



# مدیریت مالی، حسابداری و هزینه در پروژه ها و سازمان های پروژه محور

بخش هفتم:

مدیریت هزینه: برآورد هزینه و قیمت پروژه

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

## What you will learn?

- ☐ Purpose of this session
- ☐ Introduction to cost estimating
- ☐ Common types of estimates
- ☐ Other types of estimates
- ☐ Estimates during the life cycle of the project
- ☐ Types of costs
- ☐ Project time schedule
- ☐ Time-cost tradeoff
- ☐ Direct cost
- ☐ Indirect cost
- ☐ Bid price
- ☐ Computer-based estimating
- ☐ Cost models
- ☐ Project budget
- ☐ Key points

# **How To Prepare Cost Model?**



## Cost models

- ❑ The **project estimate** is the **most detailed** and **complete cost model** of the project; however **many other cost models** are used by the **project manager** to **track** and **manage** costs throughout the project. They include:
- ❖ **Project budget** used as a basis for the **cost-control system**.
  - ❖ **Project cost breakdown** or **schedule of values** defining **how** the **client** will be **billed** throughout the project.
  - ❖ **Progress estimates** used as a basis for **monthly billings**.
  - ❖ **Change order estimates** evaluating the **cost of additional** (or eliminated) work.
  - ❖ **Project cash flow** used to **track** the **flow of money into** and **out** of the project.
  - ❖ **Project completed estimate**, a key document for the **post-project review** that defines how much the **project actually cost** and **how** the **money was spent**.

## Project budget

- ❑ When the **contractor** is recognized as the **successful bidder**, the **estimate** must be restructured into a **more suitable format** for **subsequent cost control** of the actual construction work.
  - ❖ This involves the **preparation** of the job cost ledger that the project manager will use for **cost-control purposes** during the **construction phase**.
- ❑ Converting the project estimate developed as a **basis to bid** or **negotiate** the job is an excellent way for the **project manager** to become **very familiar** with the project estimate and to **take ownership for the project estimate**.
  - ❖ During this process, the project manager **may** work with the **estimator** to resolve any **discrepancies** between figures in the project estimate and the project manager's determination.

What is the difference between  
Cost Control and Cost Accounting?

## Project budget

### CII RS6-5

**Cost Control vs. Cost Accounting.** Cost control is obviously important on any project. It is appropriate here to distinguish between cost accounting and cost control. Cost accounting is concerned with tracking receipts and expenditures of importance to good bookkeeping and accepted accounting practice. The structure for such accounting must be in accordance with accepted rules of accounting and serve whatever requirements there may be that relate to contract payment provisions, taxation, regulation, or project capitalization. Cost accounting also will reflect the pricing of a contract which may differ significantly from its costing (because of unbalancing and the tracking of indirect accounts such as profit and distributables). Field construction managers are concerned with cost — what specific operations should and do cost. The structure they will use for this control is the CBS, one level of which will contain the Control Accounts. These are the accounts against which actual costs are collected and compared to those budgeted. They are often at a more summary level than the crew reporting level. The CBS seldom will have the same structure as that used for cost accounting.

### How to prepare budget baseline?

## Project budget

### CII RS6-5

**Budget Baselines.** The budget baselines for a project are generated through the **estimating process**. Whether or not the **design documents** are **complete**, planners must develop a cost estimate for the project. If the project has **yet to be fully defined**, this estimate is **approximate** and subject to some variation. As the project becomes better defined, the estimates are updated to reflect the new information.

For a **fixed-price project**, good estimating is critical because the estimate establishes the **costs of all direct work** as well as the **total contract price** which incorporates all elements of **direct cost plus field overhead, contingency, general overhead, and a reasonable profit**. The estimate also provides all **quantity, cost, and productivity targets** to be used for **detailed control**. As explained in Reference 2, the **estimate** will have been prepared using the **same WBS** as that **used for the Control Schedule**. This directly enables the **production of quantity, cost, and productivity targets** for each control **work package**.

### How to prepare an integrated cost model?

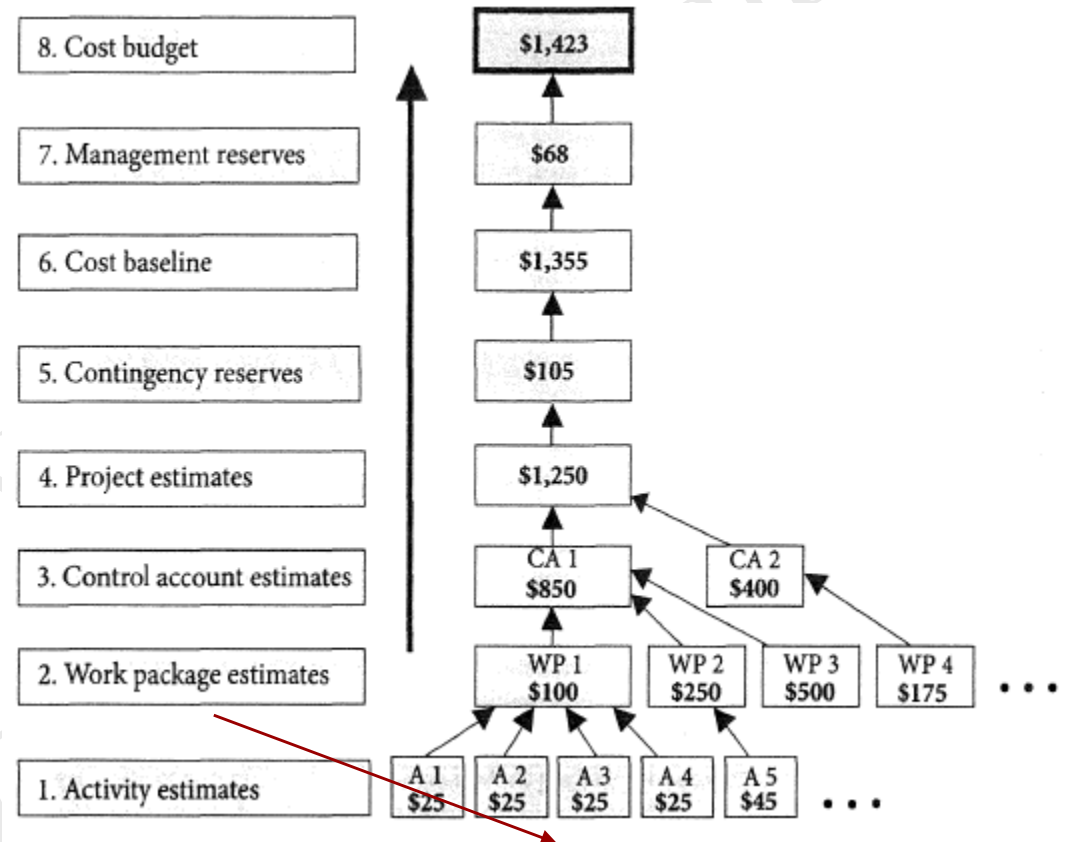
## Cost accounts for integrated project management

In large and complex projects, it is advantageous to break the project into common building blocks for control both of cost and time. The concept of a common unit within the project that integrates both scheduling and cost control has led to the development of the work breakdown approach. The basic common denominator in this scheme is the work package, which is a subelement of the project on which both the cost and time data are collected for project status reporting. The collection of time and cost data based on work packages has led to the term *integrated project management*. That is, the status reporting function has been integrated at the level of the work package. The set of work packages in a project constitutes its work breakdown structure (WBS).

**What is the  
procedure?**

## Cost accounts for integrated project management

- ❑ **Cost estimates** are aggregated by work packages in accordance with the WBS and are often referred to as construction work packages (CWPs).
- ❑ **Work packages** most often include all labor, material, equipment, and subcontractor costs.
- ❑ Work package cost estimates are aggregated for the **higher component levels of WBS**, such as **control accounts**, for the entire project.



**So how to develop work packages within this concept?**  
**Be patient!**  
**We need to define schedule levels first.**

## Cost accounts for integrated project management – Schedule levels

### CII RS6-5

**Schedule Levels.** The various participants in a construction contract have different levels of interest in the scheduling of the project. The owner and the contractor's home office are interested in summary level schedules. Project level personnel are interested in more detail. Thus, there are various schedule levels. While there is no universal agreement as to the number of schedule levels and their format, the following are representative.

- Level 0** This is the total project and is, in effect, a single bar spanning the time from start to finish.
- Level 1** This schedules the project by its major components. For example, a Level 1 schedule for a process plant may be divided into process area, storage and handling area, site and services, and utilities. It is shown in barchart format and may include key milestones.
- Level 2** Each of the Level 1 components is further subdivided. For example, utility systems are broken down into water, electrical, gas, and sanitary. In most cases, this schedule level can be shown only in barchart format, although a barchart with key constraints may be possible. Milestones are normally included.
- Level 3** The subdivision continues. This is probably the first level that a meaningful logic diagram can be developed. It is also a good level for the project's overall Control Schedule because it is neither too much of a summary nor too detailed.
- Levels 4-X** The subdivision continues to the level of detail needed by the user. When operating at these more detailed levels, the planner generally works with less than the total schedule. In most cases, these "look-ahead" schedules span periods of from 30-180 days. The user may utilize either barchart or CPM format for these schedules.

## Cost accounts for integrated project management – Schedule levels

**CII RS6-5**

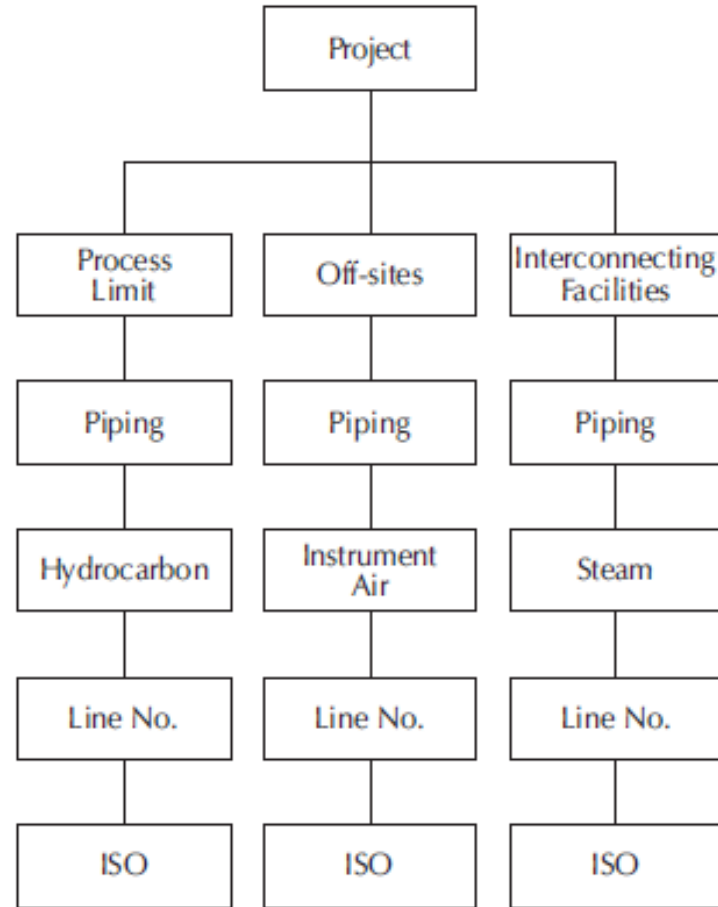
### DESCRIPTION

Total Project

### LEVEL

0

Area



1

Category

2

Sub-Category

3

Group

4

Sub-Group  
(Task)

