
Kevin T. McMeel, P.E.
Instructor
Industrial and Engineering Technology

Who am I?

- Education
  - Michigan State University
    B.S. in Civil Engineering
  - University of Missouri – Columbia
    M.S.C.E. in Construction Management

- Experience
  - Licensed Professional Engineer (1981)
  - Industry – 28 years
  - Teaching – 5 years
Experience - Construction

- Daniel International Corporation/Fluor Daniel
- Vantage Point Construction Planning and Management, Inc.
- R. B. Potashnick Co.
- McCarthy Companies
- Mac-Con Company
- Wachter Construction
- City of Cape Girardeau
- Southeast Missouri State University

Projects - Sample

- Nuclear Power Plant
- Power transmission lines
- Pipelines: water intake & discharge; gas transmission
- Parking Structures
- Hospitals
- Industrial
- Educational
Learning Objectives

- Understand the Construction Project Process
- Be familiar with various “Delivery Methods”
- Appreciate the complexities of a construction project

Construction Project Process

- Conception
- Design
- Construction
- Closeout
Project Conception

- Need
- Idea
- Funding
- Design

Selection of Design Professionals

- Competition
- Qualifications-Based Selection (QBS)
Qualifications-Based Selection
- Request for Qualifications (RFQ)
- Evaluations
- Interviews
- Evaluations/Ranking Top 3
- Negotiations
- Award Contract

Request for Qualifications (RFQ)
1. Specialized Experience & Technical Competence
2. Capacity & Capability to Perform
3. Past Record & Performance
4. Proximity & Familiarity with Area
Design Professional Services

- Pre-design Services
- Design Services
- Construction Services

Pre-design Services Provided

- Planning
  - Programming
  - Site Selection
- Help “Sell” the Program/Project
- Provide Feasibility and Justification
- Establish Budget and Schedule
Design Services Provided

- Conceptual Design
- Schematic Design (SD)
- Design Development (DD)
- Construction Documents (CD)
- Bidding

Construction Services Provided

By Consultant Only:
- Submittal/Shop Drawing Review
- Construction Document Interpretation
- Prepare Record Drawings
- Final Inspection & Punch List
Construction Services Provided

Shared by Consultant & Owner:
- Progress Observation
- Change Order Review
- Payment Review

Construction Documents

“Plans and Specs”
- Construction Drawings
- Project Manual
  - “Front Ends”
  - Technical Specifications
- Addenda
### Construction Drawings (Plans)

- Demolition/Utilities/Civil/Site (C)
- Landscaping & Site Improvements (L)
- Architectural (A)
- Structural (S)
- Mechanical
  - HVAC (M)
  - Plumbing (P)
  - Fire Protection (F)
- Electrical (E)

### Project Manual (Specs)

**Old – 16 Divisions**

<table>
<thead>
<tr>
<th>Division</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Bidding and Contract Requirements</td>
</tr>
<tr>
<td>1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>2</td>
<td>Site Construction</td>
</tr>
<tr>
<td>3</td>
<td>Concrete</td>
</tr>
<tr>
<td>4</td>
<td>Masonry</td>
</tr>
<tr>
<td>5</td>
<td>Metals</td>
</tr>
<tr>
<td>6</td>
<td>Wood and Plastics</td>
</tr>
<tr>
<td>7</td>
<td>Thermal and Moisture Protection</td>
</tr>
<tr>
<td>8</td>
<td>Doors and Windows</td>
</tr>
<tr>
<td>9</td>
<td>Finishes</td>
</tr>
<tr>
<td>10</td>
<td>Specialties</td>
</tr>
<tr>
<td>11</td>
<td>Equipment</td>
</tr>
<tr>
<td>12</td>
<td>Furnishings</td>
</tr>
<tr>
<td>13</td>
<td>Special Construction</td>
</tr>
<tr>
<td>14</td>
<td>Conveying Systems</td>
</tr>
<tr>
<td>15</td>
<td>Mechanical</td>
</tr>
<tr>
<td>16</td>
<td>Electrical</td>
</tr>
</tbody>
</table>
Project Manual (Specs)
New – 50 Divisions

00 – Procurement and Contracting Requirements
01 – General Requirements
02 – Existing Conditions
03 – Concrete
04 – Masonry
05 – Metals
06 – Wood, Plastics & Composites
07 – Thermal and Moisture Protection
08 – Openings
09 – Finishes
10 – Specialties
11 – Equipment
12 – Furnishings
13 – Special Construction
14 – Conveying Systems
21 – Fire Suppression
22 – Plumbing
23 – Heating, Ventilating and Air Conditioning
25 – Integrated Automation
26 – Electrical

Project Manual (Specs)
New – 50 Divisions, con’t

27 – Communications
28 – Electronic Safety and Security
31 – Earthwork
32 – Exterior Improvements
33 – Utilities
34 – Transportation
35 – Waterway and Marine Construction
40 – Process Integration
41 – Material Processing
42 – Process Heating, Cooling, and Drying Equipment
43 – Process Gas and Liquid Handling, Purification, and Storage Equipment
44 – Pollution Control Equipment
45 – Industry-Specific Manufacturing Equipment
48 – Electrical Power Generation
Steps of Construction

- Bid
- Evaluate Bids
- Award Contract
- Issue Notice to Proceed (NTP)
- Construction
- Close-out
- Warranty Period

