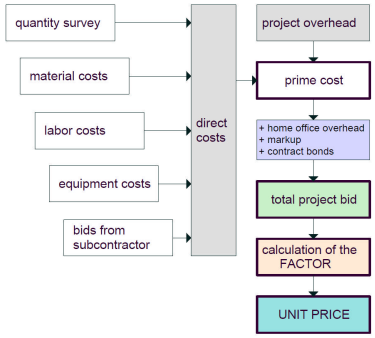
- Measurement of productivity, unit of production rates
  - equipment (time rate)
    - quantity produced / time

for example:
- excavation — m3/h or m3/d
- pouring concrete: — m3/h or m3/d

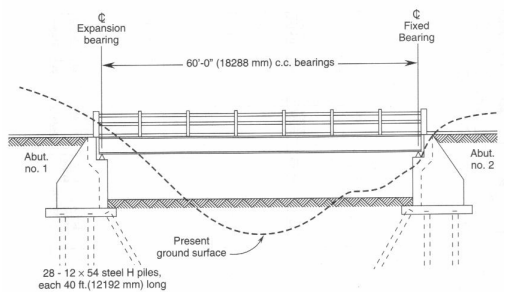
  - labor
    - time / quantity produced

for example:
- pouring concrete and compacting — h/m3
- production of formwork — h/m2
- placement of reinforcing steel — h/t
- placement of prefabricated elements — h/piece

Process of the project cost estimating



Highway bridge



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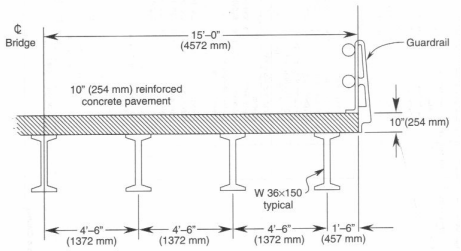


Preparation of the final price estimate

- preparation of a quantity survey
- management input:
  - project organization,
  - major construction methods,
  - sequential order of operations,
  - what construction equipment will be utilized (site organization)
- field supervision
- construction methods
- general time schedule
- construction equipment
- summary sheets

Highway bridge, bid form

Unit Price Schedule

Item No. [1]	Description [2]	Unit [3]	Estimated Quantity [4]	Unit Price [5]	Estimated Amount [6]
1	Excavation, unclassied	m^3	1,274.5		
2	Excavation, structural	m^3	91.7		
3	Backfill, compacted	m^3	259.9		
4	Piling, steel	m	682.8		
5	Concrete, footings	m^3	91.7		
6	Concrete, abutments	m^3	214.1		
7	Concrete, deck slab, 10 in.	m^2	167.2		
8	Steel, reinforcing	kg	40,823.3		
9	Steel, structural	kg	29,710.0		
10	Bearing plates	kg	1,451.5		
11	Guardrail	m	36.6		
12	Paint	ls	job		
			Total Estimated Amount =		

Highway bridge, Quantity survey

Work Quantities

Cost Code	WorkType	Unit	Quantity
	Sitework:		
02220.10	Excavation, unclassied	m^3	1,274.5
02222.10	Excavation, structural	m^3	91.7
02226.10	Backfill, compacted	m^3	259.9
02350.00	Piledriving rig, mobilization & demobilization	ls	job
02361.10	Piling, steel, driving	m	682.8
	Concrete		
03150.10	Footing forms, fabricate	m^2	33.4
03150.20	Abutment forms, prefabricate	m^2	168.2
03157.10	Footing forms, place	m^2	66.9
03159.10	Footing forms, strip	m^2	66.9
03157.20	Abutment forms, place	m^2	336.3
03159.20	Abutment forms, strip	m^2	336.3
03157.30	Deck forms, place	m^2	167.2
03159.30	Deck forms, strip	m^2	167.2
03200.00	Steel, reinforcing, place	kg	40,823.4
03251.30	Concrete, deck, saw joints	m	18.3
03311.10	Concrete, footings, place	m^3	91.7
03311.20	Concrete, abutments, place	m^3	214.1
03311.30	Concrete, deck, place & screed	m^2	167.2
03345.30	Concrete, deck, nish	m^2	167.2
03346.20	Concrete, abutments, rub	m^2	182.1
03370.20	Concrete, abutments, curing	m^2	354.9
03370.30	Concrete, deck, curing	m^2	167.2
	Metals		
05120.00	Steel, structural, place	kg	29,710.3
05520.00	Guardrail	m	36.6
05812.00	Bearing plates	kg	1,451.5

