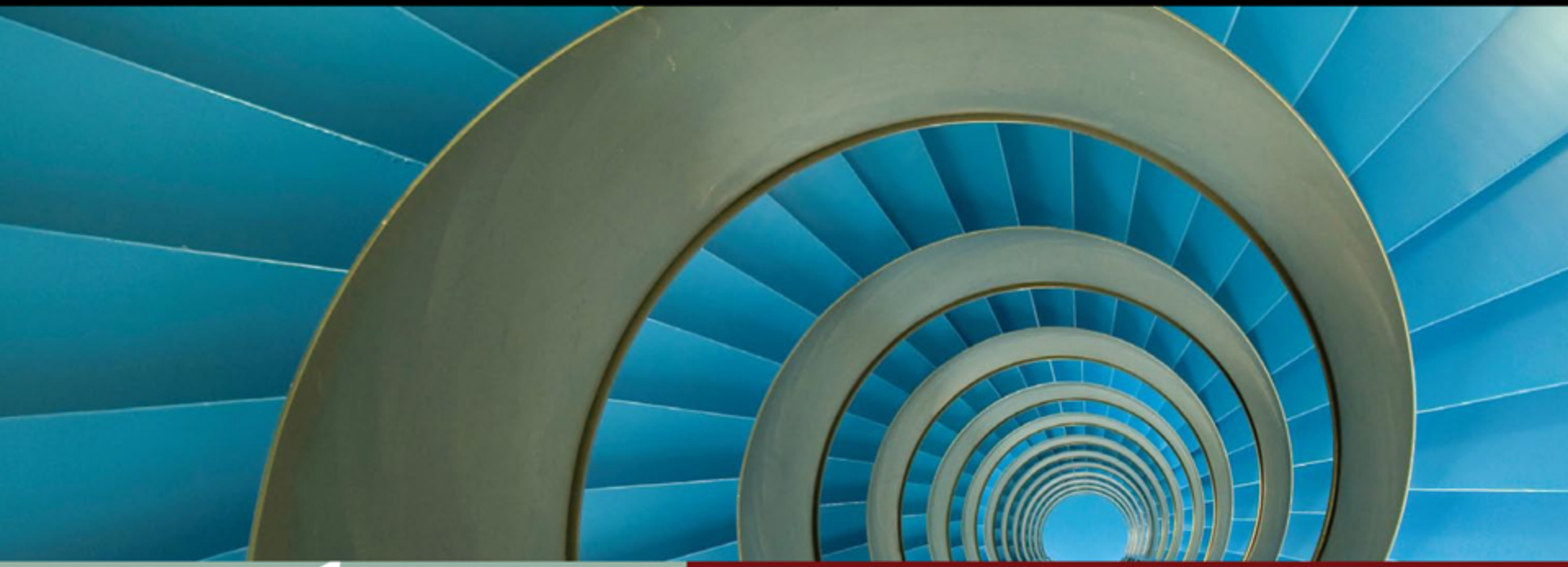
PMDP

PROJECT MANAGER DEVELOPMENT PROGRAM



MODULE 1

ESTIMATING AND JOB COSTING

SESSION 1

INTRODUCTION TO ESTIMATING BASICS

Take-Off vs. Estimate

- Take-Off = Quantities
- Estimate = $
  - The first step to obtaining work
- Includes costs for the following:
  - Material
  - Labor
  - Equipment

Importance of Estimating

- Basis for fee in negotiated work
- First step in planning and scheduling
- Examples:
  - Own vs. leasing equipment
  - Steel vs. wood forms
  - Weather conditions (will it be necessary to pour concrete during the winter?)

The Estimate as a Project Management Tool

- Procuring materials
- Long-lead items
- Self-performed vs. subcontracted

Keys to a Good Estimate

- It must be logical
- It must be easy to follow
- It must be defensible
- It must be able to be updated
- It should be obvious what is included— and what is not

Preliminary Estimates

- Often, project managers must produce a budget so that owners can study **feasibility**,
  but very little design work has been done
- Estimate is **based on systems and attributes**, rather than quantity takeoffs
- Use **comparable project** from **historical data**, and adjust for location, inflation, complexity, etc.
- Requires ability to think conceptually
- Must list **assumptions** and basis for cost

Detailed Estimates

- Design is 100 percent complete
- Plans and specifications are available for quantity takeoff
- Get quotes for most material, equipment, and subcontracts
- General conditions and means and methods assumptions influence cost

CSI 16 Divisions

Before November 2004, MasterFormat was composed of 16 Divisions:

- Division 1 — General Requirements
- Division 2 — Site Construction
- Division 3 — Concrete
- Division 4 — Masonry (Ex. Concrete block)
- Division 5 — Metals (Ex. Beams)
- Division 6 — Wood and Plastics
- Division 7 — Thermal and Moisture Protection
- Division 8 — Doors and Windows
- Division 9 — Finishes
- Division 10 — Specialties
- Division 11 — Equipment
- Division 12 — Furnishings
- Division 13 — Special Construction
- Division 14 — Conveying Systems
- Division 15 — Mechanical (Ex. Plumbing and HVAC)
- Division 16 — Electrical

Sample 16 Division Summary

	Spec Sections Worksheets	Base Bid	Bid Per Sq. ft.	Notes	Alternate
1	01000 General Conditions	$ -			
2	02000 Sitework	$ -			
3	03000 Concrete	$ 68,235.77			
4	04000 Masonry	$ -			
5	05000 Steel	$ -			
6	06000 Wood & Plastics	$ -			
7	07000 Thermal & Moisture Prot	$ -			
8	08000 Doors & Windows	$ -			
9	09000 Finishes	$ -			
10	10000 Specialties	$ -			
11	11000 Equipment	$ -			
12	12000 Furnishings	$ -			
13	13000 Special Construction	$ -			
14	14000 Conveying Systems	$ -			
15	15000 Mechanical & Plumbing	$ -			
16	16000 Electrical	$ -			
	Total	$ 68,235.77			$ -

BMA Bid Spreadsheet RD

Estimate Documentation

- The estimate should be **transparent**—anyone with the proper technical background should be able to understand where each and every number came from
  - The estimate summary should have **backup** for each number either attached to the summary or readily accessible
  - All **assumptions** should be clearly delineated

Estimate Documentation

- The estimate should be documented to the extent that any knowledgeable individual could understand where each and every number came from
- Documentation makes it easier for others to discover errors and omissions
- The better the estimate, the easier it is to make comparisons in the future
  - Why?

Recommended Documentation

- Standard format
- Basis
- Accuracy
- Contingency
- Limitations
- Scope
- Labor rates
- Quantities
- Escalation
- Schedule
- Backup information
- Checklists
- Cost categories
- Exclusions

Benefits of Consistent Formatting for Estimates

- Reduction of quantity and magnitude of errors
  - A standard procedure allows estimators to "internalize" the process
- Facilitates comparison of different estimates
  - A common format makes it easier to identify "apples to apples" numbers and ratios

Benefits of Consistent Formatting

What are the benefits?