5

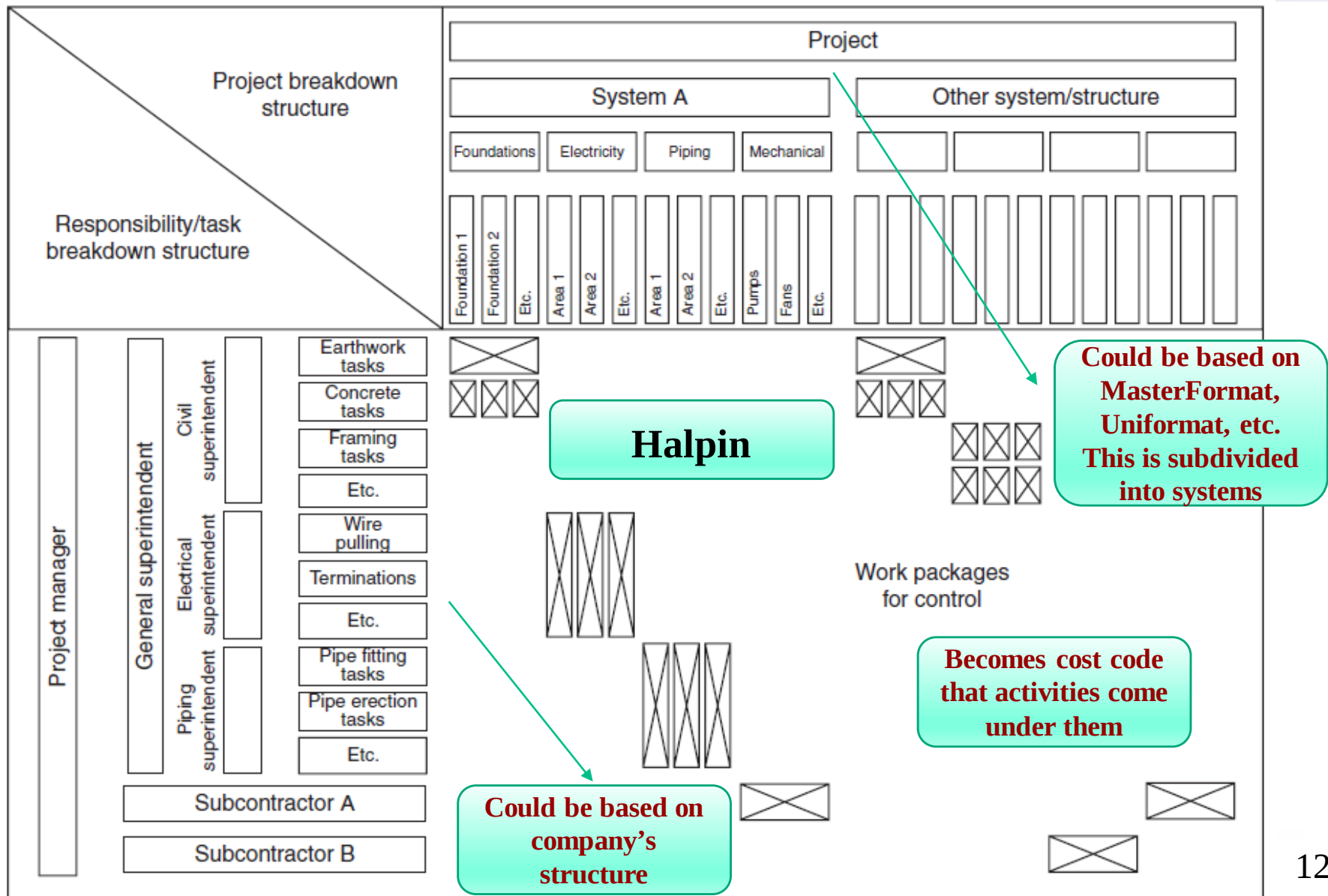
**Control account**

**Control account or Work package**

**How work packages  
would be developed?**

Figure 1. Piping Work Breakdown Structure

## Cost accounts for integrated project management – Work packages



## Cost accounts for integrated project management – Work packages

### Sears

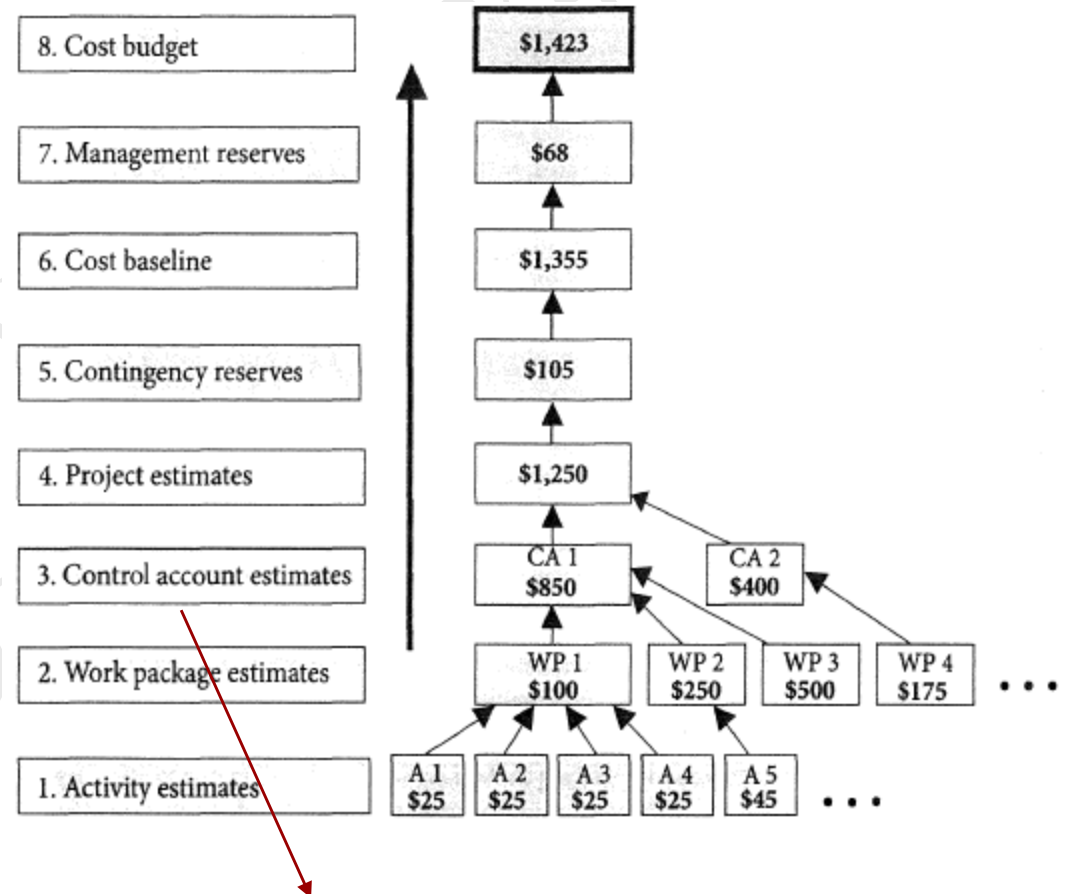
| Job: Highway Bridge         |                                                | Project Budget |      |                   |                 |                |                     | Estimator: GAS |
|-----------------------------|------------------------------------------------|----------------|------|-------------------|-----------------|----------------|---------------------|----------------|
| Cost Code                   | Work Type                                      | Quantity       | Unit | Direct Labor Cost | Labor Unit Cost | Equipment Cost | Equipment Unit Cost | Material Cost  |
| <b>General Requirements</b> |                                                |                |      |                   |                 |                |                     |                |
| 01500.00                    | Move in                                        | 1s             | 1    | \$8,112           | \$8,112         | \$3,204        | \$3,204             | \$0            |
| 01700.00                    | Clean up                                       | 1s             | 1    | \$4,248           | \$4,248         | \$1,240        | \$1,240             | \$0            |
| Subtotals                   |                                                |                |      | \$12,360          |                 | \$4,444        |                     | \$0            |
| <b>Sitework</b>             |                                                |                |      |                   |                 |                |                     |                |
| 32220.10                    | Excavation, unclassified                       | 1,667          | cy   | \$2,643           | \$1.59          | \$929          | \$0.56              | \$0            |
| 32222.10                    | Excavation, structural                         | 120            | cy   | \$2,985           | \$24.88         | \$555          | \$4.63              | \$0            |
| 32226.10                    | Backfill, compacted                            | 340            | cy   | \$2,873           | \$8.45          | \$663          | \$1.95              | \$0            |
| 31350.00                    | Piledriving rig, mobilization & demobilization | 1job           | ls   | \$6,528           | \$6,528.00      | \$5,448        | \$5,448.00          | \$300          |
| 31361.10                    | Piling, steel, driving                         | 2,240          | lf   | \$8,224           | \$3.67          | \$5,728        | \$2.56              | \$71,979       |
| Subtotals                   |                                                |                |      | \$23,253          |                 | \$13,323       |                     | \$72,279       |
| <b>Concrete</b>             |                                                |                |      |                   |                 |                |                     |                |
| 03150.10                    | Footings forms, fabricate                      | 360            | sf   | \$936             | \$2.60          | \$0            | \$0.00              | \$392          |
| 03150.20                    | Abutment forms, prefabricate                   | 1,810          | sf   | \$3,548           | \$1.96          | \$0            | \$0.00              | \$2,153        |
| 03157.10                    | Footings forms, place                          | 720            | sf   | \$360             | \$0.50          | \$0            | \$0.00              | \$202          |
| 03159.10                    | Footings forms, strip                          | 720            | sf   | \$158             | \$0.22          | \$0            | \$0.00              | \$0            |
| 03157.20                    | Abutment forms, place                          | 3,620          | sf   | \$7,312           | \$2.02          | \$2,520        | \$0.70              | \$1,014        |
| 03159.20                    | Abutment forms, strip                          | 3,620          | sf   | \$3,511           | \$0.97          | \$840          | \$0.23              | \$0            |
| 03157.30                    | Deck forms, place                              | 1,800          | sf   | \$3,190           | \$1.77          | \$420          | \$0.23              | \$1,890        |
| 03159.30                    | Deck forms, strip                              | 1,800          | sf   | \$1,460           | \$0.81          | \$210          | \$0.12              | \$0            |
| 03251.30                    | Concrete, deck, saw joints                     | 60             | lf   | \$360             | \$6.00          | \$110          | \$1.83              | \$0            |
| 03311.10                    | Concrete, footings, place                      | 120            | cy   | \$1,200           | \$10.00         | \$685          | \$5.71              | \$11,592       |
| 03311.20                    | Concrete, abutments, place                     | 280            | cy   | \$9,088           | \$32.46         | \$3,744        | \$13.37             | \$27,048       |
| 03311.30                    | Concrete, deck, place & screed                 | 200            | sy   | \$1,200           | \$6.00          | \$980          | \$4.90              | \$5,410        |
| 03345.30                    | Concrete, deck, finish                         | 1,800          | sf   | \$2,250           | \$1.25          | \$70           | \$0.04              | \$630          |
| 03346.20                    | Concrete, abutments, rub                       | 1,960          | sf   | \$3,762           | \$1.92          | \$0            | \$0.00              | \$235          |
| 03370.20                    | Concrete, abutments, curing                    | 3,820          | sf   | \$244             | \$0.06          | \$0            | \$0.00              | \$92           |
| 03370.30                    | Concrete, deck, curing                         | 1,800          | sf   | \$108             | \$0.06          | \$0            | \$0.00              | \$90           |
| Subtotals                   |                                                |                |      | \$38,689          |                 | \$9,579        |                     | \$50,747       |
| <b>Metals</b>               |                                                |                |      |                   |                 |                |                     |                |
| 05120.00                    | Steel, structural, place                       | 65,500         | lb   | \$2,911           | \$0.04          | \$1,680        | \$0.03              | \$73,688       |
| 05520.00                    | Guardrail                                      | 120            | lf   | \$1,216           | \$10.13         | \$420          | \$3.50              | \$5,826        |
| 05812.00                    | Bearing plates                                 | 3,200          | lb   | \$1,340           | \$0.42          | \$420          | \$0.13              | \$3,250        |
| Subtotals                   |                                                |                |      | \$5,467           |                 | \$2,520        |                     | \$82,764       |

### Work package oriented cost accounts

## Cost accounts for integrated project management – Control account

- ❑ Each control account is assigned a **unique code or account number** that links directly to the performing organization's accounting system.

- ❖ A cost breakdown structure (CBS) is sometimes developed as a **mapping tool** between
  1. Project WBS
  2. Organization code of accounts
  - to aid in reporting costs.



Let's see more about control account

## Cost accounts for integrated project management – Control account

### CII RS6-5

References 2 and 3 explain the use of both a Cost Breakdown Structure (CBS) and a Work Breakdown Structure (WBS) in the planning and controlling of construction. The CBS is a breakdown of all cost elements within a total project, both direct and indirect. The WBS is a part of the CBS, but includes only those CBS elements against which progress is tracked.

