COST ENGINEERING CHALLENGES IN THE MIDDLE EAST
SAME BLUE RIDGE POST JANUARY 2020 LUNCHEON

David N. Rackmales, P.E.
15 January 2020

"The views, opinions and findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation."
COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

AGENDA

1. DoD Cost Engineering
2. Cost Engineering Products
3. Challenges:
   - Serving the Customer
   - Evolving Technology
   - Cultural Challenges
4. Closing Remarks
EXPANDED AGENDA

- Cost Engineering:
  - The Profession of Cost Engineering/Cost Estimating
  - Administration of this specialty in DoD
  - Program and Project involvement

- Cost Engineering Products
  - Cost Estimates and their types/classes
  - Schedules
  - Associated Products
  - Tools of the Trade

- Challenges
  - Serving the Customer: Providing what is desired and what is required
  - Evolving Technology
  - Cultural Challenges
COST ENGINEERING

Administration of this specialty in DoD

TRACES
TRI-SERVICE AUTOMATED COST ENGINEERING SYSTEM

CoP
Community of Practice

Credentialing
CCET – Certified Cost Engineering Technician
CCC – Certified Cost Consultant
CCE – Certified Cost Engineer

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CCET – Certified Cost Engineering Technician
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Maintains state-of-the-profession within DoD.

Cost Engineering

Mission: The Cost Engineering Community of Practice (CoP) formulates all regulations and policies, and provide guidance and directions on all issues related to Cost Engineering for the Military Programs, Civil Works, Environmental and Construction Programs. In addition, it provides economic analysis for the Military Construction (MILCON) program and oversees the maintenance and operation support of the Cost Engineering automation tools.

Functions: This Community of Practice is responsible for developing policy and guidance for USACE Computer Aided Cost Engineering System (CACES), coordinate the efforts to develop standard guidance between the DOD Tri-Service Cost Engineering Community, and provide oversight to the Assigned Responsible Agency (ARA) located at the Huntsville Engineering Support Center (HNSC), Huntsville, Alabama. It develops cost engineering policy, directions, procedures and implementation guidance for Military Construction Army (MCA), Civil Works, Environmental, as well as the Support for Others programs. It prepares and review planning and budget estimates annually for authorization and appropriate by Congressional Committees. It provides staff assistance and support to the Office of the Assistant Secretary of the Army for Civil Works, ASA (CW) and the Office of the Assistant Secretary of Defense (Energy and Engineering), OUSD (E&E) on cost engineering issues, including the required survey and development of DOD Area Cost Factors and facilities Unit Prices guidance. The CoP provides cost engineering consulting and technical support to other federal, state and local agencies, field offices and the private sector.

In addition, it is responsible for overseeing the development, reviews; applications of policy, technical criteria, standards and guidance in the area of engineering economics, economic analysis (EA), and life cycle costing (LCC) of military construction

COST ENGINEERING
Program and Project involvement

PgDT/PDT
Program/Project Delivery Team(s)

The cost engineer shall be a member of the project team and be involved in all major technical discussions regarding costs concerning value engineering studies or changes, A-E negotiations, supply and service type contracts, and negotiated contracts such as RFP, 8A procurement, and as requested by the ACO on contract cost changes or claims.

The cost engineer shall be a member of the project team and be responsible for accuracy and completeness of cost estimates for all stages of the project including planning, programming, design, and construction. The cost engineer has responsibility for application of contingencies to properly weigh the uncertainties associated with each major construction cost item or feature in coordination with input with other members of the project development team.

The cost engineer shall be a member of the project team and attend appropriate project review meetings in support of project cost estimates.