- Improves understanding of estimate by other parties, especially coworkers
  - Assumptions are clearly stated, justification exists for all numbers, and the logic is easily followed
- Suggests a framework for collecting cost data as the project progresses
  - Success depends upon compatibility of accounting and estimating systems
  - Estimate recap is simpler

Pitfalls to Avoid in Estimates

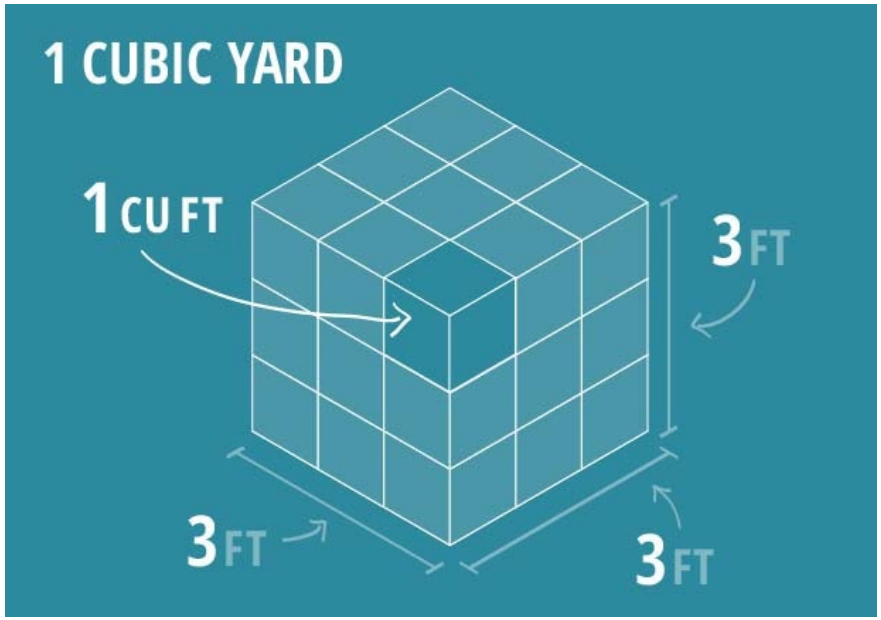
What are the pitfalls?

- Estimating to a preconceived number
- Inadequate resources and information
- Poor grasp of the accuracy required
- Omission of costs (“holes” in estimate)
- Inclusion of costs twice
- Failure to communicate assumptions

Units, Take-Offs, Time, $

UOM - Examples

- Concrete – CY
- Roofing – Squares
- Countertops – LF or SF
- Rebar – Lbs
- Stucco/Carpet – SY or SF
- Insulation – CF or LF
- Trusses – Ea



Units, Take-Offs, Productivity, Time, $

$$\frac{\text{Quantity}}{\text{Productivity}} = \text{Time (Duration)}$$

$$\frac{50\ \text{CY}}{5\ \text{CY/Hr}} = 10\ \text{Hrs}$$

Units must match

Units, Take-Offs, Time, $

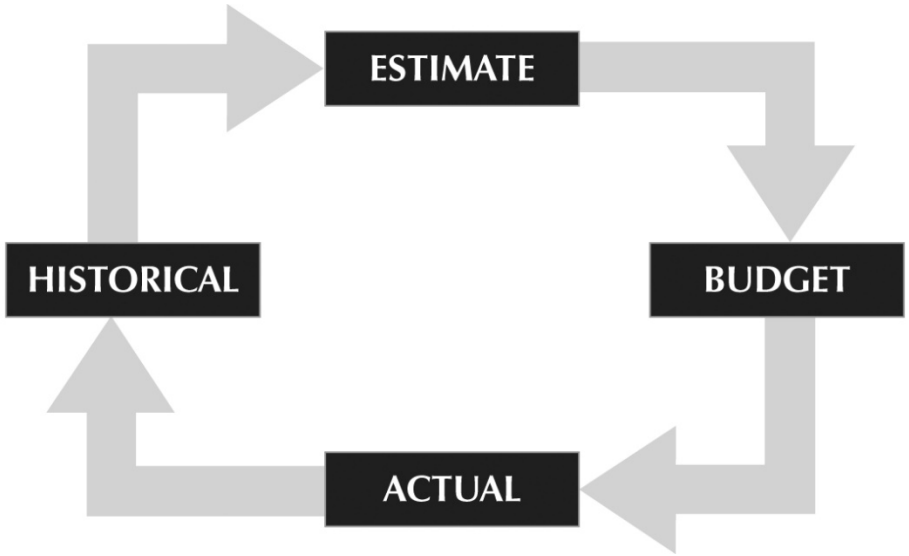
Time * Crew Rate ($) = Estimate

10 Hrs * $155/Hr = $1550

“Reality Check” Techniques

- Intuition / gut
- Compare to similar projects
- Compare to industry data
- Check ratios

Cost Information Cycle



Pioneer Crossing – Intern Example

Information Cycle

- Estimates become budgets
- Budgets are compared to actual costs
- Actual costs are archived in a database
- Database is used to find historical records for guidance on next estimate
- **Must** keep accurate records of actual cost for system to work
- Accurate cost coding is critical