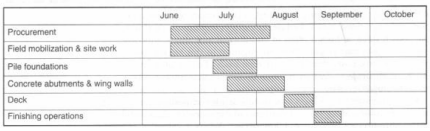
Highway bridge, construction methods

- usually there are more alternatives
- detailed cost study not necessary at every case, because of
  - conventions and experience
  - equipment availability and so on

- sometimes it is needed to make a detailed comparative study to justify which method is more economical, for example:
  - what method of scaffolding to use
  - how to dewater the site
  - how best to brace an excavation and so on

- the principal construction procedures to be used must be identified before the job can be intelligently priced

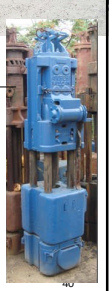
Highway birdge, general time schedule (bar chart)



- time is of prime importance on all projects,
  - in part because most contracts impose a required project completion date on the contractor
  - in part because of project pricing purposes
- many of the job overhead expenses are directly related to the duration of the construction period
- if a calendar of work operations is prepared the estimator can get invaluable information:
  - equipment and labor productivity
  - cold weather operations
  - necessity of multiple shifts or overtime and so on

Highway bridge, construction equipment

- the estimator have to know the type and productivity of the equipments that actually will be used during construction operations
- it is necessary to devise a list of larger equipment needs, e.g.:
  - 50-ton crane equipped with an 80-foot boom: for pouring concrete, placing structural steel, and driving steel piles
  - 7,200-foot-pound double-acting hammer and a 900-cubic-foot-per-minute portable air compressor with hose and connections: for the pile driving
  - a tractor with low-boy trailer and a 25-ton crane: for transport and assembly of the pile driving rig
  - a crawler tractor with bulldozer blade: for the unclassified excavation
  - 1-cubic-yard backhoe: for the structural excavation
  - a flatbed truck
  - a troweling machine
  - a concrete saw



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  - a crawler tractor with bulldozer blade: for the unclassified excavation
  - 1-cubic-yard backhoe: for the structural excavation
  - a flatbed truck
  - a troweling machine
  - a concrete saw

Highway bridge, summary sheets

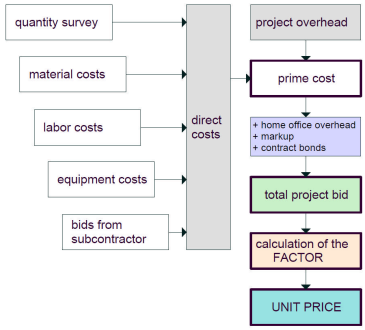
After the quantity survey has been completed and decisions concerning methods and equipment have been made, the total quantities are transferred from the quantity sheets to summary sheets for pricing purposes.

SUMMARY SHEET

Job: Highway Bridge — Bid Item No. 5: Concrete, footings

Cost Code	Work Type	Quantity	Unit	Calculations
03150.10	Footing forms, fabricate	33.45	m^2	**Labor** labor unit cost = $27.98 per m^2 33 x $27.98 = $936 **Material** plyform: $11.30 per m^2 50% salvage 2 uses 33.45 x $11.30 x 50% = $188.99 lumber: $360.00 per m^3 50% salvage 0.03378 m^3/m^2 2 uses 33.45 x $360.0 x 50% x 0.03 = $203 Total this account
03157.10	Footing forms, place	67	m2	**Labor** labor unit cost = $5.38 per m^2 67 x $5.38 = $360.00 **Material** nails, hardware, coatings $3.01 per m^2 67 x $3.01 = $201.34 Total this account
03159.10	Footing forms, strip	67	m2	**Labor** labor unit cost = $2.37 per m^2 67 x $2.37 = $158 Total this account
03311.10	Concrete, footings, place	92	m3	**Labor** foreman 1 @ $34.00 = $34.00 mason 1 @ $32.00 = $32.00 laborers 4 @ $22.00 = $88.00