Relationship of Cost Engineer and Project Manager. The cost engineer is an important member of the project management team upon whom the project manager depends for a complete, accurate, and well documented construction cost estimate, as well as input to the construction schedule. The project manager has responsibility to ensure that the cost engineer is provided with the most current design information for preparing and updating cost estimates.
COST ENGINEERING PRODUCTS
Cost Estimates and their types/classes

Four (4) Cost Estimate Types:

1. Project Comparison Estimate
   • Based on historical information of total costs from past projects
   • Compare historical project cost to new project of similar scope
   • Estimate supporting facilities as a percentage of total facilities cost
COST ENGINEERING PRODUCTS
Cost Estimates and their types/classes

Four (4) Cost Estimate Types:

2. Square Foot/Square Meter Estimating
   • Based on historical data
   • Accuracy depends on maturity of design development (e.g., is there a measurable project footprint?)
   • Uses collections/databases of historical project costs (UFC 3-701-01, RSMeans, etc.)
COST ENGINEERING PRODUCTS

Cost Estimates and their types/classes

Four (4) Cost Estimate Types:

3. Parametric Estimating

- Based on historical data
- Bases costs on detailed models of assemblies or systems
- Uses collections/databases of engineered values
COST ENGINEERING PRODUCTS
Cost Estimates and their types/classes

Four (4) Cost Estimate Types:

4. Quantity Take Off (QTO) Estimating
   - Based on quantities counted from design information
   - Uses unit prices of work increments/pieces
   - Required quantity is multiplied by the unit price and total costs obtained by summing all costs of all quantities

Data collected and evaluated no less than every three years
COST ENGINEERING PRODUCTS
Cost Estimates and their types/classes

Four (4) Cost Estimate Types:

- Quantity Take Off Estimating
- Parametric Cost Estimating
- Square Foot/Square Meter Estimating
- Project Comparison Estimating

Increased accuracy provides a greater level of confidence in the estimate but requires more information about specific project requirements and local conditions.
### COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

#### COST ENGINEERING PRODUCTS
Cost Estimates and their types/classes

Five (5) Cost Estimate Classes:

<table>
<thead>
<tr>
<th>ESTIMATE CLASS</th>
<th>MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES</th>
<th>END USAGE</th>
<th>SECONDARY CHARACTERISTIC</th>
<th>EXPECTED ACCURACY RANGE</th>
</tr>
</thead>
</table>
| Class 5        | 0% to 2%                                           | Functional area, or concept screening | SF or $\text{m}^2$ factoring, parametric models, judgment, or analogy | L: -20% to -30%  
H: +30% to +50% |
| Class 4        | 1% to 15%                                          | or Schematic design or concept study  | Parametric models, assembly driven models  | L: -10% to -20%  
H: +20% to +30% |
| Class 3        | 10% to 40%                                         | Design development, budget authorization, feasibility  | Semi-detailed unit costs with assembly level line items | L: -5% to -15%  
H: +10% to +20% |
| Class 2        | 30% to 75%                                         | Control or bid/tender, semi-detailed | Detailed unit cost with forced detailed take-off | L: -5% to -10%  
H: +5% to +15% |
| Class 1        | 65% to 100%                                        | Check estimate or pre bid/tender, change order | Detailed unit cost with detailed take-off | L: -3% to -5%  
H: +3% to +10% |

Note: [a] The state of construction complexity and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual cost from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

AACE International Recommended Practice No. 56R-08
Cost Estimate Classification System – as Applied for the Building and General Construction Industries
COST ENGINEERING PRODUCTS

Schedules

ER 1110-1-1300: “Development of project schedule requires active participation of the cost engineer to ensure that the schedule reflects compatibility with the cost estimate in the application of manpower, equipment, material resources, and the project work breakdown structure (WBS).”

The Cost Engineering team should be developing Period of Performance (PoP) schedule estimates.

The PoP estimate will inform the stakeholders regarding the time needed to construct and deliver a usable project.
**COST ENGINEERING PRODUCTS**

Schedules

Schedule *Classes* are generally analogous to Cost Estimate Classes

A Class 1 cost estimate ought to be accompanied by a Class 1 *schedule estimate*.