Let's see the control account baseline

## Cost accounts for integrated project management – Control account

# CII RS6-5

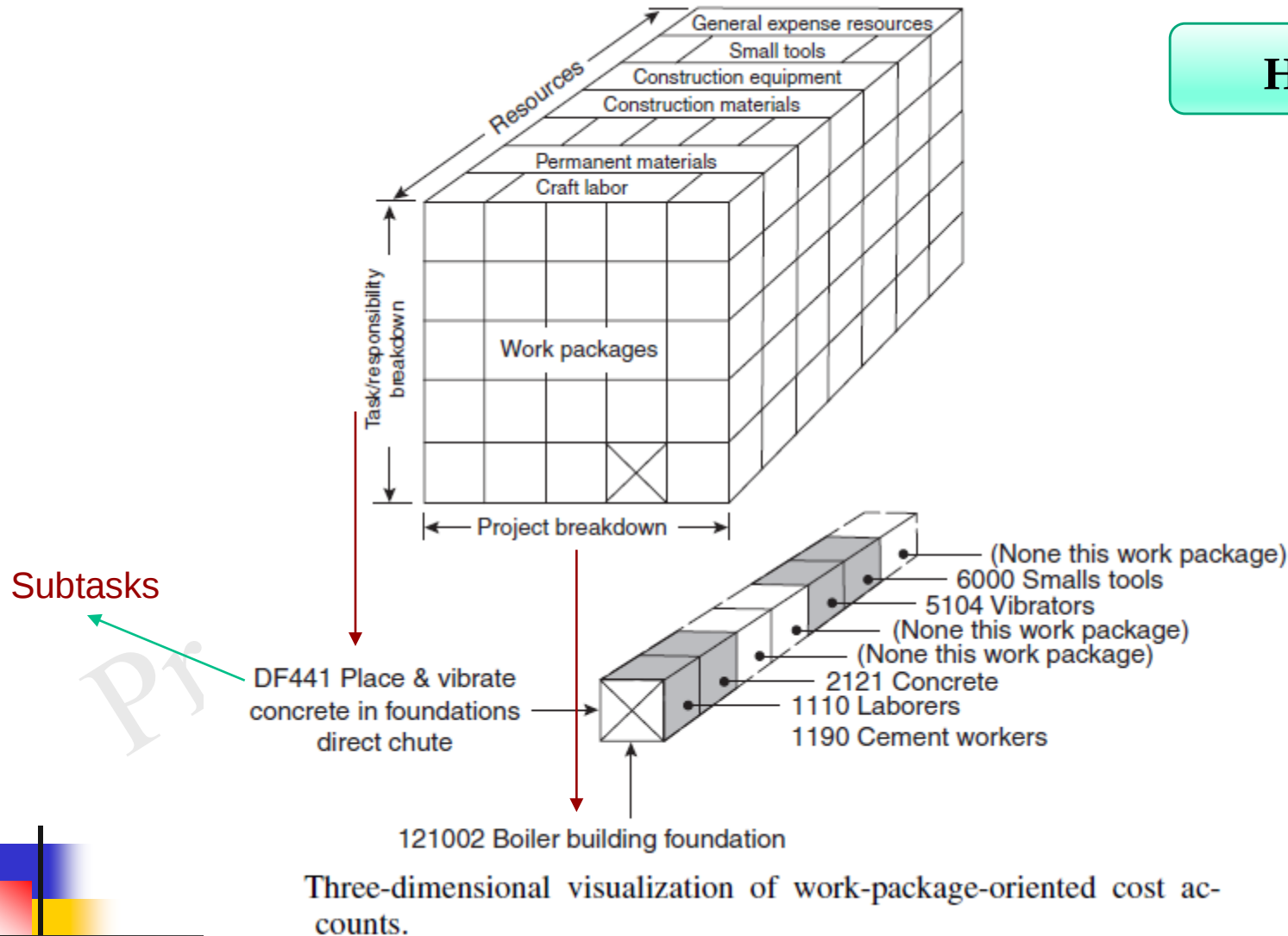
**This is developed in the  
work package levels**

|                                                                                            |                            |           |                 |                      |             |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
|--------------------------------------------------------------------------------------------|----------------------------|-----------|-----------------|----------------------|-------------|------|------|------------|------|------|------------|------------|---|---|---|---------------|--|---------|--|--|
| Control Account Baseline                                                                   |                            |           |                 | Project _____        |             |      |      | Date _____ |      |      |            | Rev. _____ |   |   |   |               |  |         |  |  |
| Account Code                                                                               |                            |           |                 | Description          |             |      |      |            |      |      |            |            |   |   |   | Total Control |  |         |  |  |
| <div>S</div> <div>W</div> <div>P</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> |                            |           |                 | Service Water Piping |             |      |      |            |      |      |            |            |   |   |   | W-H<br>3000   |  |         |  |  |
| Weight                                                                                     | Activity                   | U/M       | Latest Estimate | 1985                 |             |      |      |            |      |      |            |            |   |   |   | 1986          |  |         |  |  |
|                                                                                            |                            |           |                 | D                    | J           | F    | M    | A          | M    | J    | J          | A          | S | O | N | D             |  |         |  |  |
| 0.25                                                                                       | Large Hangers              | EA        | 100             |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
| 0.50                                                                                       | Large Pipe                 | LF        | 2000            |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
| 0.10                                                                                       | Large Vaves                | EA        | 10              |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
| 0.15                                                                                       | Large Pipe Weld            | EA        | 150             |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
| 0.25                                                                                       | Small Pipe                 | LF        | 1500            |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
|                                                                                            |                            |           | ABC1234         |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  | KKR3862 |  |  |
|                                                                                            |                            |           |                 |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
|                                                                                            |                            |           | EFG7234         |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  | EYW4493 |  |  |
|                                                                                            |                            |           |                 |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
|                                                                                            |                            |           |                 |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
|                                                                                            |                            |           |                 |                      | <div></div> |      |      |            |      |      |            |            |   |   |   |               |  |         |  |  |
| Total Control<br>1.00                                                                      | Control Item<br>Large Pipe | U/M<br>LF | Qty<br>2000     | W-H                  | 380         | 660  | 510  | 560        | 660  | 230  | Total      |            |   |   |   |               |  |         |  |  |
|                                                                                            |                            |           |                 | W-H                  | 380         | 1040 | 1550 | 2110       | 2770 | 3000 | Cumulative |            |   |   |   |               |  |         |  |  |
|                                                                                            |                            |           |                 | %                    | 13          | 35   | 52   | 70         | 92   | 100  | Cumulative |            |   |   |   |               |  |         |  |  |

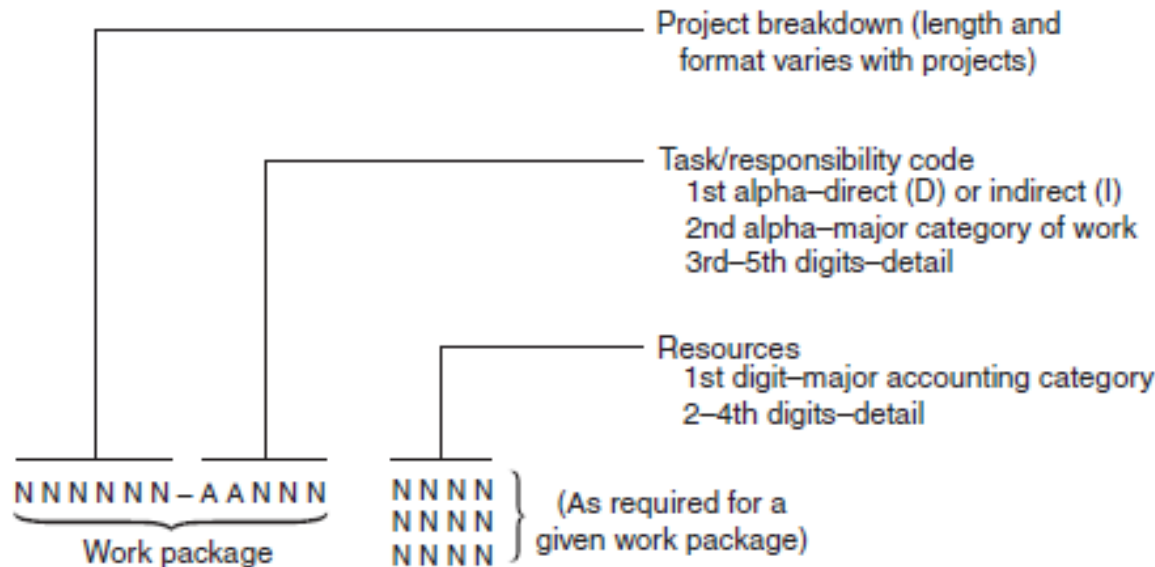
Figure 2. Control Account Baseline

## Cost accounts for integrated project management – Cost code structure

Halpin



## Cost accounts for integrated project management – Cost code structure



Halpin

Basic cost code structure.

A cost code structure to reflect this matrix structure is given in Figure. This 15-digit code defines units for collecting information in terms of work package and resource type. Resource usage in terms of monetary units, quantities, man-hours, and equipment-hours for a foundation in the boiler building would be collected under work package code 121002. If this work relates to placement and vibration of concrete by using a direct chute, the code is expanded to include the alphanumeric code DF441. The resource code for the concrete is 2121. Therefore, the complete code for concrete in the boiler building foundations placed by using a chute would be 121002-DF441-2121.

What about the connection between **subtasks** and **work package**?

ذکر مطالب فوق تنها در صورت ذکر منبع بلامانع است.

## Cost accounts for integrated project management – Cost code structure

### Halpin

This code allows collection of cost data at a very fine level. Scheduling of this work is also referenced to the work package code as shown in Figure . The schedule activities are shown in this figure as subtasks related to the work package.

What if the working schedule changed?

## Cost accounts for integrated project management – Cost code structure

### CII RS6-5

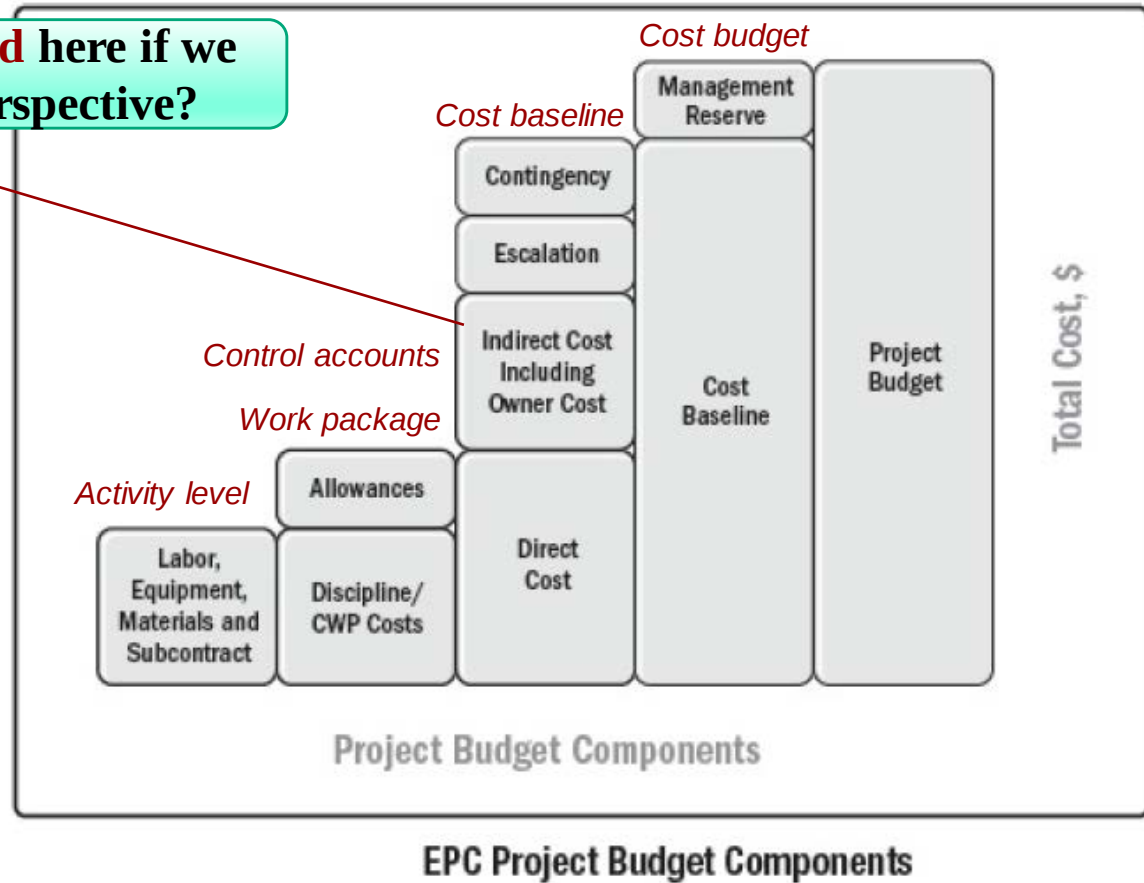
**Control vs. Working Schedule.** A number of schedules will be utilized over the life of the project. When the project is first planned, the **Original Control Schedule** is developed. When an owner-approved change is received which changes the schedule, the **Original Control Schedule** is modified to create the **Current Control Schedule**. (A copy of the Original Control Schedule will be maintained for historical purposes.) The **Current Control Schedule** subsequently will be modified with each owner-approved change. Reporting of ahead or behind status is always based on a comparison to this **Current Control Schedule**. Some owners may also require reporting of ahead or behind status against the **Original Control Schedule** as well. None of the **Control Schedules** are changed to accommodate variances in field performance by the constructors — a **Control Schedule** remains a reference baseline.