Process of the project cost estimating



Highway bridge, summary sheet

Summary Sheet

Job: Highway Bridge — Bid Item No. 2: Excavation, structural — Estimator: GAS

Cost Code	Work Type	Quantity	Unit	Calculations	Labor Cost Direct	Labor Cost Indirect	Equipment Cost	Material Cost	Total Cost
32222.10	Excavation, structural	92	m³	**Labor** foreman 1 @ $34.00 = $34.00 operator 1 @ $33.00 = $33.00 laborers 6 @ $22.00 = $132.00 Crew hourly rate = $199.00 production rate = 6.1 m³/hr 92 ÷ 6.1 x $199.00 = $2,985 **Equipment** backhoe 1 @ $37.00 per hr 92 ÷ 6 x $37.00 = $555	$2,985	$746	$555	$0	$4,286
				Total this account	$2,985	$746	$555	$0	$4,286
					$2,985	$746			
Total Bid Item No. 2					$3,731		$555	$0	$4,286

Highway bridge, material costs

- the term „materials" includes all items that become a part of the finished structure, including the electrical and mechanical plant
- the contractor solicits and receives specific price quotations for most of the materials
- written quotations for special job materials are desirable:
  - prices
  - freigth charges
  - taxes
  - delivery schedules
  - guarantees
- material costs must calculate on a common basis, for example,
  - delivered to the job site and without sales tax,
  - included freight, drayage, storage and inspection

Highway bridge, labor costs

- it is the most difficult to estimate accurately
- the estimator must make
  - a complete and thorough job analysis
  - maintain a comprehensive library of unit costs
  - maintain a production rates from past projects
  - obtain advance decisions: how construction operations will be conducted
- basic to determination of the labor cost is the production rate (labor productivity differs from one geographical location to another and varies with season and many other job factors)
- labor cost = direct + indirect labor expenses
- direct labor cost: the workers' basic wage rate (that is, the hourly rates used for payroll purposes)
- indirect labor cost: involves various forms of payroll taxes, insurance and a wide variety of employee fringe benefits (35 – 55 percent addition to direct payroll expenses)

Highway bridge, equipment costs estimating

- it is difficult to estimate accurately as well
- when the nature of the work requires major items of equipment, such as earth-moving machines, concrete plans, and truck cranes, detailed studies of the associated cost must be made
- the calculation based on the duration it will be required on the job
- it is to determine the equipment types and sizes
- equipment often is rented (usually shorter as one year) or leased (one year or more), or purchase and sale
- equipment costs based on the lease or rental rates, in consideration to the time periods of the equipment required
- parts of the costs:
  - operating costs: fuel, oil, grease, filters, repairs and parts, tire replacement and repairs, maintenance labor, and supplies
  - wages of equipment operators (can be treated as a labor cost)
  - depreciation, interest on investment or financing charges, taxes, insurance, and storage (by own equipment)

Highway bridge, bids from subcontractor (subbids)

- the compilation and analysis of subcontractor bids is an important aspect of making up the final project estimate
- the estimator must analyze each subbid to determine exactly what each proposal includes and does not include
- the general contractor is responsible to for providing the subcontractor with certain job-site services, for example:
  - hoisting
  - electricity and water
  - storage facilities for materials and many others
- factors by accepting a subcontractor:
  - Does the subcontractor have a history of reliability and financial stability?
  - Is the subcontractor experienced and equipped to do the type of work involved?
  - Does the company have a good safety record?
- The general contractor must remember that it is completely responsible by contract with the owner for all subcontracted work as well as that performed by its own forces.