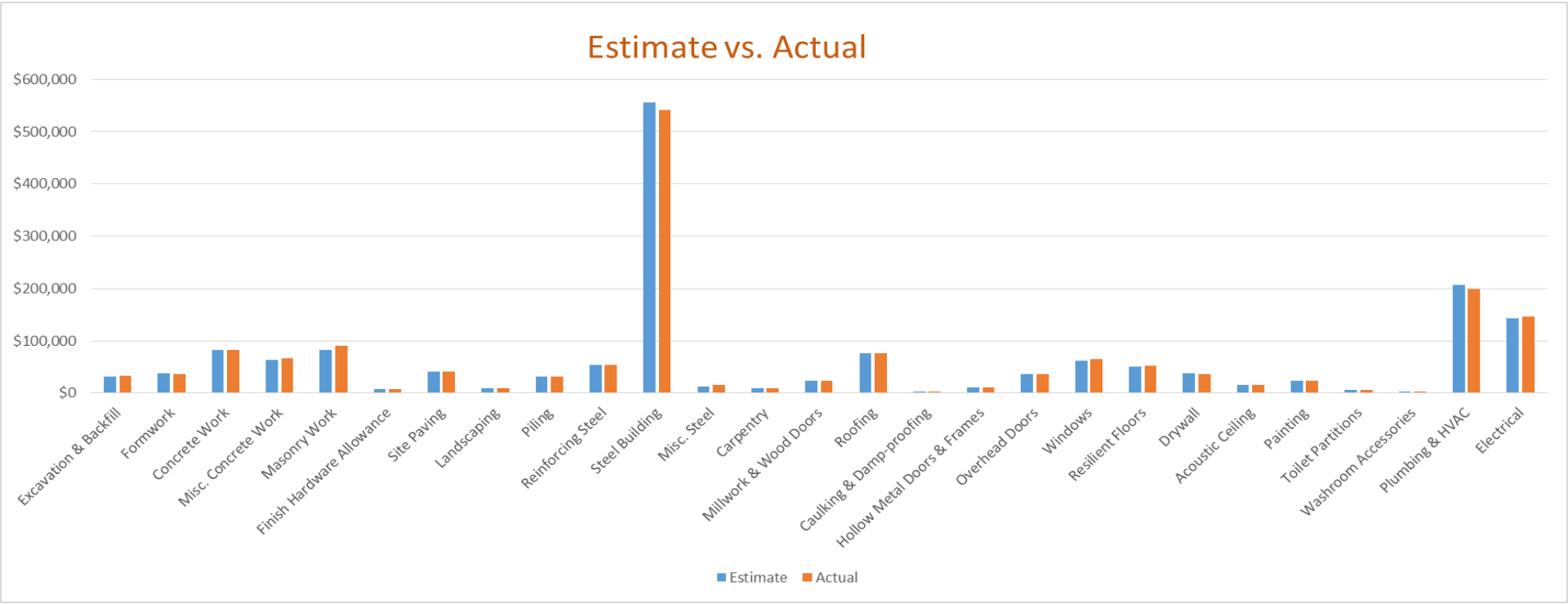
Estimate vs. Actual

Subcontractors	Labor	Material	Equip	Subs	Other	Estimate	$/SF	Actual	Variance
Finish Hardware Allowance				7,000		**$7,000**	$0.28	7,000	$0
Site Paving				40,460		**$40,460**	$1.62	41,253	($793)
Landscaping				10,027		**$10,027**	$0.40	9,599	$428
Piling				31,500		**$31,500**	$1.26	31,500	$0
Reinforcing Steel				54,025		**$54,025**	$2.16	54,025	$0
Steel Building				555,000		**$555,000**	$22.20	542,087	$12,913
Misc. Steel	2,783			9,275		**$12,058**	$0.48	15,684	($3,626)
Carpentry				9,000		**$9,000**	$0.36	9,000	$0
Millwork & Wood Doors	5,550			18,500		**$24,050**	$0.96	24,050	$0
Roofing				76,000		**$76,000**	$3.04	76,000	$0
Caulking & Damp-proofing				2,250		**$2,250**	$0.09	2,250	$0
Hollow Metal Doors & Frames	1,040			10,200		**$11,240**	$0.45	11,240	$0
Overhead Doors				36,000		**$36,000**	$1.44	36,000	$0
Windows				62,406		**$62,406**	$2.50	64,852	($2,446)
Resilient Floors				50,205		**$50,205**	$2.01	51,625	($1,420)
Drywall				38,492		**$38,492**	$1.54	36,551	$1,941
Acoustic Ceiling				15,305		**$15,305**	$0.61	15,200	$105
Painting				24,240		**$24,240**	$0.97	24,240	$0
Toilet Partitions				6,480		**$6,480**	$0.26	6,480	$0
Washroom Accessories	800			1,625		**$2,425**	$0.10	2,425	$0
Plumbing & HVAC				206,250		**$206,250**	$8.25	198,557	$7,693
Electrical				142,550		**$142,550**	$5.70	146,394	($3,844)
Subtotal	**$10,173**	**$0**	**$0**	**$1,406,790**	**$0**	**$1,416,963**	$56.68	**$1,406,012**	**$10,951**
Running Total	**$122,202**	**$161,236**	**$15,063**	**$1,417,068**	**$0**	**$1,715,569**	$68.62	**$1,714,506**	**$1,063**

General Expenses	Labor	Material	Equip	Subs	Other	Estimate	$/SF	Actual	Variance
General Expenses Subtotal	**$93,825**	**$8,640**	**$20,514**	**$7,700**	**$30,510**	**$161,189**	$6.45	**$184,562**	**($23,373)**
Running Total	**$216,027**	**$169,876**	**$35,577**	**$1,424,768**	**$30,510**	**$1,876,758**	$75.07	**$1,899,068**	**($22,310)**

Add-Ons		Labor	Material	Equip	Subs	Other	Estimate	$/SF	Actual	Variance
3%	Small Tools (% of Labor)					6,481	**$6,481**	$0.26	5,421	$1,060
25%	Payroll Additive (% of Labor)					54,007	**$54,007**	$2.16	54,000	$7
12%	State Taxes (% of Mat'l)					20,385	**$20,385**	$0.82	19,985	$400
	Building Permit ($6 for every $1000 of Bid)					12,600	**$12,600**	$0.50	12,137	$463
	50% Bond ($7.25 for every $1000 of Bid)					15,225	**$15,225**	$0.61	15,225	$0
	Insurance ($3 for every $1000 of Bid)					6,300	**$6,300**	$0.25	6,120	$180
	Fee					102,000	**$102,000**	$4.08	81,700	$20,300
	Subtotal	**$0**	**$0**	**$0**	**$0**	**$216,998**	**$216,998**	$8.68	**$194,588**	**$22,410**
	Bid Total/Running Total	**$216,027**	**$169,876**	**$35,577**	**$1,424,768**	**$247,508**	**$2,093,756**	$83.75	**$2,093,656**	**$100**

Estimate vs. Actual



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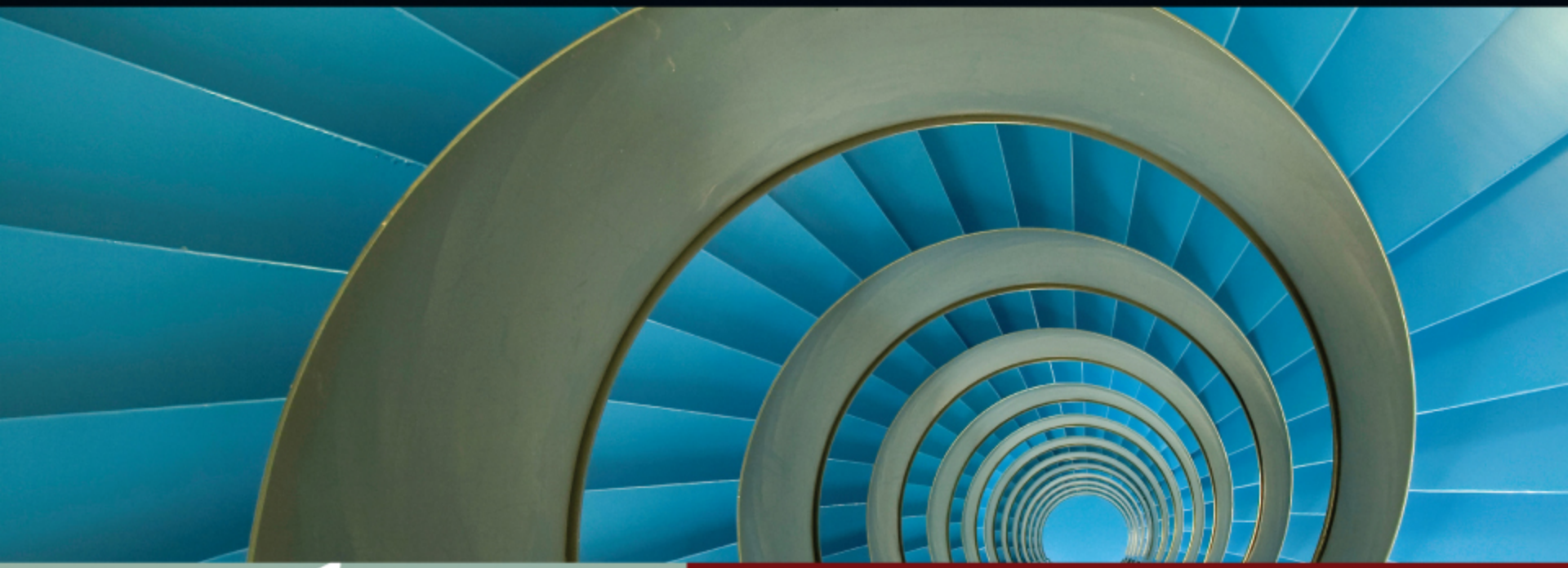


MODULE 1

ESTIMATING AND JOB COSTING

SESSION 2

PROJECT PLANNING AND SETUP

Planning and Scheduling

- Sound similar
- However, they are different tasks

Planning

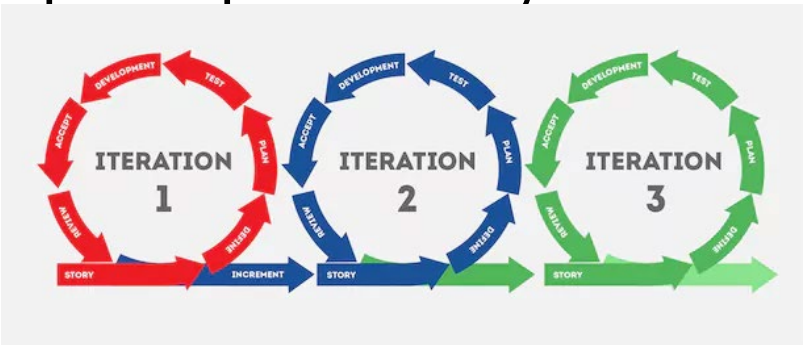
- Must be done first
- “Big picture” concepts
- Decisions on **how** a project is to be built

Scheduling

- “Nuts and bolts” of project management
- Work items broken down into individual tasks (Work Breakdown Structure)
- Apply crew sizes, productivity rates, and quantities to each task to develop durations
- Identify equipment needed to support the task

Iterative Process

- Planning and scheduling are **iterative** tasks
- If schedule doesn't meet owner's milestones, the plan must change:
  - Crew sizes **adjusted**
  - New work methods selected
  - Ways to improve productivity identified