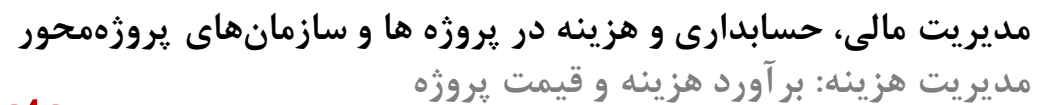
### How to develop the baseline in EPC projects?

## Project budget – EPC projects

Should we add **general overhead** here if we see the cost from the GC's perspective?

**PMBOK  
Extension**





### Example of EPC Estimate Summary

By: Alavipour, PhD, PM

## Project budget – EPC projects

Next year I will add one **important update**  
about planning and budgeting of  
Engineering Projects

**DON'T WORRY**  
**Association members** will have it

## Key points

- ☐ The **project manager** works with **many cost models** throughout the project.
- ☐ The **project manager** may not be involved in **developing** the **project estimate** but becomes **responsible** for it when the **project is handed off**.
- ☐ **Progress and change estimates** are **developed** throughout the **project** by the **project manager**.

**What will be added next year?**

## Activity-based costing

# Activity-based costing

**I will teach you this in the online sessions of this course**

**DON'T WORRY**  
**Association members will have it**



# مدیریت مالی، حسابداری و هزینه در پروژه ها و سازمان های پروژه محور

بخش هشتم:

مدیریت هزینه: تعیین درصد سود برای مناقصه

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

## What you will learn?

- ☐ Purposes of this session
- ☐ The profit equation
- ☐ Contribution margin
- ☐ Break-even volume of work
- ☐ Break-even contribution margin ratio
- ☐ Adjusting the financial mix
- ☐ Profit and overhead markup

## Purposes of the this session

- ☐ Learn to set **profit margins** for use in **bidding**
- ☐ Learn how to **calculate** the **profit changes** as the **volume of work changes**
- ☐ Learn to **determine** the **volume** of project work and **profit** and **overhead markup** necessary to **cover** the costs **associated** with the **general overhead**

## Indirect cost – How to allocate general overhead?

3. A suitable **“markup” percentage** can be added:

1. Contribution margin
  2. Break-even contribution margin ratio
  3. P & O Markup
- ✓ Markup % = (General overhead % + profit % + contingency %)
  - ✓ We teach you how to **calculate this %**

## Introduction - Assumptions

- ❑ To **successfully operate a company**, the **company's managers** must understand **how** a company **generates profit**.
- ❑ We will **assume** that all of the **equipment costs** will be **allocated** to the **construction costs** during the **course of the year**; therefore, the **company's net equipment costs** will be **zero**.
- ❑ We assume that **other income and expense** is **zero** in our calculations.

## The profit equation

- ❑ The **revenues** are in the form of **payments** from the **project owners** **or** from the **sale of projects**
- ❑ These **revenues** are then used for **three key items**:
  - ❖ To **pay** the **project costs**,
  - ❖ To **pay** the **general overhead costs**, and
  - ❖ To **provide** the **profit** for the investors.

### BIG W CONSTRUCTION INCOME STATEMENT

#### REVENUES

#### CONSTRUCTION COSTS

Materials  
Labor  
Subcontract  
Equipment  
Other  
Total Construction Costs

#### EQUIPMENT COSTS

Rent and Lease Payments  
Depreciation  
Repairs and Maintenance  
Fuel and Lubrication  
Taxes, Licenses, and Insurance  
Equipment Costs Charged to Jobs  
Equipment Costs Charged to Employees  
Total Equipment Costs

#### GROSS PROFIT

#### OVERHEAD

#### NET PROFIT FROM OPERATIONS

#### OTHER INCOME AND EXPENSE

#### PROFIT BEFORE TAXES

#### INCOME TAX

#### PROFIT AFTER TAXES

## The profit equation

Holm

$$\begin{aligned}\text{Revenue} &= \text{Construction cost} + \text{Fee} \\ \text{Fee} &= \text{Home office overhead} + \text{Profit (OH\&P)}\end{aligned}$$

This chapter discusses the creation of the home office general conditions (GCs) or overhead estimate and management of that estimate which is a chief financial and executive officers' (CFO and CEO) responsibility. It is very unlikely that most project managers will ever see their corporate GCs estimate, unless they become an officer in the company. The construction company must produce enough revenue from its jobsites to pay for the home office GCs. If the total fee from the jobsite exactly equals the home office GCs costs, then the company has just broken even. It is the ultimate goal of each project team to provide sufficient fees, beyond the breakeven point, to return a net profit which can be returned to equity partners or invested back into the company. Producing enough fee to break even is important, but it is not enough.

## The profit equation

When are general conditions not general conditions? 'General conditions' is a generic term, which has different meanings to different parties in different situations, but it is still important that it be used properly. GCs are general, in that they do not have a specific focus. In the case of the home office, the GCs funds the financing of the operations of the company, which is outside of and not applicable to individual jobsite operations. Essentially if there were not any construction projects, the company would still have GCs activities and costs, but it then would not be in business for very long. Similar to the list presented in Chapter 5, some alternate terms or use of the phrase GCs include:

- American Institute of Architects (AIA) A201 is a general conditions contract attachment to most standard AIA contracts;
- Construction Specifications Institute (CSI) divisions 00 and 01 include general conditions but more often designated supplemental or special conditions to the contract;
- Overhead or overhead costs or general overhead;
- Indirect costs, in that they are not direct to the cost of construction;
- General requirements;
- General and administrative costs often are how general conditions or overhead is described by public entities;
- Distributable costs is another name for general conditions, as overhead is distributed over the costs of the entire company operations and not attributed to any particular project or construction activity;
- Administration or administrative or operational costs;
- Overhead and profit is known as fee for contractors. If the contractor anticipated 2% home office general conditions cost and desired a 3% profit, they would bid a project with a 5% fee; and
- Overhead for consulting companies includes the cost of the work plus profit. There is not any profit factored into overhead for contractors.



## The profit equation

❑ **Revenues** = Project Costs (including project overhead)

+ General overhead + Profit

❑ **Gross profit** is calculated by:

❖  $Gross\ profit = Revenues - Project\ Costs$   
(including project overhead)

❑ **Pretax profit** is calculated by:

❖  $Profit\ before\ taxes = Revenues - Project\ Costs$   
(including project overhead) – General overhead

❖ What if **other income and expense** is **not zero**?

❑ The above values are **read** from the **income statement**

**How to calculate general overhead costs?**

### BIG W CONSTRUCTION INCOME STATEMENT

#### REVENUES

#### CONSTRUCTION COSTS

Materials  
Labor  
Subcontract  
Equipment  
Other  
Total Construction Costs

#### EQUIPMENT COSTS

Rent and Lease Payments  
Depreciation  
Repairs and Maintenance  
Fuel and Lubrication  
Taxes, Licenses, and Insurance  
Equipment Costs Charged to Jobs  
Equipment Costs Charged to Employees  
Total Equipment Costs

#### GROSS PROFIT

#### OVERHEAD

#### NET PROFIT FROM OPERATIONS

#### OTHER INCOME AND EXPENSE

#### PROFIT BEFORE TAXES

#### INCOME TAX

#### PROFIT AFTER TAXES

## General overhead costs

### ❑ Two ways:

1. Simply apply a pre-determined percentage to the anticipated yearly volume produced by the construction operations.
2. More accurate way to prepare a detailed line-item estimate
  - ❖ This is all very similar to the jobsite estimate

## General overhead costs – Percentage

### Holm

The problem with estimating with a rough percentage, such as this, is that it does not consider changes from one year to the next.

Total anticipated revenue: \$100,000,000  
Total anticipated home office overhead: \$2,000,000  
General overhead percentage:  $\$2,000,000 / \$100,000,000 = 2\%$   
Minimum fee each project must generate to break even: 2%

## General overhead costs – Line item

Holm

The complete estimate may be 100 to 200 line items long, depending upon the size of the company and the proportion of management which is performed at the home office compared to the jobsite. The general overhead budget should be detailed enough to track, but not so detailed that it is unmanageable, similar to the 80-20 rule that is used throughout this discussion of cost accounting and financial management. Different categories of office labor should be kept separate and not combined as they all have different rates. The process for estimating the home office general conditions would be similar to estimating direct construction costs. Historical costs are available, trends are analyzed, and new conditions of the coming year must be considered. At the completion of this year, the actual costs should be fed back into the GCs database to better prepare future estimates.

|                                                           |                       |     |      |           |             |             |                    |             |
|-----------------------------------------------------------|-----------------------|-----|------|-----------|-------------|-------------|--------------------|-------------|
| Evergreen Construction Company                            |                       |     |      |           |             | Date:       | 01/01/2020         |             |
| Annual Home Office General Conditions Budget, Abbreviated |                       |     |      |           |             | Estimator:  | Robert Benson, OIC |             |
|                                                           |                       |     |      |           |             | Estimate #: | 1                  |             |
| Home Office General Conditions                            |                       |     |      |           |             |             |                    |             |
| Line Item                                                 | Description           | Qty | Unit | Wage Rate | Labor Cost  | Unit M Cost | Material Cost      | Total Cost  |
| 5                                                         | Receptionist          | 12  | mos  | \$3,000   | \$36,000    |             |                    | \$36,000    |
| 14                                                        | VP of Operations      | 12  | mos  | \$10,000  | \$120,000   |             |                    | \$120,000   |
| 56                                                        | Cleaning Service      | 52  | wks  |           |             | \$800       | \$41,600           | \$41,600    |
| 72                                                        | Office Supplies       | 1   | LS   |           |             | \$25,000    | \$25,000           | \$25,000    |
| 99                                                        | Copy Machine Rental   | 12  | mos  |           |             | \$700       | \$8,400            | \$8,400     |
| 141                                                       | Warehouse and Storage | 12  | mos  |           |             | \$3,000     | \$36,000           | \$36,000    |
|                                                           | Continued...          |     |      |           |             |             |                    |             |
| Totals:                                                   |                       |     |      |           | \$1,150,000 |             | \$850,000          | \$2,000,000 |

How about  
contract?

## General overhead costs – Contract

### Holm

The AIA A102, cost plus fee with a guaranteed maximum price (GMP), is the contract that Evergreen Construction Company (ECC) executed on the Olympic Hotel and Resort project. Contract Article 7 in that agreement spells out the cost-reimbursable items and Article 8 lists those which are non-reimbursable. Generally any cost incurred at the site is considered a reimbursable cost and any function carried out at the home office is considered non-reimbursable. Any additional home office general conditions item or person can be inserted into Article 7 as a reimbursable cost, but it must be mutually agreeable and done so before the contract is executed. Some of the home office GCs costs which can be inserted into the contract include:

- Scheduler,
- Estimator,
- Safety officer or inspector,
- Quality control officer or inspector,
- Data processing costs, including accounting and audits,
- Cost engineer or accountant,
- Senior project manager,
- Preconstruction services fee or costs,
- Specialty superintendents, such as a hoisting superintendent, concrete finisher superintendent, earthwork superintendent, ironworker or structural steel superintendent, and others.