Highway bridge, project overhead estimate

- Overhead or indirect expenses are outlays that are incurred in achieving project completion but that do not apply directly to any specific work item.
- Two kind of overhead exist:
  - project overhead: field overhead or job overhead
  - office overhead
- calculation of project overhead
  - as a percentage of the total direct job cost (5 to 15 percent or more),

    the use of percentages when computing filed overhead is not generally considered to be good estimating practice because different projects can and do have widely varying job overhead requirements
  - make a detailed analysis of the particular demands of the project (on a separate overhead sheet)

Highway bridge, project overhead estimate

Project Overhead Estimate

Job: Highway Bridge — Estimator: GAS

Overhead Item	Calculations	Amount	Totals
Project manager	$5,500 x 3.5 mo x 0.5 time =	$9,625.00	
Project superintendent	$5,000 x 3.5 mo =	$17,500.00	
Utilities			
Electricity	$225 / mo		
Telephone	$350 / mo		
Fax	$100 / mo		
	$675 / mo x 3.5 mo =	$2,362.50	
Utility installation charges	(job)	$1,520.00	
Facilities			
Job office	$350 / mo		
2 ea. tool sheds	$600 / mo		
Toilet	$125 / mo		
	$1,075 / mo x 3.5 mo. =	$3,762.50	
Travel expense	$212 / wk x 15 wk =	$3,180.00	
Water tank & water service	$80 / wk x 15 wk =	$1,200.00	
Soil & concrete testing	$600 / mo x 3.5 mo =	$2,100.00	
Scaffolding	$480 / mo x 1 mo =	$480.00	
Trash removal	$190 / mo x 3.5 mo =	$665.00	
Tire repair	$100 / mo x 3.5 mo =	$350.00	
Photographs	$130 / mo x 3.5 mo =	$455.00	
Computer	$140 / mo x 3.5 mo =	$490.00	
	Subtotal of time variable overhead expenses =		$43,690.00
Surveys	(job)	$1,600.00	
Project insurance	(job)	$1,164.00	
First aid	(job)	$220.00	
Sign	(job)	$570.00	
Reproductions	(job)	$400.00	
Fence	$6.56 / m x 207 m =	$1,360.00	
Move In	See calculations, Appendix A	$14,155.20	
Clean Up	See calculations, Appendix A	$6,709.20	
	Subtotal of time constant overhead expenses =		$26,178.40
	Total project overhead =		**$69,868.40**

Highway bridge, home office overhead

- ~ includes general company expenses:
  - office rent,
  - office insurance
  - heat, electricity
  - office supplies
  - furniture,
  - telephone
  - legal costs
  - donations
  - advertising
  - office travel
  - association dues
  - office salaries
- the total of this overhead expense usually ranges from 2 to 8 percent of a contractor's annual business volume
- calculation of the office overhead: as a percentage of the total estimated project expense
- the allowance for office overhead can be added:
  - as a separate line item in the cost estimate, or
  - as a suitable „markup" percentage, or
  - as a fee that includes both home office overhead and profit

Highway bridge, markup

- markup or margin is added at the close of the estimating process
- it is an allowance for profit, office overhead and contingency
- contingency can be a separate component (management philosophy)
- ~ may vary from 5 percent to more than 20 percent of the estimated project cost
- influencing factors:
  - the size of the project and its complexity
  - location of the project
  - provisions of the contract documents
  - the competition
  - the contractor's desire for the work
  - the identity of the owner and/or the architect-engineer and so on
- by adding the markup to the project cost, the estimator develops the project price or the bid price

