Integrated Cost Engineering System for Bridge Construction, Repair and Upgrade Projects

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Goal

Develop and implement an automated system to accurately estimate the cost of new bridge construction and/or upgrading existing bridges at the pre-design and preliminary design stage.
Opportunities to improve current concept estimating approaches

• Historical/Bid Based approach
  – Historic project/cost data has insufficient detail for predicting future costs
  – Ability to adjust historic cost data to fit project requirements requires rigorous analysis (scale, material types, location, project conditions, etc.)

• Detailed MTO type estimates are not feasible for concept estimates
  – Insufficient design detail to do take-off
  – Limited labor resources for estimating
Parametric quantity models can overcome these limits

- Parameter inputs are used to make estimate project specific
- Models assure “complete” project estimates - helps eliminate errors/omissions
- Current *detailed* price data eliminates problems with determining relevance of historical costs
- Approach is much less labor intensive than MTO type estimating
Proposed system objectives

- Develop cost models for common new bridge construction and bridge upgrade projects
- Implement a construction process model to deal with construction methods, productivity, staging, and scheduling
- Implement a labor, equipment, and material cost database
- Interface with other planning and construction management systems as appropriate
Why build the proposed system?

• Improve project definition and pre-planning
• Consistency and lessons learned among states
• Saves time and money
• Meets AASHTO and FHWA objectives
• Proven approach - 20 years of public construction experience
How could it be used?

- Advocate for funds for projects
- Set firm budget estimates for individual projects or groups of projects
- Accurate allocation of total state-wide budgets to individual projects
- “What-if” analysis of various design options
- Basis for negotiating contract terms
- Monitor and manage costs during planning, design, construction
Mechanics - How will it work?

• Use project requirements, inspection data or preliminary design as input to cost models
• System generates total project requirements (eliminates common problem of errors and “omissions”)
• Use a current cost database - not history - for pricing
• Update cost estimates through the design and construction process
Proposed Work Flow

Project Requirements, Inspection Data, Preliminary Design Information

Current Condition Assessment

System Recommended Design Options

Cost Models
- Process
- Materials
- Labor
- Equipment
- Indirect Costs
- Soft Costs

Total Project Cost

User Input

Cost Database

Project Alternative Design Solutions
User Establishes Project

Projects are Location Specific

Location Data Includes Labor, Material and Equipment Unit Cost
Projects can have multiple facilities or bid items.

User selects models to create complete project.

Models are included for primary structures, sitework, preparatory work, etc.
Each Model has “required” parameters and “secondary” parameters.

This is an example of the Bridge Model - showing optional structure types.
User provides required information (length and bridge type)
The user can change any of the secondary parameters to fit project definition.

Secondary Parameters are default values provided by the system’s inference engine.
System calculates quantities and costs at an MTO level of detail using current price data.

User can add items, delete items, change quantities or change costs for any item.
Project markups are included for indirect costs.
Building the System

- Form “steering committee” of state users to validate design and development.
- Focus on highest priority construction needs first.
- Gather project information and cost data from states and commercial sources.
- Create software and relational database that is compatible with state bridge management system databases.
- Include decision rules and a knowledge-based model to identify feasible construction alternatives.
What we are seeking from State DOT’s

- Information about your processes
- Suggestions about our approach
- Potential support on our design steering committee
- Collaborative financial support through AASHTO for development
Benefits to State DOT’s

- Proven Approach - Over $20 Billion in completed public agency construction estimated within 8% accuracy over 15 years
- Can be developed quickly (<12 months)
- Consistency across states for “lessons learned”
- Confidence in project definition and cost
- Money and time savings
- Evaluation of emerging technologies
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