### How about management?

## General overhead costs – Management

### Holm

Management of the home office general conditions budget is the responsibility of the CFO and CEO and is not project-based. The contractor's goal is to reduce its home office overhead costs with respect to overall volume. Recall that fee equals overhead and profit. If the fee is fixed and home office costs are reduced, then profit is increased as reflected in the following equations. The jobsite team focuses on producing fee, and the home office team uses that fee to first pay its operational costs. Anything remaining is considered profit.

$$\begin{aligned} \text{Fee} &= \text{Overhead} + \text{Profit} \\ \downarrow \text{Overhead} &= \uparrow \text{Profit} \end{aligned}$$

### How to perform analysis?

## Contribution margin

- ❑ The **contribution margin** is the **amount of money** that a **project or projects** **contribute** to the **company** to be used to
  1. Pay for **general overhead**
  2. Provide a **profit** for the stakeholders
- ❑ The **contribution margin** is what is **left over** from the **revenues** **after paying**

**Project cost** including **project overheads**

## Contribution margin

□ The **equation** for the **contribution margin** may be written as follows:

❖ **Profit** = Revenues – Project Costs (excluding project overhead) – Project overhead - General overhead

❖ **Contribution Margin (CM)** = Revenues – Project Costs (excluding project overhead) – Project Overhead

❖ **CM Ratio** = Contribution Margin / Revenues

❖ **Contribution Margin (CM)** = CM Ratio × Revenues

❖ **Profit** = CM Ratio × Revenues – General Overhead



## Contribution margin – Example 1

❑ **Example:** What are the **contribution margin** and the **contribution margin ratio** for the company's income statement, if revenue is **\$3,698,945**, project cost excluding project overhead is **\$3,186,457**, and the project overhead is **\$45,000**.

❑ **Solution:**

Contribution Margin = \$3,698,945 - \$3,186,457 - \$45,000

Contribution Margin = \$467,488

The contribution margin ratio may be calculated by:

CM Ratio = \$467,488 / \$3,698,945 = 0.126 or 12.6%

### BIG W CONSTRUCTION INCOME STATEMENT

#### REVENUES

#### CONSTRUCTION COSTS

Materials  
Labor  
Subcontract  
Equipment  
Other  
Total Construction Costs

#### EQUIPMENT COSTS

Rent and Lease Payments  
Depreciation  
Repairs and Maintenance  
Fuel and Lubrication  
Taxes, Licenses, and Insurance  
Equipment Costs Charged to Jobs  
Equipment Costs Charged to Employees  
Total Equipment Costs

#### GROSS PROFIT

#### OVERHEAD

#### NET PROFIT FROM OPERATIONS

#### OTHER INCOME AND EXPENSE

#### PROFIT BEFORE TAXES

#### INCOME TAX

#### PROFIT AFTER TAXES

## Contribution margin

1. The contribution margin ratio is used to calculate the breakeven volume of work

or

2. Volume of work may be used to calculate the break-even contribution margin ratio

## Break-even volume of work

- ❑ Once a company has (1) established a general overhead budget for a year, it can (2) use the **historical contribution margin ratio** to (3) determine the break-even volume of work that it needs to **produce** during the year to cover general overhead costs and provide a specified profit.
  - ❖ The historical contribution margin ratio may be calculated from the company's income statement for the previous year, as it was done in **previous example**.
  - ❖ The historical contribution margin ratio may need to be adjusted to take into account changing market conditions.
    - ❖ For example, during an economic downturn contribution margin ratios often **shrink**, whereas during a rapidly growing economy, contribution margin ratios often **increase**.

## Indirect cost – Sample of general overhead

| Item                            | Annual Cash Flow From Operations |         |         |         |         |         |         |         |         |         |         |         | Total     |
|---------------------------------|----------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|
|                                 | Jan.                             | Feb.    | March   | April   | May     | June    | July    | Aug.    | Sept.   | Oct.    | Nov.    | Dec.    |           |
| Revenues                        | 768,000                          | 712,000 | 785,000 | 769,000 | 560,000 | 545,000 | 500,000 | 391,000 | 342,000 | 460,000 | 492,000 | 516,000 | 6,840,000 |
| Overhead:                       |                                  |         |         |         |         |         |         |         |         |         |         |         |           |
| Advertising                     | 7,680                            | 7,120   | 7,850   | 7,690   | 5,600   | 5,450   | 5,000   | 3,910   | 3,420   | 4,600   | 4,920   | 5,160   | 68,400    |
| Promotion                       | —                                | —       | —       | —       | —       | —       | 8,000   | —       | —       | —       | —       | 15,000  | 23,000    |
| Car and Truck Expenses          | 1,100                            | 1,100   | 1,100   | 1,100   | 1,100   | 1,100   | 1,100   | 1,100   | 1,100   | 1,100   | 1,100   | 1,100   | 13,200    |
| Computer and Office Furniture   | —                                | —       | —       | —       | —       | —       | 18,000  | —       | —       | —       | —       | —       | 18,000    |
| Employee Wages and Salaries     | 22,618                           | 22,618  | 22,618  | 22,618  | 22,618  | 22,618  | 22,618  | 22,618  | 22,618  | 22,618  | 22,618  | 22,618  | 271,416   |
| Employee Benefits               | 750                              | 750     | 750     | 750     | 750     | 750     | 750     | 750     | 750     | 750     | 750     | 750     | 9,000     |
| Employee Retirement             | 679                              | 679     | 679     | 679     | 679     | 679     | 679     | 679     | 679     | 679     | 679     | 679     | 8,142     |
| Employee Taxes                  | 2,300                            | 2,238   | 2,046   | 1,994   | 1,924   | 1,878   | 1,809   | 1,809   | 1,809   | 1,801   | 1,565   | 1,144   | 22,317    |
| Insurance                       | 4,366                            | 4,086   | 4,451   | 4,371   | 3,326   | 3,251   | 3,026   | 2,481   | 2,236   | 2,826   | 2,986   | 3,106   | 40,514    |
| Taxes & Licenses                | 100                              | —       | —       | —       | —       | —       | —       | —       | —       | —       | —       | —       | 100       |
| Office Supplies                 | 500                              | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 6,000     |
| Office Rent                     | 500                              | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 6,000     |
| Office Utilities                | 350                              | 350     | 250     | 250     | 250     | 350     | 350     | 350     | 250     | 250     | 350     | 350     | 3,700     |
| Postage and Delivery            | 100                              | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 1,200     |
| Janitorial and Cleaning         | 433                              | 433     | 433     | 433     | 433     | 433     | 433     | 433     | 433     | 433     | 433     | 433     | 5,200     |
| Telephone                       | 440                              | 440     | 440     | 440     | 440     | 440     | 440     | 440     | 440     | 440     | 440     | 440     | 5,280     |
| Charitable Contributions        | —                                | —       | —       | —       | —       | —       | —       | —       | —       | —       | —       | 3,000   | 3,000     |
| Dues and Memberships            | —                                | —       | —       | 1,500   | —       | —       | —       | —       | —       | —       | —       | —       | 1,500     |
| Legal and Professional Services | 1,000                            | —       | —       | 3,000   | —       | —       | 1,000   | —       | —       | 1,000   | —       | —       | 6,000     |
| Meals and Entertainment         | 867                              | 867     | 867     | 867     | 867     | 867     | 867     | 867     | 867     | 867     | 867     | 867     | 10,400    |
| Bank Fees                       | 50                               | 50      | 50      | 50      | 50      | 50      | 50      | 50      | 50      | 50      | 50      | 50      | 600       |
| Miscellaneous                   | 100                              | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 1,200     |
| Total Overhead                  | 43,933                           | 41,931  | 42,734  | 46,942  | 39,237  | 39,066  | 65,321  | 36,686  | 35,851  | 38,614  | 37,958  | 55,897  | 524,170   |

### General Overhead Budget

## Break-even volume of work

❑ By setting **profit equal to zero**, we can determine the **break-even volume of work** for a **specific contribution margin** and **general overhead**.

❑  $Profit = CM\ Ratio \times Revenues - General\ Overhead$

**Without profit**

$$Revenues = \frac{General\ Overhead}{CM\ Ratio}$$

**At fixed level of profit**

$$Revenues = \frac{Profit + General\ Overhead}{CM\ Ratio}$$

This **revenue** is called **break-even volume of work**

## Break-even volume of work – Example 2

❑ **Example:** Determine the **break-even volume of work** for a company with a **general overhead of \$350,000** and a **contribution margin ratio of 9.5%**.

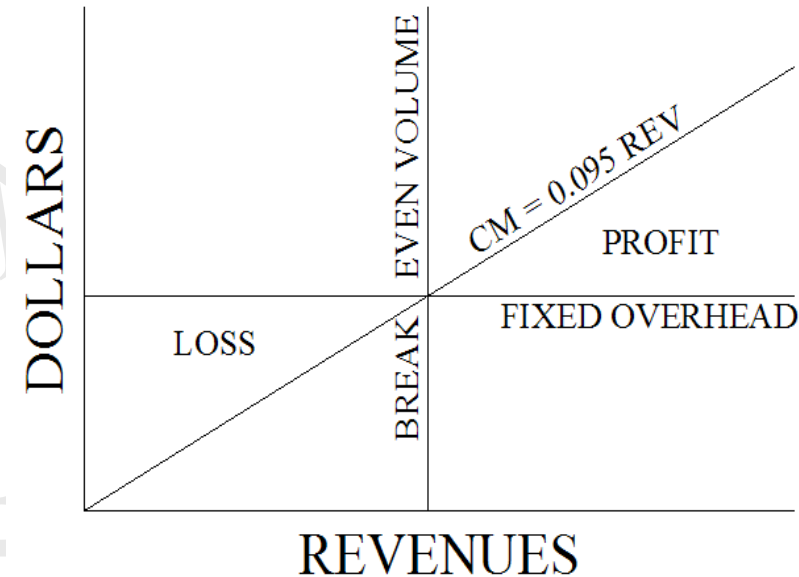
❑ **Solution:** Setting the profit equal to zero, we get the following:

$$\$0 = 0.095 (\text{Revenues}) - \$350,000$$

❑ Solving for revenues, we get the following:

$$0.095 (\text{Revenues}) = \$350,000$$

$$\text{Revenues} = \$350,000 / 0.095 = \$3,684,211$$



The company will **need** to generate **\$3,684,211** in revenues to **cover** its **general overhead**. If it generates **less than \$3,684,211**, the company will **not cover** the general overhead and will **lose money** on project operations. For the revenues **in excess of \$3,684,211**, the entire contribution margin will be **profit** from operations.

## Break-even volume of work – Example 3

**Example:** Determine the **break-even volume of work** for a company with a **general overhead of \$350,000**, a **contribution margin ratio of 9.5%**, and a **required level of profit of \$190,000**.

The company will need to generate **\$5,684,211** in revenues to **cover** its **general overhead** and make **\$190,000 in profit**.

If it generates **less than \$5,684,211**, it will **not meet its profit requirements**.

If the company generates **more than \$5,684,211**, it will **exceed its profit requirements**.

## Break-even contribution margin ratio

- ❑ Once a company has (1) established a general overhead budget for a year, it can (2) use the anticipated volume of work to (3) forecast the required contribution margin ratio.
  - ❖ The **volume of work** may be estimated by looking at **historical levels of work** and **making adjustments** to reflect the **economic conditions**.
  - ❖ **Alternately**, the **volume of work** may be **projected** based on the **work** the company **thinks** it can get **during the upcoming year**.

## Break-even contribution margin ratio

- ❑ By setting **profit equal to zero**, we can determine the **break-even contribution margin ratio** for a **specific level of revenues** and **fixed overhead**.