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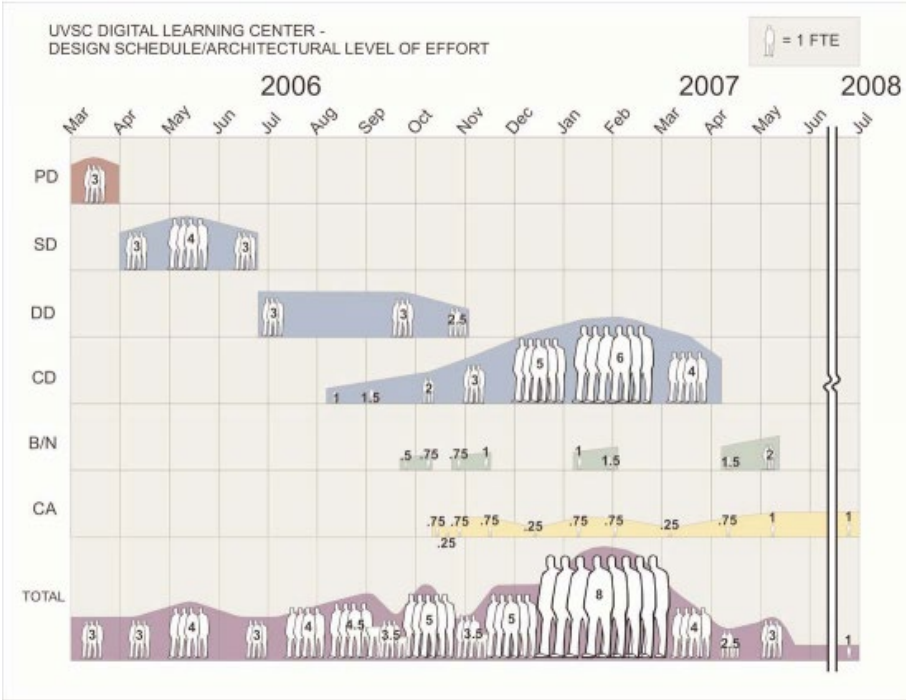
Project Staffing

- Importance of people in the construction process
- Construction is based on relationships:
  - Owner-Contractor
  - Contractor-Arch/Eng
  - Contractor-Subs



Self-Performed Work

- Done by a company's own personnel
- Advantages:
  - Contractor has more direct **control** of when and how work is done
  - Contractor either keeps the markup that a sub would have added or has a lower bid price
  - Contractor keeps own forces busy

Subcontracted Work

- Contractor hires a specialty contractor to perform a specific area of work
- Advantages:
  - Contractor can take on more projects since fewer of own personnel are busy
  - A specialty may be able to complete the work more cheaply
  - Spreads around risk of project to other contractors
  - Specialization
  - Reduced schedule

Managing Subcontractors

- Subcontractors both share risk with a general contractor and add to it:
  - Safety issues
  - Financial problems
  - Personnel problems

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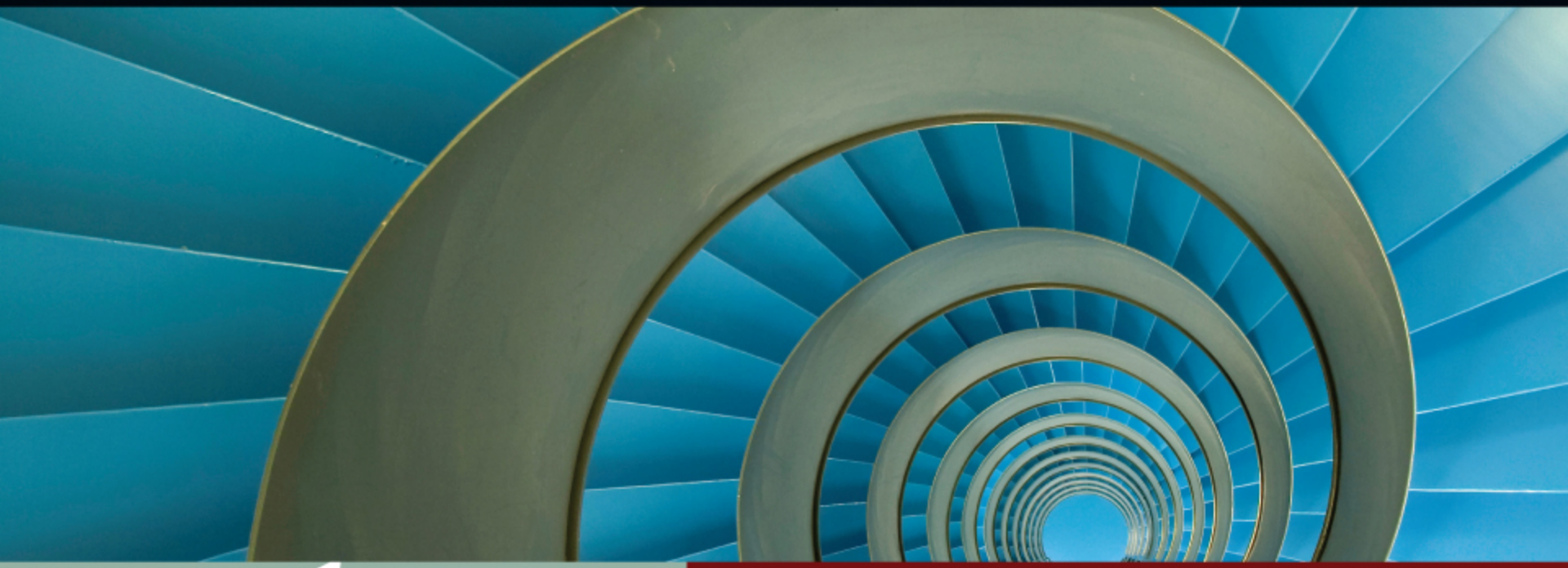


MODULE 1

ESTIMATING AND JOB COSTING

SESSION 3

ESTIMATING COSTS FOR SPECIFIC TASKS

Quantity Survey

- Detailed takeoff from plans and specifications
- Quantities are usually measured or estimated from plans
- Specifications provide more detailed information than can be given on drawings

Information in Specifications

- Acceptable manufacturers
- References (ASTM standards, ANSI, etc.)
- Quality levels
- Accessories
- Acceptable methods for installation (for some materials)

Tradeoffs in Methods of Construction

- Very frequently a contractor has choices with regard to the exact methods used to build a building
- Usually methods requiring less labor have a higher material or equipment cost

Material Costs

- Usually material costs come from vendors
- Costs may be in two forms:
  - **Unit price**: price per given quantity ($/cubic yard or $/square foot or $/each)
  - **Lump sum**: price for a given quantity
  - Pros & Cons
- Vendor quotes usually have expiration dates

Description	UOM	$/Unit	Qty	Total
4000 PSI Concrete Footing	CY	$118	85.5	$10,089
4001 PSI Concrete Footing	LS	$10,089	1	$10,089

Productivity

- **Definition**: the rate of production by labor forces in the field
- Estimators must make assumptions about how much work can be done by a given crew in a given time frame
- Necessary factor in developing a schedule

Productivity Tables

Production Rates

Operation	Low Output	High Output	Prod UOM
2x3 Plates	50	54	BF/Hr
2x4 Plates	63	68	BF/Hr
2x6 Plates	90	95	BF/Hr
2x3 Studs	79	92	BF/Hr
2x4 Studs	100	115	BF/Hr
2x6 Studs	110	125	BF/Hr

Field Productivity

- Some of the reasons for poor field productivity:
  - Poor supervision
  - Unavailability of materials
  - Unsafe work conditions
  - Need to redo work already completed
  - Unavailability of tools or equipment
  - Lack of communication

Field Productivity (cont'd.)