Highway bridge, contract bonds

- it is a specified form of a financial protection against contractor default
- it has two forms:
  - surety bond is an agreement: a surety company will carry out the contractor's obligations to the owner if the contractor itself fails to do so
  - contractor bond: the general contractor is required to provide the owner with a performance bond and a labor and a material payment bond
- the contractor obtains these bonds from the surety company with which is customarily does business
- this substantial costs is paid by the contractor and must be included in the price estimate of the project
- the bond is based on the total contract amount, it is the last item of expense to be added into the project estimates

Highway bridge, recap sheet

Recap Sheet

Bid Date: April 25, 20

Job: Highway Bridge — Estimator: GAS

Item No.	Bid Item	Unit	Estimated Quantity	Labor Cost	Equipment Cost	Material Cost	Subcontract Cost	Direct Cost	Bid Total	Unit
1	Excavation, unclassified	m^3	1,275	$3,569	$929	$0	$0	$4,497	$6,386	$5.01
2	Excavation, structural	m^3	92	$3,731	$555	$0	$0	$4,286	$6,086	$66.34
3	Backfill, compacted	m^3	260	$3,591	$663	$0	$0	$4,254	$6,040	$23.23
4	Piling, steel	m	683	$21,390	$11,176	$72,281	$0	$104,847	$148,876	$218.05
5	Concrete, footings	m^3	92	$3,661	$685	$12,185	$0	$16,531	$23,473	$255.85
6	Concrete, abutments	m^3	214	$37,458	$7,104	$30,541	$0	$75,103	$106,641	$498.15
7	Concrete, deck slab, 10 in.	m^2	167	$11,745	$1,790	$8,020	$0	$21,554	$30,606	$183.02
8	Steel, reinforcing	kg	40,823	$0	$0	$0	$66,240	$66,240	$94,056	$2.304
9	Steel, structural	kg	29,710	$4,220	$1,680	$73,687	$0	$79,588	$113,009	$3.804
10	Bearing plates	kg	1,451	$1,943	$420	$3,250	$0	$5,613	$7,970	$5.49
11	Guardrail	m	37	$1,664	$420	$5,826	$0	$7,910	$11,231	$307.06
12	Paint	ls	job	$0	$0	$0	$8,550	$8,550	$12,140	$12,140.39
			Totals	$92,972	$25,422	$205,790	$74,790	$398,974	$566,514	

Job overhead		$69,868
		$468,842
Small tools (5% of labor)		$4,649
		$473,491
Tax	3%	$14,205
		$487,695
Markup	15%	$73,154
		$560,850
Bonds		$5,665
Total Project Bid		$566,514

Factor = $566,514 / $398,974 = 1.4199

Highway bridge, completed bid form

Unit Price Schedule

Item No. [1]	Description [2]	Unit [3]	Estimated Quantity [4]	Unit Price [5]	Estimated Amount [6]
1	Excavation, unclassified	m^3	1,275	$5.01	$6,385.31
2	Excavation, structural	m^3	92	$66.34	$6,086.17
3	Backfill, compacted	m^3	260	$23.34	$6,038.61
4	Piling, steel	m	683	$218.05	$148,874.07
5	Concrete, footings	m^3	92	$255.85	$23,473.36
6	Concrete, abutments	m^3	214	$498.15	$106,641.64
7	Concrete, deck slab, 10 in.	m^2	167	$183.02	$30,605.61
8	Steel, reinforcing	kg	40,823	$2.304	$94,056.91
9	Steel, structural	kg	29,710	$3,804	$113,016.84
10	Bearing plates	kg	1,451	$5.49	$7,968.71
11	Guardrail	m	37	$307.06	$11,231.03
12	Paint	ls	job	$12,140.39	$12,140.39
				Total Estimated Amount =	$566,518.65

Assuming that our contractor is the successful bidder, it must now restructure its estimate into a more suitable format for subsequent cost control of the actual construction work.
This involves the preparation of the control budget.