Design Changes

- Addenda (during Bidding Stage)
- Change Orders (during Construction Stage)
  - Request for Information (RFI)
  - Change Proposal Request (CPR)
  - Construction Change Directive (CCD)
**Project Delivery Systems**

- Design / Bid / Build (Lump Sum)
  - Single Prime (Traditional)
  - Multiple Primes
  - Unit Price
- Design-Build
- Turnkey
- Construction Management
  - CM Agency
  - CM At-Risk
- Cost-Plus Process
- Design / Negotiated Price

**Design / Bid / Build**

- Project is Designed
  - Architect/Engineer (A/E) hired by Owner
- Bid
  - General Contractor (GC) hired by Owner
- Constructed
  - Managed by Owner
**Single Prime Contractor - Advantages**

- Complete Design
- Complete Cost
- Simple Selection
- Best Understood
- Work w/ One Contractor

**Single Prime Contractor – Disadvantages**

- Design Time
- No Control over Subcontractors
- Need to Clearly Define A/E Roles
- C.O.s & Claims from Design
Multiple Prime Contractors – Advantages

- Award Contracts at Different Times
- Lower OH&P
- Direct Access to (sub)Contractors
- Owner May Self-perform work

Multiple Prime Contractors – Disadvantages

- Management Risk
- Coordination
- Loss of Leverage
- Define Each Scope
- Separate Documents
Unit Price – Advantages

- Can Bid w/o Complete Design
- Known Prices for Units of Work
- Typically used on Heavy and Highway projects

Unit Price – Disadvantages

- Owner Determines Estimated Units
- Impact of Changes in Estimated Units
- Final Cost Not Known Until Project is Complete
**Design-Build**

- Designer & Constructor “Partnered”
- Either Party May Be “Lead Partner”
- Owner Must Prepare Performance Specifications
- May Not Be Allowed for Public Entities

**Design-Build – Advantages**

- Better Control of Cost
- “Fast Track”
- Less Involvement with design disputes
- Communication
- Contractor Control
- Chance of Success
Design-Build – Disadvantages

- Competitive Bidding More Difficult
- Less Control over Final Design
- Quality Control
- Leadership
- Staff Time

Turnkey – Advantages

- Similar to Design-Build
- Minimal Owner Activity
- Financing by Turnkey Firm
- Additional Services Provided
**Turnkey – Disadvantages**

- Similar to Design-Build
- Bid Document Preparation
- Statutory Requirements

**Construction Management – CM Agency**

- Owner’s Agent
- Often called Program Management (PM)
- Uses Professional Services Contract
- CM Cannot Perform Direct Work
- Owner Holds All Contracts
Construction Management – CM At-Risk

- Similar to General Contractor
- Uses Construction Contract
- Guaranteed Maximum Price (GMP)
- CM Holds Contracts

CM Agency – Advantages

- Provides Services during Design Phases
- Can Better “Drive Schedule” for Owner
- Can Involve More Smaller Contractors
- Can Reduce Project Cost
- Provides Leadership to Project Team
- Extension of Owner’s Limited Staff
**CM Agency – Disadvantages**

- Better for Larger or More Complex Projects
- Need Strong Management
- Some Contractors may not be Bonded
- More Complex Paperwork for Owner
- Willingness to Work with CM
- May Not Know Final Price until far along

**CM At-Risk – Advantages**

- Gives Owner Guaranteed Maximum Price (GMP)
- Provides Services during Design Phase
- CM “Owns” the Schedule
- Can Involve More Smaller Contractors
- CM Can Self-perform Work
- Can Reduce Project Cost
- Reduces Owner’s Staff Needs
**CM At-Risk – Disadvantages**

- Not Statutorily Allowed for Public Institutions
- Better for Larger or More Complex Projects
- Need Strong Management
- Willingness to Work with CM

**Cost-Plus Process**

- Cost-Plus-Percentage (“Time & Materials” or “T&M”)
- Cost-Plus-Fixed Fee
- Cost-Plus-Award Fee
- Cost-Plus with GMP
- Target Estimate with Penalty and Incentive
Cost-Plus Process – Advantages

- Construction Can Be Started Before Design is Complete
- Contractor Can Be Available for Design Input
- Owner Can Make Changes at Actual Cost
- Project Can Be Delivered in Less Time
- Less risk for contractors on changes

Cost-Plus Process – Disadvantages

- Total Cost Not Known until Completion
- Little or No Incentive to Control Costs
- Potential for Abuse
Project Closeout

- Commissioning
- Final Inspection
- Punch List
- O&M Manuals
- Substantial Completion
- Liquidated Damages
- Final Completion

Recap: Learning Objectives

- Understand the Construction Project Process
- Be familiar with various “Delivery Methods”
- Appreciate the complexities of a construction project
Recap: Construction Project Process

- Conception
- Design
- Construction
- Closeout

Recap: Project Delivery Systems

- Design / Bid / Build (Lump Sum)
  - Single Prime (Traditional)
  - Multiple Primes
  - Unit Price
- Design-Build
- Turnkey
- Construction Management
  - CM Agency
  - CM At-Risk
- Cost-Plus Process
- Design / Negotiated Price
Recap: Construction Complexities


Questions?

Assignments