**Without profit**

$$CM \text{ Ratio} = \frac{\text{General Overhead}}{\text{Revenues}}$$

**At fixed level of profit**

$$CM \text{ Ratio} = \frac{\text{Profit} + \text{General Overhead}}{\text{Revenues}}$$

This **CM Ratio** is called **break-even contribution margin ratio**

## Break-even contribution margin ratio

Holm

Table 6.1 Breakeven analysis

| Ideal Revenue   | Breakeven Revenue Without Profit | Construction Cost | Stepped Fixed OH | Variable OH % | Variable HOOH | Total HOOH   | Total HOOH % of Cost | Ideal Profit as % of Cost | Fee, or OH&P | Ideal Net (Before Tax) Profit |
|-----------------|----------------------------------|-------------------|------------------|---------------|---------------|--------------|----------------------|---------------------------|--------------|-------------------------------|
| \$50,000        | \$50,000                         | \$0               | \$50,000         | 2.0%          | \$0           | \$50,000     | NA                   | 4.0%                      | NA           | \$0                           |
| \$156,000       | \$152,000                        | \$100,000         | \$50,000         | 2.0%          | \$2,000       | \$52,000     | 52.0%                | 4.0%                      | 56.0%        | \$4,000                       |
| \$630,000       | \$610,000                        | \$500,000         | \$100,000        | 2.0%          | \$10,000      | \$110,000    | 22.0%                | 4.0%                      | 26.0%        | \$20,000                      |
| \$1,160,000     | \$1,120,000                      | \$1,000,000       | \$100,000        | 2.0%          | \$20,000      | \$120,000    | 12.0%                | 4.0%                      | 16.0%        | \$40,000                      |
| \$2,220,000     | \$2,140,000                      | \$2,000,000       | \$100,000        | 2.0%          | \$40,000      | \$140,000    | 7.0%                 | 4.0%                      | 11.0%        | \$80,000                      |
| \$10,850,000    | \$10,450,000                     | \$10,000,000      | \$250,000        | 2.0%          | \$200,000     | \$450,000    | 4.5%                 | 4.0%                      | 8.5%         | \$400,000                     |
| \$53,650,000    | \$51,650,000                     | \$50,000,000      | \$650,000        | 2.0%          | \$1,000,000   | \$1,650,000  | 3.3%                 | 4.0%                      | 7.3%         | \$2,000,000                   |
| \$107,000,000   | \$103,000,000                    | \$100,000,000     | \$1,000,000      | 2.0%          | \$2,000,000   | \$3,000,000  | 3.0%                 | 4.0%                      | 7.0%         | \$4,000,000                   |
| \$532,000,000   | \$512,000,000                    | \$500,000,000     | \$2,000,000      | 2.0%          | \$10,000,000  | \$12,000,000 | 2.4%                 | 4.0%                      | 6.4%         | \$20,000,000                  |
| \$1,063,000,000 | \$1,023,000,000                  | \$1,000,000,000   | \$3,000,000      | 2.0%          | \$20,000,000  | \$23,000,000 | 2.3%                 | 4.0%                      | 6.3%         | \$40,000,000                  |

Volume = Revenue = Contracted Construction Cost (Direct + Indirect) + OH&P (Home Office Overhead (Fixed + Variable) + Profit)

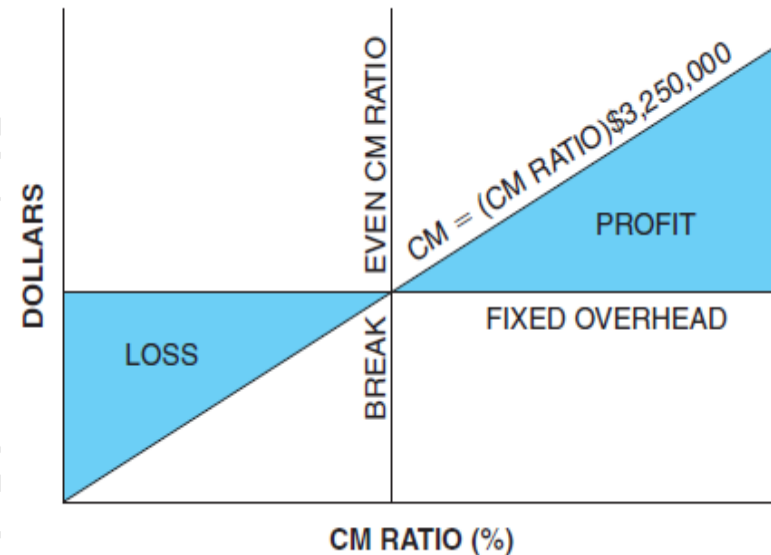
## Break-even contribution margin ratio – Example 4

**Example:** Determine the **break-even contribution margin ratio** for a company with a **general overhead of \$350,000** and **revenues of \$3,250,000**.

□ Setting the profit equal to zero, we get:  
 $\$0 = \text{CM Ratio}(\$3,250,000) - \$350,000$

**CM Ratio** =  $\$350,000 / \$3,250,000 = 0.1077$  or  
 10.77%

The company should **maintain this ratio** to  
 cover its **fixed overhead**



## Adjusting the financial mix

☐ We should check two things:

1. Calculated **break-even volume of work** with the **volume of work that the company thinks**
2. Calculated **break-even contribution margin ratio** with the **historical contribution margin ratio**

*Let's look at what should be done when these are compared*

## Adjusting the financial mix

1. If the **calculated break-even volume of work** exceeds the **volume of work** that the company thinks it can perform, the **contribution margin ratio** needs to be increased.

❖ This may be done by raising prices; however, this often **results** in a reduced volume of work.

1. If the company's clients are not price sensitive, raising prices may solve the problem.
2. If the company's clients are price sensitive—as is the case when clients solicit **multiple bids** for their work—**raising prices** may further reduce the **volume of work** and may only **aggravate the problem**.

*So, what to do?*

**At fixed level of profit**

$$\text{Revenues} = \frac{\text{Profit} + \text{General Overhead}}{\text{CM Ratio}}$$

## Adjusting the financial mix

❑ When raising prices is **not an option**,

❖ The company **must**:

1. **Reduce the general overhead costs** or
2. **Increase the contribution margin ratio** by
  - ✓ **Reducing construction costs** or
  - ✓ **Reducing project overhead costs**

**At fixed level of profit**

$$\text{Revenues} = \frac{\text{Profit} + \text{General Overhead}}{\text{CM Ratio}}$$

❖ **Contribution Margin (CM)** = Revenues – Project Costs (excluding project overhead) – Project Overhead

❖ **CM Ratio** = Contribution Margin / Revenues

## Adjusting the financial mix

2. When the **break-even contribution margin ratio** exceeds the **historical contribution margin ratio**,
1. **The volume of work** and/or the **price** need to be **raised** or
  2. **Reduce** the **general overhead costs** or
  3. **Reduce** the **project overhead costs** or
  4. **Construction costs** need to be **reduced**
- to achieve the **contribution margin**.

**At fixed level of profit**

$$CM \text{ Ratio} = \frac{\text{Profit} + \text{General Overhead}}{\text{Revenues}}$$

$$\text{❖ Contribution Margin (CM)} = \text{Revenues} - \text{Project Costs (excluding project overhead)} - \text{Project Overhead}$$

$$\text{❖ CM Ratio} = \text{Contribution Margin} / \text{Revenues}$$

## Adjusting the financial mix

- ❑ A **key goal** of any company should be to **make a profit**
  - ❖ The **object of looking** at the **profit equation** and performing a **break-even volume of work** or **break-even contribution margin ratio** analysis is to **clarify** how the company is going to **make a profit**.

## Adjusting the financial mix

❑ Too often a company is **focused** on **increasing the volume** of its work **rather** than on its **profitability**.

❖ **When** a company **focuses** on **volume of work** **without** taking into account **profit**, it often settles for **smaller profit margins** or takes **unprofitable work** in order to increase its volume of work.

✓ These **increases in the volume of work** are often **accompanied** by the need to **increase** its main office support, thus **increasing general overhead**.

*It is **not uncommon** for companies that **pursue this strategy** to find that **significant increases** in the **size of the company** and the **volume of work** that it performs have occurred, yet its **profits** have **improved little** or **actually declined**.*

## Adjusting the financial mix

**Next year** I will talk about

1. How profit is estimated
2. What are the sources of profits that contractors could focus on to improve profitability?

**However, let's see some important points here!**

## Adjusting the financial mix – How to improve profitability?

- ❑ Many companies have found that **profits** could be **increased** by being **more selective**
  - ❖ This **specialization** allows to earn **more profit**.
  - ❖ This **specialization** allows the company to **learn** from the projects and to **reduce** the number of **project problems** that occur, the company can:
    - ✓ **Reduce** the **time** it takes to construct the project
    - ✓ **Reduce** the **project overhead**
    - ✓ **Avoid** costly construction mistakes
    - ✓ **Reduce** change orders
    - ✓ **Better relationship** with **suppliers** and **subcontractors** which **may** result in **reducing the costs**.

## Adjusting the financial mix – Methods to improve profits

- ❑ Another way to improve profitability is to put more time and effort into **planning** the construction process **anticipating** and **solving** the problems **before** they occur.
  - ❖ Building information modeling (BIM) is the proper use of **BIM** allows contractors to **identify** and **resolve** conflicts in the drawings **before** the materials are fabricated and delivered to the jobsite.
    - ✓ The **schedule** and **budget** may be integrated into a building information model.

**So, let's take a look at P&O Markup!**

## Profit and overhead markup

❑ The process to estimate **break-even CM ratio**:

❖ If you have any **clue** about the **profit you want**:

1. Estimate (1) **revenues**, (2) **general overhead**, and (3) **break-even CM ratio** using **historical data**, **exponential regression**, and **market analysis**.
2. Estimate **break-even CM ratio** using:

$$\text{Break-even CM Ratio} = \frac{\text{Profit} + \text{General Overhead}}{\text{Revenues}}$$



Adjusting the **financial mix** by comparing:

1. Calculated break-even volume of work with the **volume of work that the company thinks**
2. Break-even contribution margin ratio with the **historical contribution margin ratio**

## Profit and overhead markup

❑ The process to estimate **break-even CM ratio**:

❖ If you do **not have** any **clue** about the **profit you want**:

1. Estimate (1) **revenues**, (2) **project costs (excluding project overhead)**, (3) **project overhead**, and (4) **break-even CM ratio** using **historical data**, **exponential regression**, and **market analysis**.

2. Estimate **contribution margin** using:

❖  $\text{Contribution Margin} = \text{Revenues} - \text{Project Costs (excluding project overhead)} - \text{Project Overhead}$

3. Estimate **break-even CM ratio** using:

❖  $\text{Break-even CM Ratio} = \text{Contribution Margin} / \text{Revenues}$



Adjusting the **financial mix** by comparing:

1. Calculated break-even volume of work with the **volume of work that the company thinks**

2. Break-even contribution margin ratio with the **historical contribution margin ratio**

## Profit and overhead markup

Is break-even CM ratio a Markup?

Let's see!

## Profit and overhead markup – Example 5

❑ We assume that we do **not have** any clue about the **profit**:

1. Estimated revenues = **\$1,000,000** and estimated project costs including project overhead = **\$850,000** for the **next year**.

2. Estimate contribution margin using:

$$\begin{aligned} \text{Contribution Margin} &= \text{Revenues} - \text{Project Costs (excluding project overhead)} \\ &\quad - \text{Project Overhead} = \$150,000 \end{aligned}$$

3. Estimate CM ratio using:

$$\text{Break-even CM Ratio} = \text{Contribution Margin} / \text{Revenues} = \$150,000 / \$1,000,000 = 15\%$$

Is break-even CM ratio a Markup?

Let's see!

## Profit and overhead markup – Example 5

- ❑ If we were to **mark up the project costs by 15%** to get the **bid price** (revenue from the project), we would get the following:

❖  $Revenue = \$850,000 (1 + 0.15) = \$977,500$

- ✓ But what was the estimated revenue? **Estimated revenues = \$1,000,000**

If we were to bid for \$977,500, the revenue achieved would be **\$22,500** (\$1,000,000 - \$977,500) **less** than the **actual revenues** (\$1,000,000) from the project.

Is \$1,000,000 obtained?

**NO!**

**So, what should have been done?**

## Profit and overhead markup

$$P\&O \text{ Markup} = \frac{\text{Gross Profit Ratio}}{(1 - \text{Gross Profit Ratio})}$$

❖ **Gross profit ratio = Break-even CM Ratio**, because:

- ✓  $\text{Gross Profit} = \text{Revenues} - \text{Project Costs (including project overhead)}$
- ✓  $\text{Contribution Margin} = \text{Revenues} - \text{Project Costs (excluding project overhead)} - \text{Project Overhead}$

➡ Gross Profit Ratio = Break-even CM Ratio

➡  **$P\&O \text{ Markup} = \frac{\text{Break-even CM Ratio}}{(1 - \text{Break-even CM Ratio})}$**

## Profit and overhead markup

➔ 
$$\text{P\&O Markup} = \frac{\text{Break-even CM Ratio}}{(1 - \text{Break-even CM Ratio})}$$

➔ No contingency is considered

Break-even CM Ratio was = 15%

$$\text{P\&O Markup} = 0.15 / (1 - 0.15) = 17.65\%$$

$$\text{Revenue} = \$850,000 (1 + 0.1765) = \$1,000,025$$

with the difference being due to the rounding of the profit and overhead markup

## Profit and overhead markup

Not all projects can or should be bid at the same profit and overhead markup.

A company should **set a minimum profit and overhead markup** and then **increase the markup** when **conditions warrant**.