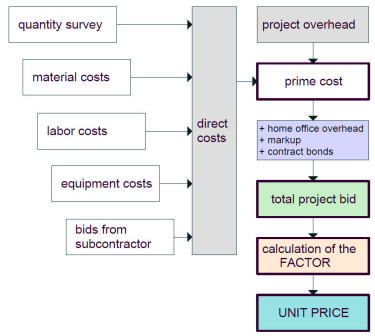
Highway bridge, project budget

Project Budget

Job: Highway Bridge — Estimator: GAS

Cost Code	Work Type	Quantity	Unit	Direct Labor Cost	Labor Unit Cost	Equipment Cost	Equipment Unit Cost	Material Cost
	General Requirements							
01500.00	Move In	ls	1	$8,112	$8,112	$3,204	$3,204	$0
01700.00	Clean Up	ls	1	$4,248	$4,248	$1,240	$1,240	$0
			Subtotals	$12,360		$4,444		$0
	Sitework							
02220.10	Excavation, unclassified	1,275	m^3	$2,643	$2.07	$929	$0.73	$0
02222.10	Excavation, structural	92	m^3	$2,985	$32.54	$555	$6.05	$0
02226.10	Backfill, compacted	260	m^3	$2,872	$11.05	$663	$2.55	$0
02350.00	Piledriving rig, mobilization & demobilization	job	ls	$6,528	$6,528.00	$5,448	$5,448.00	$300
02361.10	Piling, steel, driving	683	m	$8,224	$12.05	$5,728	$8.39	$71,981
			Subtotals	$23,253		$13,323		$72,281
	Concrete							
03150.10	Footing forms, fabricate	33	m^2	$936	$27.99	$0	$0.00	$392
03150.20	Abutment forms, prefabricate	168	m^2	$3,548	$21.10	$0	$0.00	$2,153
03157.10	Footing forms, place	67	m^2	$360	$5.38	$0	$0.00	$201
03159.10	Footing forms, strip	67	m^2	$158	$2.37	$0	$0.00	$0
03157.20	Abutment forms, place	336	m^2	$7,311	$21.74	$2,520	$7.49	$1,014
03159.20	Abutment forms, strip	336	m^2	$3,511	$10.44	$840	$2.50	$0
03157.30	Deck forms, place	167	m^2	$3,190	$19.08	$420	$2.51	$1,890
03159.30	Deck forms, strip	167	m^2	$1,460	$8.73	$210	$1.26	$0
03251.30	Concrete, deck, saw joints	18	m	$360	$19.68	$110	$6.01	$0
03311.10	Concrete, footings, place	92	m^3	$1,200	$13.08	$685	$7.47	$11,592
03311.20	Concrete, abutments, place	214	m^3	$9,088	$42.45	$3,744	$17.49	$27,048
03311.30	Concrete, deck, place & screed	167	m^2	$1,200	$7.18	$980	$5.86	$5,410
03345.30	Concrete, deck, finish	167	m^2	$2,250	$13.45	$70	$0.42	$630
03346.20	Concrete, abutments, rub	182	m^2	$3,763	$20.66	$0	$0.00	$235
03370.20	Concrete, abutments, curing	355	m^2	$244	$0.69	$0	$0.00	$92
03370.30	Concrete, deck, curing	167	m^2	$108	$0.65	$0	$0.00	$90
			Subtotals	$38,688		$9,579		$50,746
	Metals							
05120.00	Steel, structural, place	29,710	kg	$2,910	$0.10	$1,680	$0.06	$73,687
05520.00	Guardrail	37	m	$1,216	$33.25	$420	$11.48	$5,826
05812.00	Bearing plates	1,451	kg	$1,340	$0.92	$420	$0.29	$3,250
			Subtotals	$5,466		$2,520		$82,763

Sum up: process of the project cost estimating



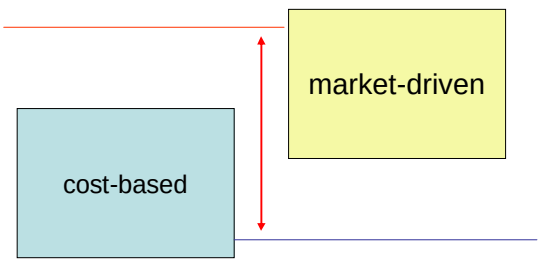
Profit = revenues - costs

Profit: the ultimate goal, which is the guarantor and quantitative indicators of successful activity.