- Impact of long-term overtime (several weeks of ten hours/day) on worker productivity:
  - Workers are tired
  - Workers tend to slow down with lack of rest
  - Costs per unit of work increase
  - Workers are more likely to become injured
  - Overtime hours may be "shared" per union trade work rules (a different worker picks up the work task for the O.T. hours)

Weather-Related Productivity Issues

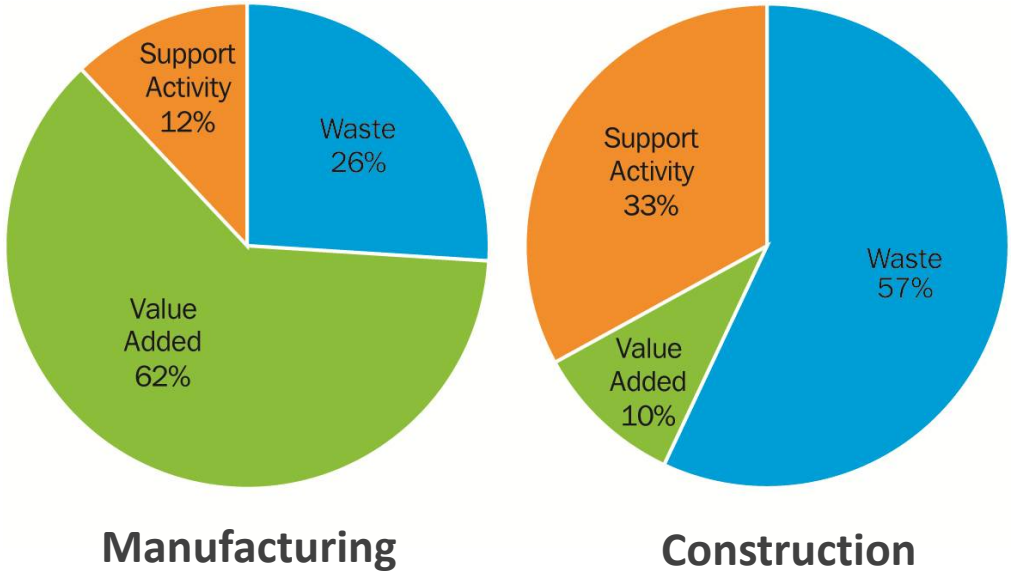
- Extreme cold
- Extreme heat
- Rain, wind, and snow
- Solutions:
  - Temporary enclosures
  - Temporary heat / cooling
  - Increased frequency of breaks

Labor is NOT a Commodity

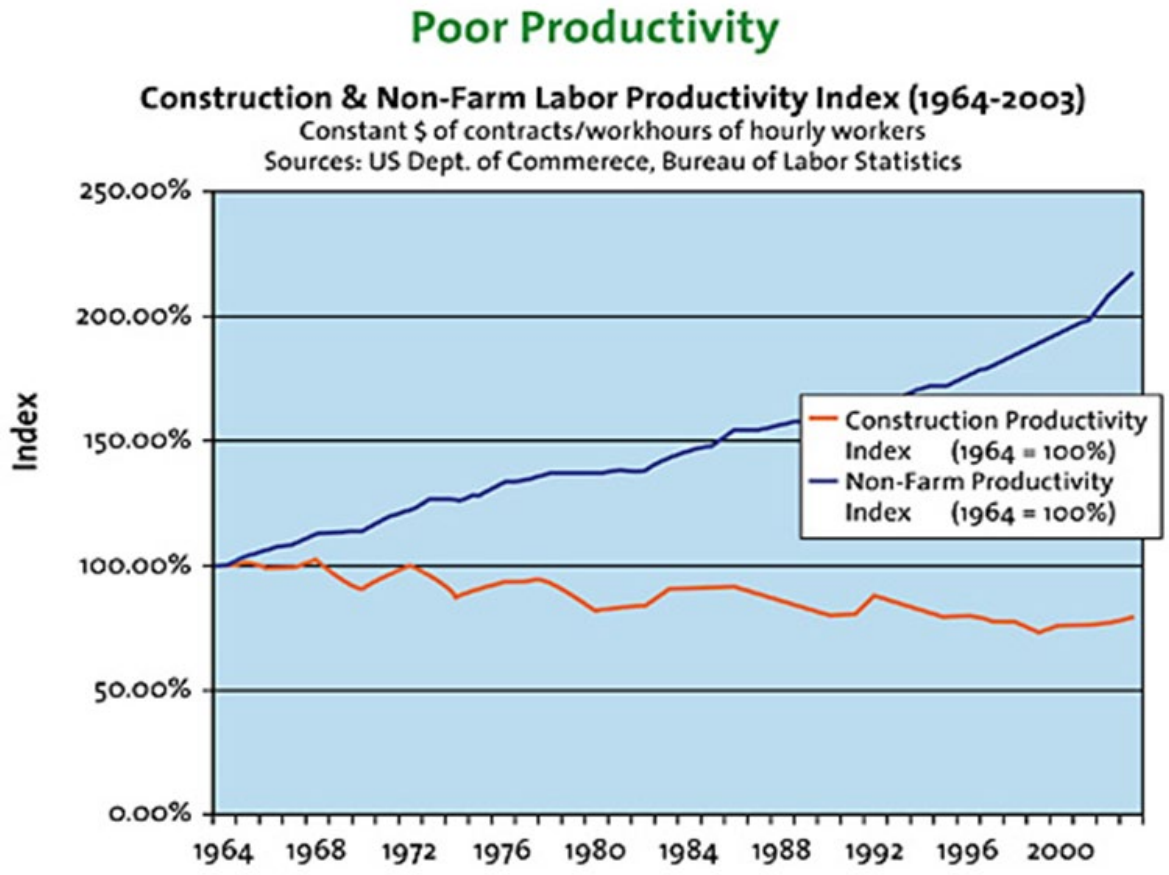
- Money, materials, and time all need management
- People need **leadership**
- Craft workers are not commodities
- Craft workers have choices about where to work and whom to work for

Project Management and Productivity

- High productivity does not just happen by chance; it is the result of planning
- Productivity is a function of management, both good and bad



Labor Productivity



Labor Productivity

- Lack of supervision
- Lack of coordination
- Insufficient mat'ls
- Poor jobsite layout
- Lack of proper tools
- Congested work area
- Poor housekeeping
- Unsafe conditions
- Excessive moving labor
- Adverse weather
- Poor lighting
- Poor heating/ventilation
- Tardiness/absenteeism
- Uncontrolled work hrs/breaks
- Proximity of parking, water restrooms
- High turnover
- Poor training
- Untimely decisions by mgmt
- Bad attitudes
- Poor use of shifts/overtime
- Construction mistakes
- Changes

The Role of Management

- Management should remove barriers to worker productivity
- Management should consistently enforce standards
- Management should also recognize good work

Material Handling Rules

- Always move mat'l w/ least expensive labor possible
- Deliver mat'l as close as possible to the location of install
- Deliver mat'l to its location with delivery people
- Deliver from the truck to the install location (if possible)
- Avoid moving mat'l more than once
- Anticipate equip needs for entire project – ensure availability

Material Handling Rules

- Select optimum equip for moving mat'l
  - Consider cost, availability, capacity, safety, quantity of mat'l, access to point of use, provide delivery routes, coordinate deliveries
- Place equip in install location (early if necessary)
- Mat'l storage should be systematic
  - Coordinate shop drawings and fabrication with supplier
  - Establish areas for delivery of each major mat'l
  - Sort the mat'l upon delivery
  - Allow adequate spec for sorting and storing waste
  - Protect storage mat'l (as necessary)

  - Example: Tilt-up

Site Constraints

Site Constraints

- Point of delivery considerations
  - Optimal traffic patterns
  - Delivery vehicle size/turning radius
  - Accessibility for loading equip
  - Queuing area for waiting vehicles
    - Concrete trucks
- Location of temp facilities
  - Storage trailers, temp offices, etc.
- Large site considerations
  - Temp fencing
  - Temp/haul roads
  - Extra lifting/hauling equip (hauling from distant storage areas)