When **starting to bid after not bidding for a few months** or bidding in a **new market**, it is **wise to bid on two or three projects to get a feel for the market and to get back into a bidding rhythm.**

This gives the **company's management** a chance to **get a feel for the level of profit and overhead markup** that it can add to its bids, as well as **give estimators a chance to warm up.**



## Profit and overhead markup

$$P\&O \text{ Markup} = (Bid / Construction Costs) - 1$$

When we change the price due to competitors:

This is **easy calculation** to find **different P & O Markup** by changing the **bid price** and **check with minimum P & O markup** that is **set** for the company

See **other strategies** mentioned in previous section



# مدیریت مالی، حسابداری و هزینه در پروژه ها و سازمان های پروژه محور

بخش نهم:

مدیریت هزینه: مدیریت هزینه پروژه

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

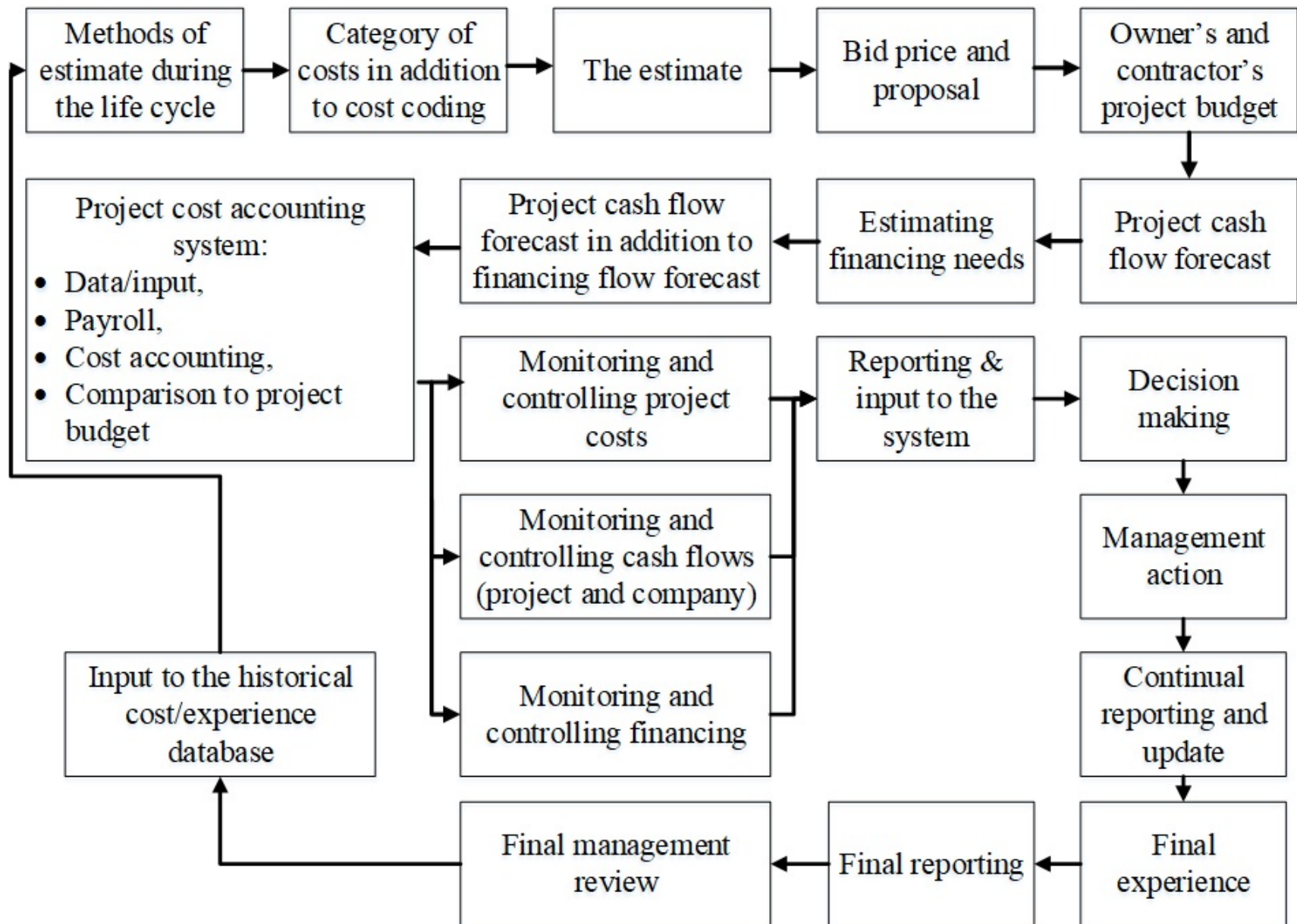
## What you will learn?

- ☐ Purpose of this session
- ☐ Roadmap
- ☐ Why cost control is important?
- ☐ What are the purposes of cost control?
- ☐ How the costs of a project are controlled?
- ☐ Importance of cost code
- ☐ Monitoring and controlling material, labor, subcontracts, and equipment costs
- ☐ Monitoring and controlling project overhead and general overhead costs
- ☐ Monitoring project profitability
- ☐ How to manage the sources of cost overrun
- ☐ Cost-loaded schedule
- ☐ Earned value management system (EVMS)
- ☐ Target levels for cost performance index (CPI)
- ☐ Target levels for schedule performance index (SPI)
- ☐ Project closeout audit

## Purposes of the this session

- ❑ Learn to **monitor** and **control** project costs for materials, labor, subcontractors, equipment, project overhead and general overhead costs.
- ❑ Learn to **find** the sources of **problems**, and resolve the **problems**
- ❑ Learn to **measure** the **success** of the **project** by **monitoring profitability** by using the **schedule performance index**, the **cost performance index**, and **project closeouts**.

*In this Section we look at **monitoring** and **controlling** the individual costs as well as monitoring the costs of the entire project.*



## Why cost control system is important?

- ❑ Contractors generate small percentage of profit margins, **between 2 and 7%**.
- ❑ For example the **2006 annual report** of the **UK's largest contractor Balfour Beatty** indicates an **after-tax profit**, that is, 2.13 ([www.balfourbeatty.com](http://www.balfourbeatty.com)).
- ❑ Without an **effective company-wide cost-control system**, this would result in **substantial risk** to any contractor's margins.
- ❑ **Cost management** is very much **more than simply maintaining records** of expenditure and **issuing cost reports**.
- ❑ **Cost management** means **understanding how** and **why costs occur** and **promptly** taking the **necessary response**.
- ❑ Keeping a project within budget **depends** on the application of an **efficient** and **effective system of cost control**.

## What are the purposes of cost control system?

❑ **Bennett (2003)** identifies **three purposes**:

1. Means of **comparing actual** with **budgeted expenses**
2. Database of **productivity** and **cost-performance** for **use** in subsequent cost estimating
3. Data for **valuing variations** and **changes** to the **contract** and **potential claims**

❑ Cost control is **far more** than **controlling expenditure**. Cost control also includes:

- ❖ The **control of revenue**.
- ❖ Make sure that **all possible** and **justifiable income** is **recovered** from the **client**.
- ❖ Making sure that **no additional cost** is incurred.

These three items are done by preparing (1) **job cost ledger**, (2) **committed and non-committed tables**, and (3) **over and under billing tables**.

## What are the purposes of cost control system?

### Halpin

As construction proceeds, field data are collected in the appropriate job cost accounts. At this point, the project manager is in a position to compare actual field data with the expectations reflected in the budget. Variances are monitored between expected costs and actual field production rates and charges. By examining the variances, the manager can detect which accounts are seriously deviating from planned progress and can take corrective action.

### How the costs are controlled?

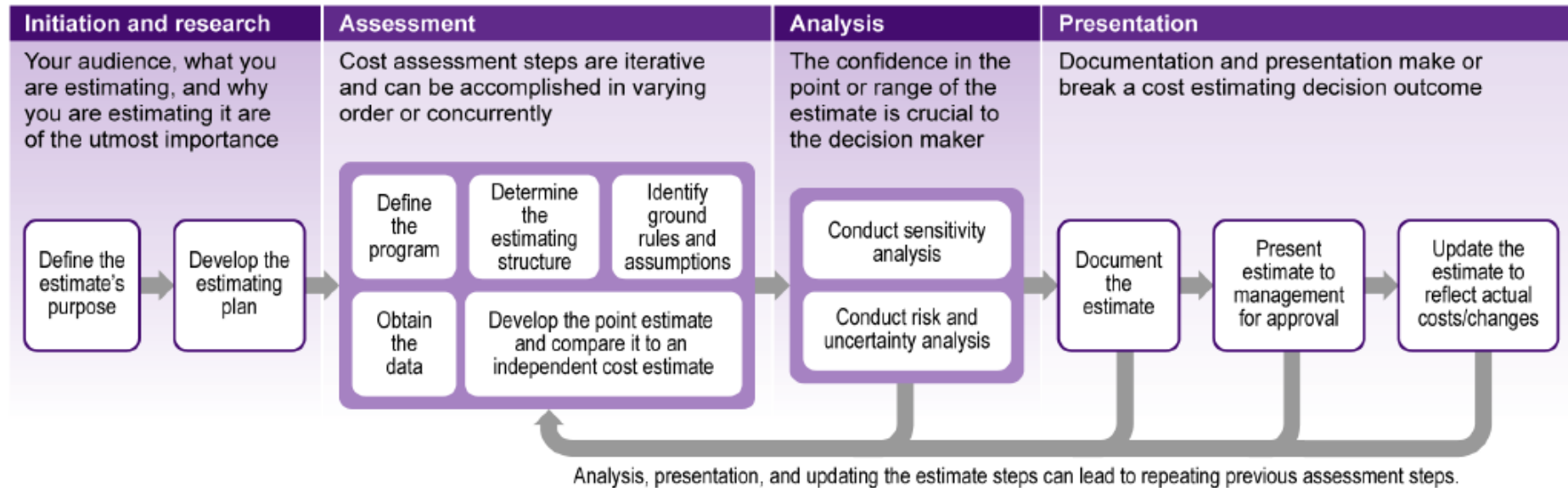
## How the costs of a project are controlled?

In conclusion, an **effective cost-control system** should contain the **following characteristics**:

- **A budget** for the project set with **a contingency** figure to **be used**.
- **Costs** should be **forecast before decisions** are made.
- The **cost-recording system** should be **cost-effective to operate**.
- **Actual costs** should be **compared** with **forecasted costs** at **appropriate periods**.
- **Actual costs** should be subject to **variance analysis** to **determine reasons** for **deviations**.
- The cost implications of **time** and **quality** should be incorporated into the **decision-making process**.

## How the costs of a project are controlled?

Figure 5: The Cost Estimating Process



Source: GAO. | GAO-20-195G

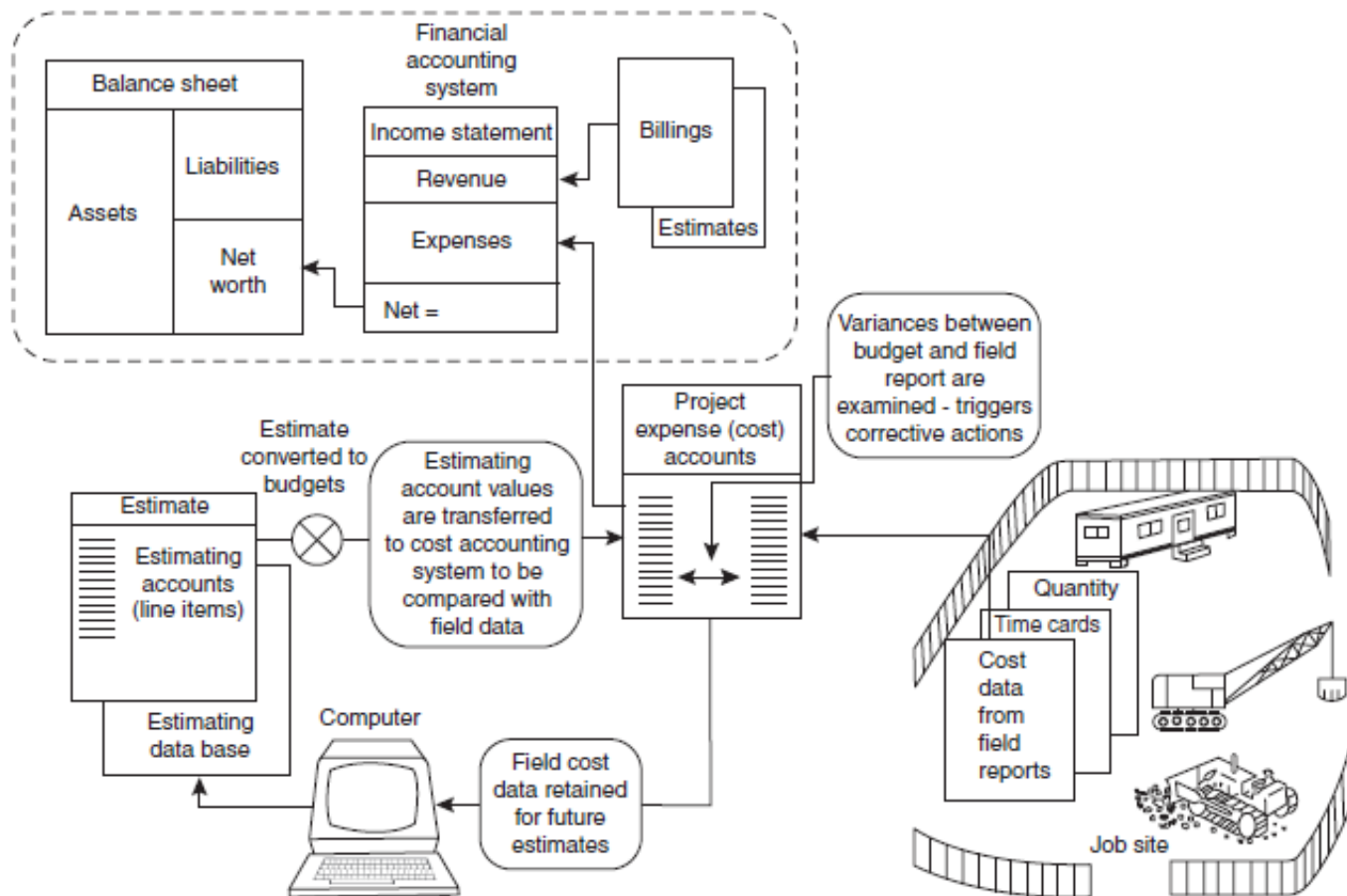
## How the costs of a project are controlled?