<table>
<thead>
<tr>
<th>Schedule Class</th>
<th>Degree of Project Definition (Expressed as % of complete definition)</th>
<th>End Usage</th>
<th>Scheduling Methods Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 5</td>
<td>0% to 2%</td>
<td>Concept screening</td>
<td>Top down planning using high level milestones and key project events.</td>
</tr>
<tr>
<td>Class 4</td>
<td>1% to 15%</td>
<td>Feasibility study</td>
<td>Top down planning using high level milestones and key project events. Semi-detailed.</td>
</tr>
<tr>
<td>Class 3</td>
<td>10% to 40%</td>
<td>Budget, authorization, or control</td>
<td>&quot;Package&quot; top down planning using key events. Semi-detailed.</td>
</tr>
<tr>
<td>Class 2</td>
<td>30% to 70%</td>
<td>Control or bid/tender</td>
<td>Bottom up planning. Detailed.</td>
</tr>
<tr>
<td>Class 1</td>
<td>70% to 100%</td>
<td>Bid/tender</td>
<td>Bottom up planning. Detailed.</td>
</tr>
</tbody>
</table>

Table 1 – Generic Schedule Classification Matrix

[1] RP 18R-97 provides the range in percentages for each class.

AACE® International Recommended Practice No. 27R-03

Schedule Classification System
COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

COST ENGINEERING PRODUCTS

Estimates

Programming (1391/3086) Estimates

Rough-Order-of-Magnitude (ROM)

Current Working Estimates (CWEs)

Independent Government Cost Estimate (IGCE or IGE)*

*Kept close until after bid opening and/or award.
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COST ENGINEERING PRODUCTS

Cost/Schedule Risk Analysis (CSRA)
ER 1110-1-1300: “Project cost estimates shall include cost risk analysis to cover unknown conditions or uncertainties on work elements that will impact cost of construction …

Life Cycle Cost Analyses (LCCA)
ER 1110-1-1300: “The features [for LCCA] should be selected in accordance with economic good sense, such that LCCA are conducted primarily where it is cost effective to do so.”

Value Engineering and Cost/Schedule-Risk and Value Engineering (CsRAVE)

Does it have to cost *that* much?
Does it have to take *that* long?

Risks AND Alternatives are considered, evaluated, quantified, ranked.
COST ENGINEERING PRODUCTS

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COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

COST ENGINEERING PRODUCTS

Tools of the Trade

Cost Estimating:
Parametric Estimating: PC-Cost, PACES
Detailed QTO Estimating: MCACES II/MII

Scheduling:
Prima Vera P6, Microsoft Project

Capturing Historic Data:
HII

Tying it all together…
AutoDesk NavisWorks (Advanced Modeling- AdM/BIM)
CHALLENGES:

SERVING THE CUSTOMER!

Providing what is *desired* and what is *required*

- Planning and Scoping
- USACE Requirements
- Managing Risk and Unknowns
- Situational Awareness/Market Forces
- Market Research
CHALLENGES:

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- Planning and Scoping
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  - Unified Facilities Criteria (UFCs)/UFGS
  - Area Cost Factors (ACF)
  - International Balance of Payments (IBOP)
  - Country-Specific “Cost Books”
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Kuwait issues tender for entertainment city

12 JANUARY 2020 5:19 PM | BY NEHA BHATIA

Bids submitted for Bahrain's Al-Fateh Highway upgrade

12 JANUARY 2020 5:18 PM | BY NEHA BHATIA

Aramco to set up $500m technology investment fund

12 JANUARY 2020 2:05 PM | BY INDRAJIT SEN

Shell appoints contractor for Oman solar power plant

12 JANUARY 2020 5:03 PM | BY JENNIFER AGUILARDO
COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

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CHALLENGES:

EVOLVING TECHNOLOGY

Advanced Modeling (AdM)

- BIM mandated since at least 2006
- Vision for 2012: BIM interface with cost estimating programs
- Vision for 2020: Build with construction robots using standard facility design models.