Site Storage

Site Storage

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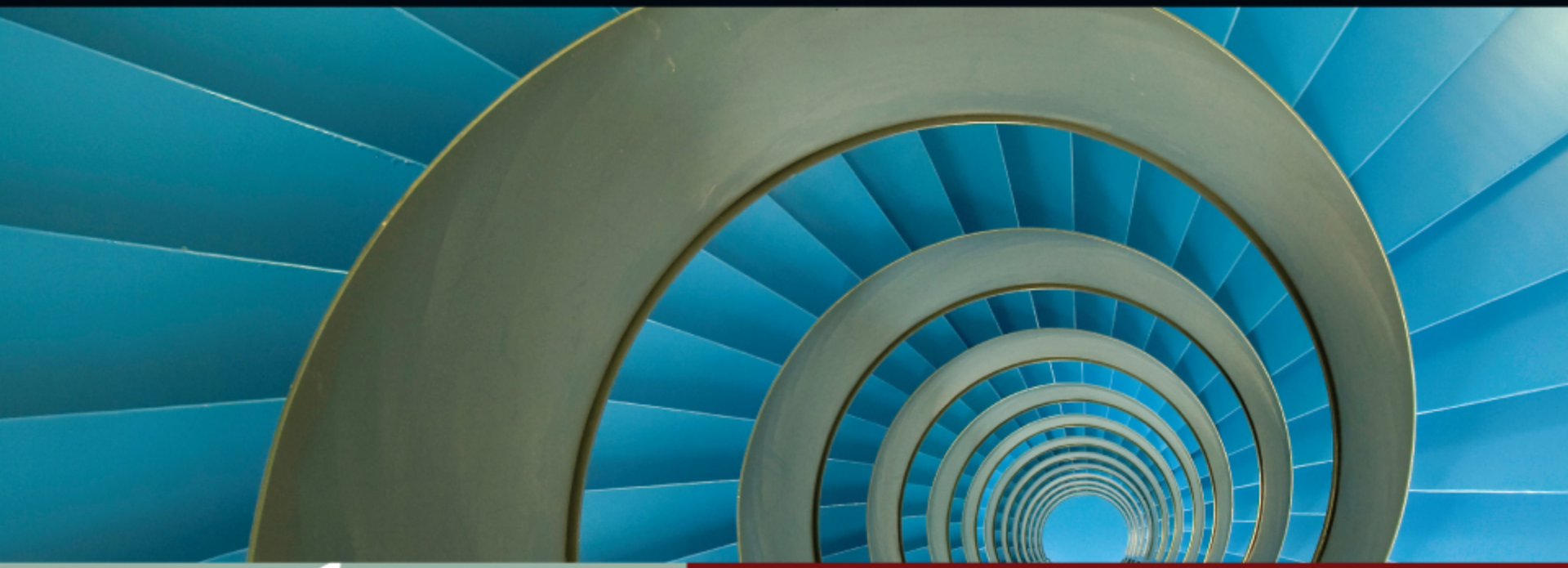

MODULE 1 ESTIMATING AND JOB COSTING

SESSION 4 ESTIMATING COSTS NOT ASSOCIATED WITH A SPECIFIC TASK

Equipment Selection

- For major pieces of equipment, this should be an early step in estimating and project planning
- Equipment selection determines capabilities and rates of work (**equipment productivity**)
- Also affects jobsite safety:
  - Use less “muscle” and more equipment

Equipment Cost Estimating

- Ownership cost:
  - Costs to own
  - Cost to rent
  - Cost to lease
- Operating cost:
  - Hourly costs: fuel, repairs, grease, lubricants

Rent vs. Own vs. Lease

- Ownership advantages:
  - Control of equipment; always yours to use
  - An asset for company net worth
  - Can be depreciated for tax purposes

Rent vs. Own vs. Lease

- Renting Advantages:
  - Best for short-term use, such as when an owned piece of equipment breaks down
  - Useful for highly specialized equipment that is needed infrequently or for only short time periods
  - Someone else is responsible for maintenance and repair

Rent vs. Own vs. Lease

- Leasing Advantages:
  - Usually cheaper than renting
  - Useful for a long-term need
  - Someone else is usually responsible for maintenance and repair
  - Allows a contractor to “try out” a new piece of equipment before making a large investment to buy it

Equipment Cost Rates

- What is best means of projecting the cost of an item of equipment to be used on a future project?
  - Past historical equipment cost and production records
- Why is production an important part of determining equipment cost?
  - Use equipment efficiently to operate at lowest cost

Equipment Production Rates

In regard to equipment production rates, what is meant by a “50-minute hour”?

Efficiency Factors:

- Operator Skill (.9)
- Machine Avail (.95)
- Gen. Oper. Efficiencies (.83)

Project Overhead vs. General Overhead

- Overhead expenses are costs that do not pertain to any given construction work item but are nevertheless necessary for the ultimate completion of the job
- Two types – project and general
  - **Project**: costs incurred at the project site
  - **General**: cost incurred by the general contractor in support of the company's overall construction program
  - Examples…

General Overhead

- Salaries of non-project personnel
- Facilities, utilities, taxes, insurance
- Marketing and promotion
- Operations (supplies, professional fees)
- Financing (interest on loans)

Project Overhead

- Project Manager's salary
- Superintendent's salary
- Job trailers
- Temporary utilities
- Cost items that can be identified with a specific project, but not with a specific work item on that project

Risk and Margin

- Risk is capital that is being used to obtain a financial gain
- Risk means that the capital could be lost
- Margin (or profit) is a business's anticipated financial gain as the result of taking a risk

Risk and Margin (cont'd.)

- If a company takes on more risk, there should be the potential to make more profit
- However, there will also be more potential to lose money
- Companies should always get paid to take on risk
- Managing risk is necessary to stay in business

Margin vs. Markup

- Are they the same?
- Which calculation makes more?

- Margin is always greater than markup
- Google search: Margin vs. Markup

Markup Components

- Profit, sometimes called margin, is the final contract cost minus all project costs
- Markup is usually added to an estimate as a percentage of total cost after all costs are identified
- However, profit on the project is not the same as profit for the company because of general overhead
- Markup = project profit + general overhead

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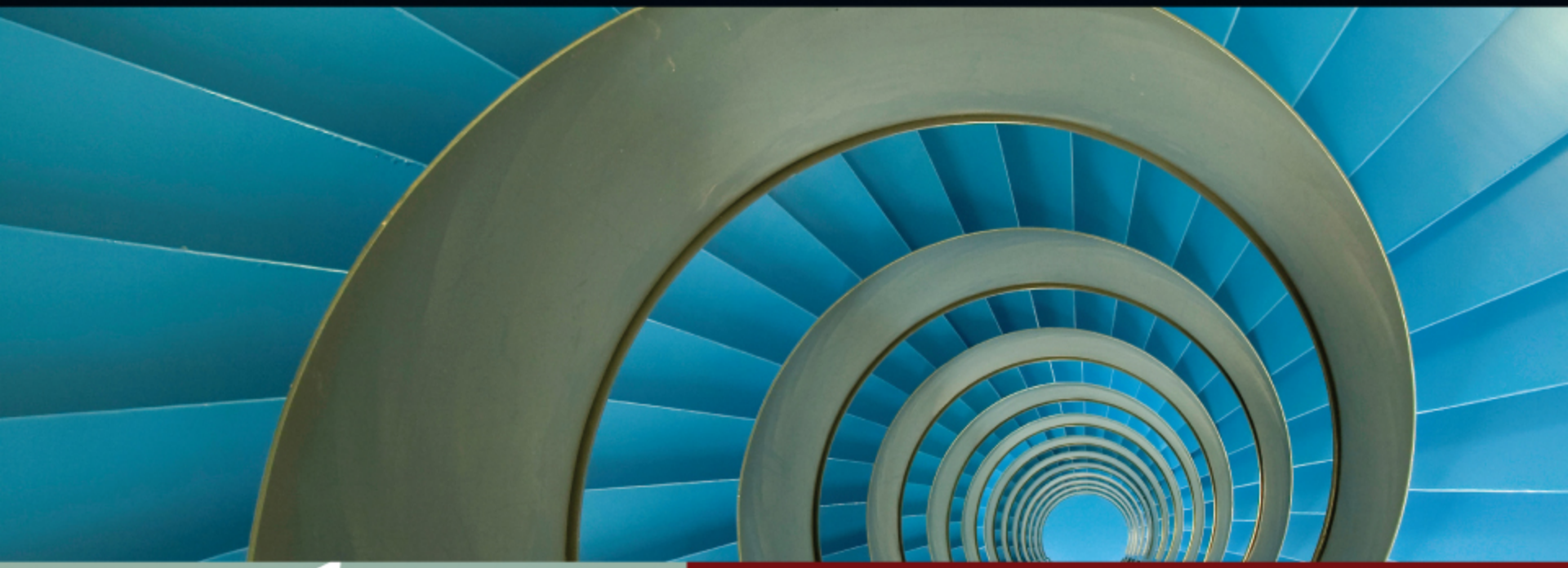