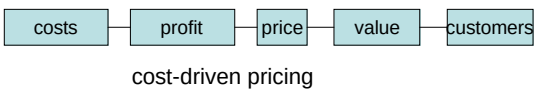
Revenues: it depends on the circumstances of the market
- Price level
- Customers' ability to pay,
- The company's position in the market (what can?)
- The customers' needs
- Market price level of competitors.

Costs: depends on the circumstances of the company
- Material prices, prices of finished and semi-finished products,
- Energy prices,
- Transportation costs
- Labor and equipment costs,
- Other service charges,
- General costs (overheads).

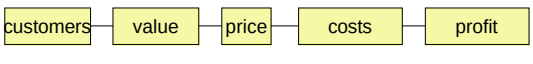
Pricing methods



The cost-driven and market-driven pricing has a different logic



cost-driven pricing



market-driven pricing

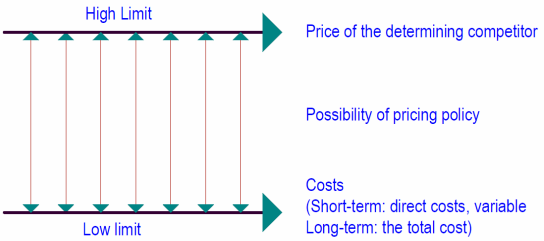
Pricing methods

cost-based pricing:
- total cost plus profit pricing
- target return pricing

market-driven pricing:
- pricing according to perceived value
- competitive strategy based on competitors
- capacity-based pricing
- competitive tendering (procurement)

Market-driven pricing

driven pricing actions by competitors



Market-driven pricing

Capacity-based pricing

For example: agent, commission or advisory contracts

Competitive tendering (procurement)

Act CXXIX. 2003. Government Procurement Law

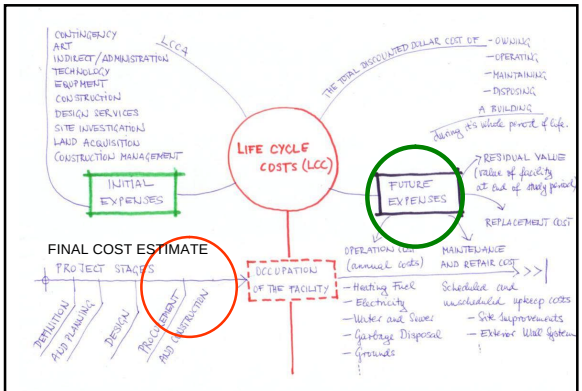
The role of the bid preparation is as follows:
knowledge of the marketplace,
the estimate of expert,
planning,
scientific methods,
the statistical analysis.

Detailed analysis of the three factors are required:
the company itself
the buyer and
the competitors.

Market-driven pricing

Competitive tendering (procurement)

Costs of the project (€) A	Tender prices (€) B	Profit (€) B - A	The probability of winning P	Expected profit (€) Px(B-A)
500 000	400 000	–100 000	1,00	–100 000
500 000	450 000	–50 000	0,95	–47 500
500 000	500 000	0	0,90	0
500 000	550 000	50 000	0,85	42 500
500 000	600 000	100 000	0,80	80 000
500 000	650 000	150 000	0,70	105 000
500 000	700 000	200 000	0,60	120 000
500 000	**750 000**	**250 000**	**0,50**	**125 000**
500 000	800 000	300 000	0,40	120 000
500 000	850 000	350 000	0,30	105 000
500 000	900 000	400 000	0,20	80 000
500 000	950 000	450 000	0,10	45 000
500 000	1 000 000	500 000	0,00	0



Summary

Thank you very much for your attention.

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