Reality 2020…
CHALLENGES:

Evolving Technology

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Reality 2020…

Bentley Systems is meeting with Project Time and Cost, the developers of MCACES Version 2 (MII), 4Q 2006, to develop a BIM interface with Triforma product and MII. Bentley has also invited five other commercial cost estimating software developers to join the Bentley Developer’s Network for free.
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Reality 2020…

Goal 6: Leverage NBIMS To Automate Life Cycle Tasks No Later than 2020

Focus: Identify downstream technologies to leverage investment in the NBIMS data

Metric: Substantial reduction in cost and time of constructed facilities

6.1 Objective: Fabricate components from NBIMS data
6.2 Objective: Automate site adaptation of standard facilities
6.3 Objective: Automate construction site progress monitoring
6.4 Objective: Robotically construct facilities based on NBIMS model
COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

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Reality 2020…
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CHALLENGES:

CULTURAL CHALLENGES
COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

CHALLENGES:

CULTURAL CHALLENGES

Earning by careers

<table>
<thead>
<tr>
<th>Career</th>
<th>Avg. gross salary</th>
<th>(USD)</th>
<th>Salary entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Engineer</td>
<td>KWD 22,257</td>
<td>US$ 77,163</td>
<td>07</td>
</tr>
<tr>
<td>Construction Project Manager</td>
<td>KWD 29,186</td>
<td>US$ 100,810</td>
<td>05</td>
</tr>
<tr>
<td>Construction Manager</td>
<td>KWD 12,600</td>
<td>US$ 42,302</td>
<td>02</td>
</tr>
<tr>
<td>Construction Engineer Lead</td>
<td>KWD 20,000</td>
<td>US$ 71,393</td>
<td>01</td>
</tr>
<tr>
<td>Construction Labor Worker</td>
<td>KWD 12,000</td>
<td>US$ 42,421</td>
<td>01</td>
</tr>
<tr>
<td>Construction Carpenter Lead</td>
<td>KWD 10,000</td>
<td>US$ 35,351</td>
<td>01</td>
</tr>
<tr>
<td>Construction Carpenter</td>
<td>KWD 10,000</td>
<td>US$ 32,841</td>
<td>01</td>
</tr>
<tr>
<td>Construction Electrician</td>
<td>KWD 2,500</td>
<td>US$ 8,306</td>
<td>01</td>
</tr>
<tr>
<td>Construction Electrician Lead</td>
<td>KWD 2,400</td>
<td>US$ 7,862</td>
<td>01</td>
</tr>
<tr>
<td>Construction Project Coordinator</td>
<td>KWD 1,500</td>
<td>US$ 4,926</td>
<td>01</td>
</tr>
</tbody>
</table>

Earning by cities

<table>
<thead>
<tr>
<th>City</th>
<th>Avg. gross salary</th>
<th>(USD)</th>
<th>Salary entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuwait City</td>
<td>KWD 18,030</td>
<td>US$ 62,426</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: www.averagesalarysurvey.com
CHALLENGES:

CULTURAL CHALLENGES

فرشة

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COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

CHALLENGES:

CULTURAL CHALLENGES

COST ENGINEERING CHALLENGES IN THE MIDDLE EAST

QINTIDES Official Store

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KWD 0.34

KWD 0.29

KWD 0.07

M3

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to Kuwait via AliExpress Standard Shipping -
Estimated Delivery: 26-47 days

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4.9 - 30 Reviews 13 orders

Online Store 124094

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CLOSING REMARKS

• Cost Engineering is important!
• Manage Risk
• Be realistic about technology
• Consider the geopolitical situation(s)
• Getting into the weeds is OK…
THANK YOU!

UNITED STATES ARMY CORPS OF ENGINEERS
TRANSATLANTIC MIDDLE EAST DISTRICT
ENGINEERING DIVISION
TECHNICAL SERVICES BRANCH

MISSION STATEMENT

Deliver World Class cost engineering, technical specifications, and advanced modeling products, services, and solutions that support the District’s mission and meet the needs of our customers and stakeholders. To maintain and continuously develop and improve our capabilities and contributions to the acquisition process and workforce.