MODULE 1 ESTIMATING AND JOB COSTING

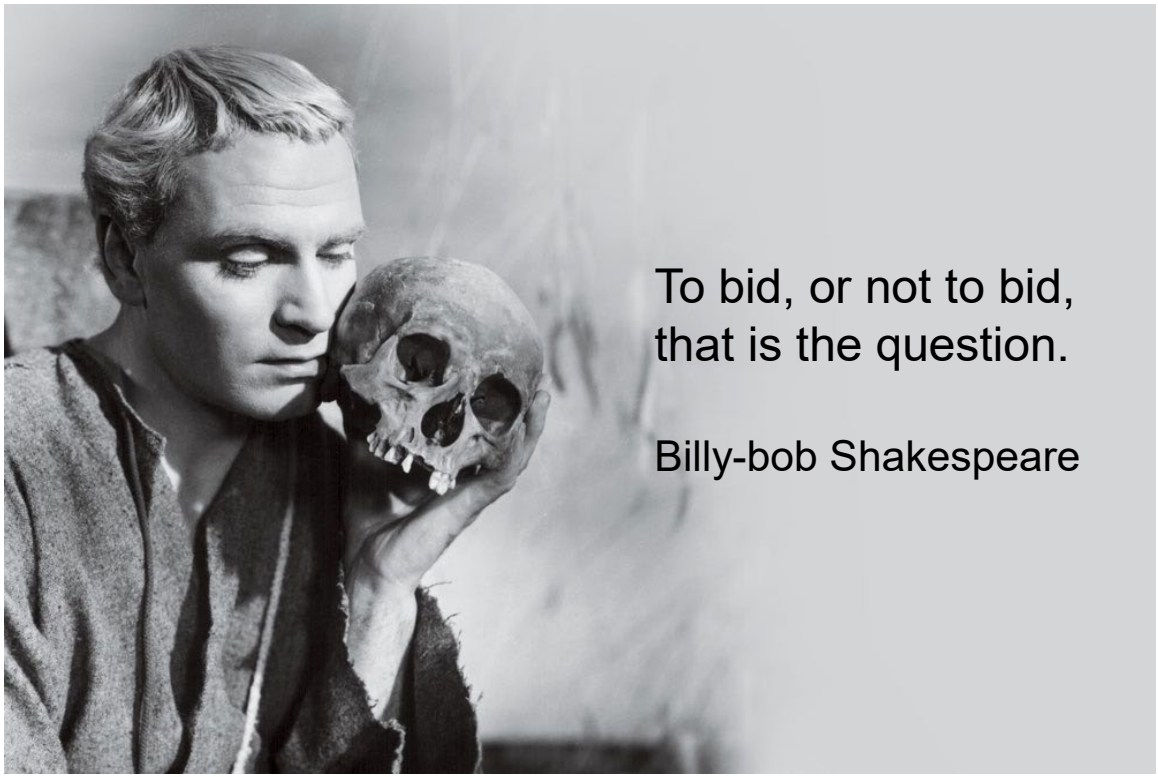
SESSION 5

ESTIMATING THE COST OF WORK BY OTHERS

Bidding

- Giving an owner a price to do a set amount of work
  - Work is usually detailed in plans and specifications
- Normally done in competition with other contractors
- Bidding is the business part of getting work for a construction company

Bidding



- When should we bid? When should we not bid?

Decision to Bid

- The contractor's decision to bid depends on the bidding climate
- What is meant by "bidding climate"?
- The bidding climate is affected by:
  - Bonding capacity considerations
  - Location of project
  - Severity of contractual terms (contractor responsibilities and liabilities)
  - Owner's financial status
  - Project's architect/engineer
  - Nature and size of project as it relates to company experience and equipment
  - Labor conditions and supply
  - Completion date

Preparing a Bid

- Preliminary considerations
  - Become familiar with:
    - Instruction to bidders
    - Proposal form
    - Alternates
    - General and supplementary/special conditions
    - Drawings and specifications (addenda)
  - Pre-bid meeting (in-house)
  - Pre-bid meeting (with owner)

Preparing a Bid (cont'd.)

- Jobsite visit:
  - Observe jobsite-specific conditions that must be covered in the bid (site access, logistics)
- Bid invitations
- Quantity surveys (takeoffs):
  - Unit-price project (A/E's #'s vs. contractor's)
  - Experience needed to do quantity surveys?
  - General contractor's cost estimate of own work

Bid Components

- Material costs – anything that becomes a part of the finished structure
- Direct labor costs:
  - Basic wage rates of the labor categories
  - Production rate that applies to the work type
  - The largest areas of uncertainty
  - Where is the most reliable labor productivity information to be found?
    - Historical cost data

Bid Ethics

- What is meant by:
  - Bid shopping
  - Bid peddling
  - Bid rigging

The Bidding Period

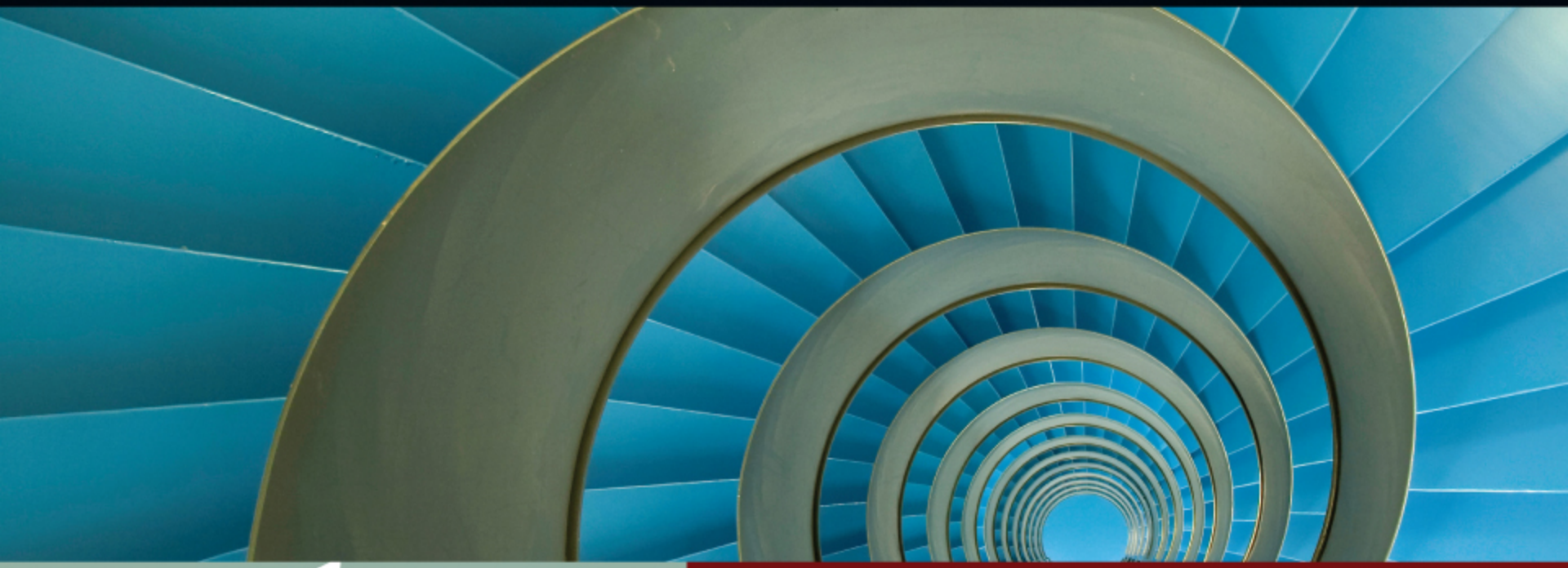
- Why is a reasonable bidding period important?
  - An accurate bid requires adequate time
  - Too little time to bid results in contractors either not bidding or bidding too high
  - Result of “rushed” or “quick” bids is NOT a lower price
  - When unsure, contractors add contingency money to their bids

Subcontracts

- What if a subcontractor's bid is substantially lower than that of any other subcontract for a particular area or unit of work within the project?
  - What should the prime contractor do in this case?
- What happens if a prime contractor uses that same subcontractor for most, if not all, of its projects that are bid competitively?