- 12 Update the estimate to reflect actual costs and changes
- Update the estimate to reflect changes in technical or program assumptions or keep it current as the program passes through new phases or milestones;
  - Replace estimates with EVM EAC and independent estimate at completion (EAC) from the integrated EVM system;
  - Report progress on meeting cost and schedule estimates;
  - Perform a post mortem and document lessons learned for elements whose actual costs or schedules differ from the estimate;
  - Document all changes to the program and how they affect the cost estimate

**How to build a cost control system?**

## Building a cost control system

### Halpin



Cost control system layout.

## Building a cost control system

❑ For management to control costs, it must :

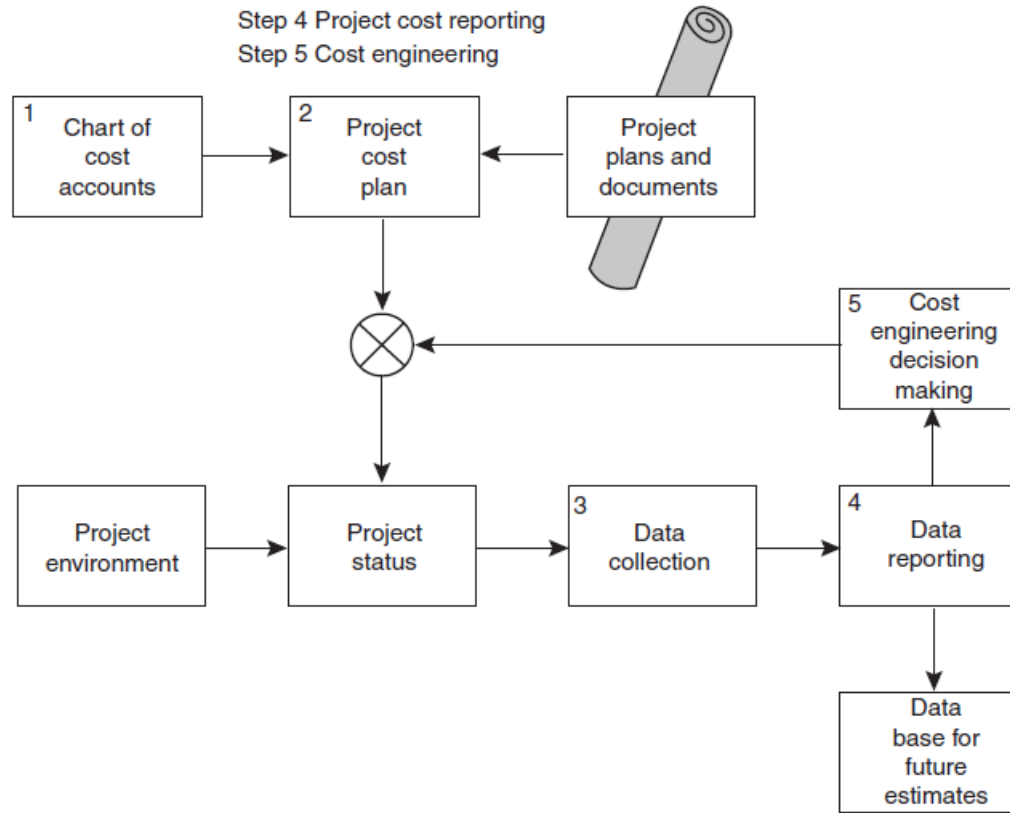
1. **Actively monitor costs**
2. Looking for **potential problems**
3. **Proactively address** the **problems**

What are the steps?

## Steps in cost control

### Halpin

- Step 1 Chart of cost accounts
- Step 2 Project cost plan
- Step 3 Cost data collection
- Step 4 Project cost reporting
- Step 5 Cost engineering



Let's see them more in detail

## Steps in cost control

❑ The **monitoring and controlling** process involves **four key steps**:

1. Chart of cost accounts
2. Project cost plan (establishing a baseline)
3. Cost data collection
4. Project cost reporting (assessing the data)
5. Cost engineering (if needed, taking corrective action)

## Monitoring and controlling project costs

### 1. Chart of cost accounts

- ❖ What will be the **basis adopted** for developing estimated project expenditures  
how will this basis be **related** to the firm's **general accounts and accounting functions**?
- ❖ What will be the **level of detail** adopted in defining the project cost accounts  
how will they **interface** with the **general ledger accounts** of the company's financial accounting system?

## Monitoring and controlling project costs

### 2. Project cost plan (establishing a baseline)

- ❖ The **budget** should be recorded in the **accounting system**.
- ❖ As **change orders** are issued by the owner, the **project's budget** should be updated.
- ❖ **Additional baselines** for **individual line items** in the project's budget are established by entering
  1. Purchase orders
  2. Subcontracts

*What system it reminds you?*

## Monitoring and controlling project costs

### 2. Project cost plan (establishing a baseline)

❖ Another key baseline for the project is the **project's schedule**

1. If the project **falls behind schedule**, additional costs (e.g., overtime) may be incurred making up the lost time.
2. If the project **goes over project duration**, the project overhead costs increase and the project may incur a penalty for the delay
  - ❖ either the incurring of **liquidated damages** or **loss of a performance incentive**.
3. Conversely, **finishing the project ahead of schedule** reduces overhead costs.

## Monitoring and controlling project costs

### 3. Cost data collection

❖ Collect data to **measure performance**.

❖ Could be in the **form of:**

*time cards, invoices from suppliers and subcontractors, estimated cost to complete, and field reports (e.g., percent of work complete).*

❖ Much of this data is **entered** into the **accounting system**.

❖ For this data to be useful, it must be collected and entered in a **timely manner**.

## Monitoring and controlling project costs

### 3. Cost data collection

Work packages are a way to communicate the estimate and schedule and gather the tools and materials necessary to allow the foremen and craftsmen to efficiently build an element of the project. During construction, all expenditures for labor, materials, equipment rental, and subcontractor invoices need to be cost coded properly; otherwise the jobsite team will not really have a true picture of the cost of the work compared to how it was estimated.

- ❖ With the widespread adoption of smart phones and tablets, much of this data can be collected and **entered using apps.**

*PowerBI?*

## Monitoring and controlling project costs

### 4. Project cost reporting (assessing the data)

❖ It includes:

- I. Comparing the data against the **baseline**
- II. Identifying any **variances** (e.g., costs that are higher or lower than expected)
- III. Identifying the underlying **causes** of the variances.

*Here the principle of management by exception plays an important role.*

- ❖ The **accounting system** should provide clear, concise reports identify any variances, especially **variances that fall outside predetermined limits.**
- ❖ This allows management to **quickly and easily identify** variances that need to be **addressed**.

## Monitoring and controlling project costs

**Here is the MAGIC!**

The first four steps of the monitoring and controlling process can be seen in the committed cost worksheet, however the analysis needs more steps to be taken.

**Let's see!**

## Monitoring and controlling project costs

- ☐ **The baseline budget** = Columns C through F
- ☐ The **data collected on invoiced costs** and the **estimated cost to complete the work** = columns G through K
- ☐ The **variance** = Column L

*This worksheet allows management to quickly see which cost codes need their attention*

Committed Cost Worksheet

|   | A    | B           | C        | D      | E        | F         | G         | H         | I         | J         | K          | L        |
|---|------|-------------|----------|--------|----------|-----------|-----------|-----------|-----------|-----------|------------|----------|
| 1 |      |             |          |        |          |           |           |           | Total     |           | Total      |          |
| 2 |      |             |          |        |          |           |           |           | Committed |           | Estimated  |          |
| 3 |      |             |          |        |          |           |           | Non-      | and Non-  | Estimated | Cost       | Variance |
| 4 |      |             |          |        | Total    |           | Committed | Committed | Committed | Cost      | at         | Over /   |
| 5 |      |             | Original | Change | Estimate | Committed | Costs     | Costs     | Costs     | To        | Completion | (Under)  |
| 6 | Code | Description | Estimate | Orders | (C + D)  | Costs     | Invoiced  | Invoiced  | (F + H)   | Complete  | (I + J)    | (K - E)  |
| 7 |      |             |          |        | —        |           |           |           | —         |           | —          | —        |
| 8 |      |             |          |        | —        |           |           |           | —         |           | —          | —        |
| 9 |      |             | —        | —      | —        | —         | —         | —         | —         | —         | —          | —        |

## Monitoring and controlling project costs

### 5. Cost engineering (taking corrective action)

- ❖ For corrective action to be effective, it must be taken in a **timely manner**.
- ❖ For **cost overruns**, management should
  1. Take action to mitigate the **cause of the overrun**
  2. Take steps to ensure that the **same problem** does **not occur** on other areas of the project or other projects.
- ❖ For **cost underruns**, management should
  1. Try to **identify what actions** led to the underrun
  2. Try to **repeat these actions** to improve the performance of their projects.

*It is just as important to **learn** from underruns as it is overruns.*

*The monitoring and controlling process is repeated throughout the **life of the project**.*

## Importance of project cost code

- ❑ To ensure that each expenditure is properly **charged to the correct cost account**, **every expenditure** is **coded** in accordance with the **project cost code system**.
- ❑ For the **project cost code** to serve its basic purpose, it must be **understood** and **used consistently** by **all company personnel**.
- ❑ It is mandatory that the project be broken down into the **same established work types** and that the **project cost code** be used consistently for the purposes of **project estimating, general financial accounting**, and **field cost accounting**.
- ❑ When the **estimator** prices a **new project**, the work is subdivided into the **standard classifications**.

## Monitoring and controlling project costs

❑ Six different **types of costs** that should be **monitored and controlled**:

1. Material purchases
2. Labor
3. Subcontracts
4. Equipment
5. Other (project overhead costs)
6. General overhead costs

*Let's see some important points about them*

## Monitoring and controlling project costs

### Holm

The markups, including home office overhead, are beyond the control of the jobsite team and are the focus of the CEO and CFO. If subcontractors and suppliers were bought out diligently, and tight agreements written, then there is little to 'control' with respect to their costs. Direct materials should have been accurately measured and competitive prices applied to those quantities. The superintendent cannot install less concrete in the footings to save money than was drawn, so cost exposure is limited for materials as well. Most of the items within the jobsite general conditions estimate can be managed, but the biggest variable there is time – if the project lasts longer, jobsite general conditions will run over. Construction equipment should be cost-coded to direct work and not general conditions wherever possible.

**Do you think we should whether tell foremen and superintendents the true budgeted value of each work package?**

## Monitoring and controlling project costs

### Holm

Some construction executives believe that superintendents should not be told the true budgeted value of each work package. This is a poor practice, because the foremen and superintendents are key members of the project team and have critical roles in achieving project financial success. These men and women are regarded as the last planners and should be provided the actual budgeted cost for installation, both in materials and man-hours (MHs), as well as the scheduled time for installation for each work package.

**We would see the practical procedures to control each category!**

## موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

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