PMDP

PROJECT MANAGER DEVELOPMENT PROGRAM



MODULE 1 ESTIMATING AND JOB COSTING

SESSION 6
PUTTING ESTIMATES INTO ACTION

Post-bid Reviews

- After the bids are announced, hold a post-bid evaluation and review, whether or not you are the low bidder
- Identify any mistakes or reasons why the bid was too high or too low
- If you are the low bidder, your estimate must be converted into a job-costing report to track actual cost vs. estimated cost

Project Conception:

- Scope, schedule and budget must be linked
- Schedule and budget are derived from scope

Scope

- Must be defined first (**AE** – what, why; **Context** – where, when; **Process** - how).
  - Operational criteria
  - Size
  - Aesthetics
  - Features
  - Quality
  - Maintainability, operational cost
- Must be defined by the owner, but:
  - Many owners need assistance from designers and contractors in defining scope
  - Some owners do not have adequate budget resources, and you must be able to politely determine their ability to fund the project

How to Scope a Project

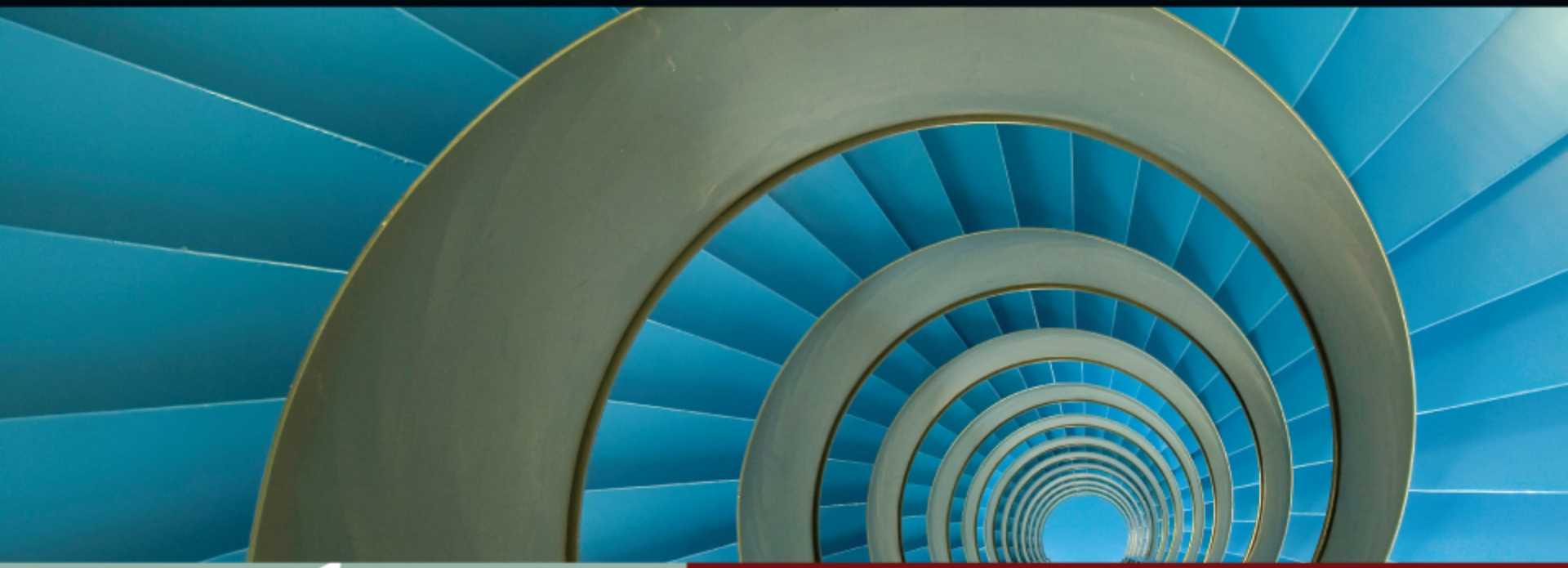
- Site visit
- As-built drawings
- Plans & specifications (construction docs, project manual)
- Ask questions
- Vendor input
- “Build it before you build it”

Contingency “Allowance”

- Every estimate prior to the completion of detailed design MUST include a contingency
- Contingency should be included to account for risks and uncertainty
- Contingency is NOT intended to cover omissions in the estimate due to estimator laziness or incompetence
- The magnitude of the contingency is determined from an evaluation (risk analysis) of risk and uncertainty, but the end result is often based upon experience and “gut feelings”

PMDP

PROJECT MANAGER DEVELOPMENT PROGRAM



MODULE 1 ESTIMATING AND JOB COSTING

SESSION 7

ESTIMATING REDESIGN AND REVISIONS

Value Engineering

- A process by which the project team looks for ways to reduce the project cost without sacrificing project quality
- Results in changes to the contract documents

Other Uses of Value Engineering

- A process by which an owner gets more value for the money
- Examples:
  - Higher-quality windows that use less energy over the life of the building
  - Durable finishes such as tile or terrazzo floors in place of carpet

Contract Changes

- Change in construction projects is expected
- Changes can be generated by the owner, architect, or contractor
- Dealing with changes is an important task for project managers
- Changes should be estimated and priced like any other part of the job
- All parties need to agree to the change order's impact on scope, price, and time
- Should we proceed without documentation?

Why Do Owners Want Project Changes?

- Certainly designers and constructors DON'T
- Why do changes occur?
  - Project life cycle from design to move-in can be very long
  - Owners are indecisive
  - Owner's needs can change during the design and construction processes
  - Many owners are not adept at looking at black and white 2-D plans and visualizing the 3-D final product

Cardinal Change

- Drastic changes to the work
- Could be one single item
- Could be the accumulation of many smaller items
- Will require significant contract modification
- Could be drastic enough that work needs to halt until after exact changes are worked out

Constructive Change

- Change that affects contract dollar amount and/or project schedule
- Work can still proceed
- Sometimes there are disagreements over price, time, and/or justification

Minor Change

- Does not impact project cost
- Does not impact construction schedule
- Usually simple, such as changing paint color

Necessity of Documentation

- Always get it in writing! If not, it never happened
- To avoid problems later, carefully document what was asked for and who directed the change
- Minor changes can become constructive changes
- Constructive changes can develop into cardinal changes

Dealing with Changing Conditions

- The contractor should either ask for or generate a change order as soon as he/she has encountered a need for one
- Many contracts require written notification and approval **before** proceeding with the work
  - What if you are asked to proceed without written approval?

Acceleration

- Speeding up the construction schedule and contract time
- Usually accomplished by working:
  - Longer hours
  - Multiple shifts
  - Weekends

Constructive Acceleration

- Constructive acceleration happens due to one of the following:
  - An owner refuses to grant a time extension for delays
  - The scope of a project has been increased without an extension of time