

Quality in Construction – Improving productivity and reducing rework by establishing a Built-in Quality (BIQ) program

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Project Background and Summary

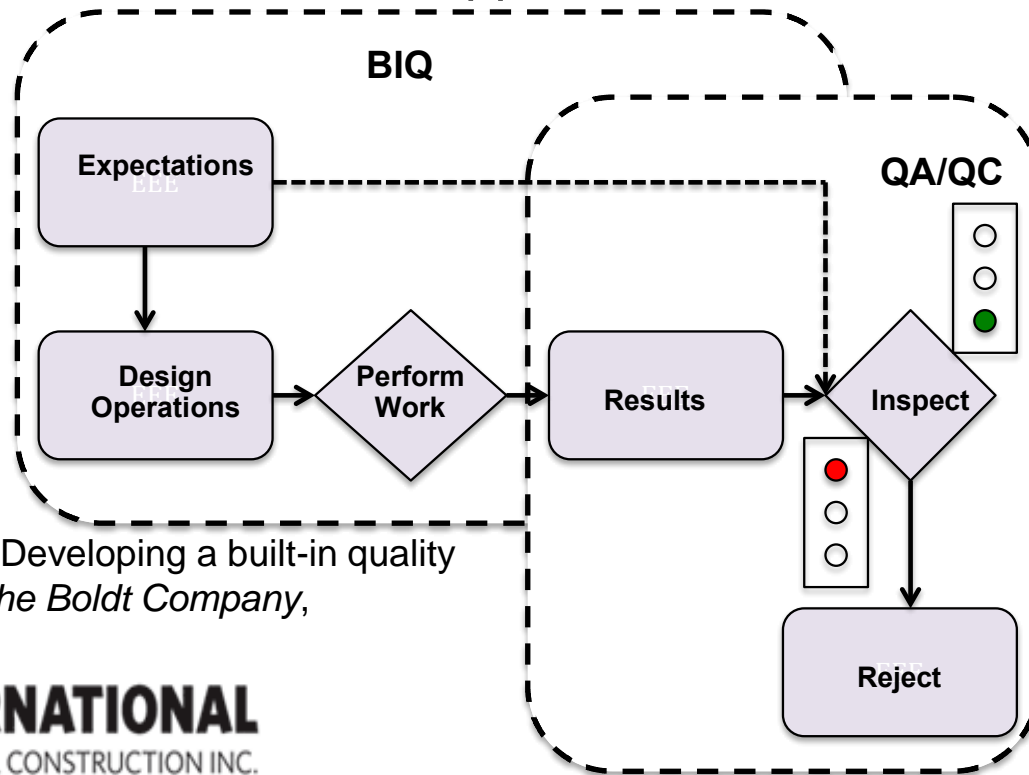
- The standard construction quality process typically consists of Quality Planning, Quality Assurance (QA), and Quality Control (QC)
- However, “one of the fundamental tenets of modern quality management states that quality is planned, designed, and **built in** (emphasis added) – not inspected in”¹
- Built-In Quality (BIQ) is a new method that uses a real-time, interactive process to increase quality and reduce rework
- A BIQ program focuses upon the initial stages of a quality process by identifying customer expectation, converting these expectations into requirements, developing design operations, then performing the work

1. Project Management Institute (PMI) (2008) “A Guide to the Project Management Body of Knowledge (PMBOK).” Fourth Edition, ANSI/PMI 99-001-2008, Newton Square, PA., 189-214.

Project Introduction and Justification

- A Built-In Quality (BIQ) program implements a new quality process in construction operations
- A schematic of an integrated quality process overlays the project BIQ process onto a traditional QA/QC approach-

Schematic of the Quality Process²



2. Lichtig, W. A. (2011). "Developing a built-in quality plan for SMCS/WCC." *The Boldt Company*, whitepaper, Jun.6

Project Introduction and Justification

- The results of the BIQ process provide input into QA/QC inspection.
- If the inspection results meet the quality requirements (green light) the work is accepted; if not (red light), the work is rejected
- This BIQ process figure differs from conventional QA/QC in that an electrical contractor and their customers, both internal (other contractors) as well as external (other stakeholders, including the owner) strive toward an integrated approach
- This collaborative focus is maintained throughout the project, from pre-construction planning through construction, commissioning, and owner occupancy

Project Goals and Objectives

Research Goal

The purpose of this research is to prepare electrical contractors to establish an interactive, real-time quality management system

Research Objectives

1. Determine the current standard for quality within the electrical construction industry
2. Establish a BIQ process to mitigate the loss of labor productivity associated with quality issues
3. Develop a framework for implementation outlining common BIQ standard procedures and best practices that are independently applicable to any project

Task No. 1 – Survey of the current standard for quality in the electrical construction industry

- Research the current standard for quality within the electrical construction industry
- This will include conducting a survey and compiling a database of common quality issues on construction projects
- Some of the parameters that will be surveyed include:

Company data

- geographic location
- annual value of business
- range of projects, in square footage
- range of projects in constructed cost
- percentage of each market sector
- percentage of type of project delivery

Project data

- project type, size, and cost
- type of project delivery
- amount of rework
- quantity of RFIs
- number of change orders
- other appropriate parameters

Task No. 2 - Establish a BIQ process to mitigate the loss of labor productivity

- Correlate these quality issues to the reduction in labor productivity and formulate a BIQ process that can be applied to mitigate the loss of labor productivity associated with quality issues
- A wide range of BIQ documents are anticipated being prepared, including:
 - Flowchart and checklist
 - Process worksheet, with several essential requirements:
 - Product Worksheet of the BIQ cycle
 - Failure Analysis Worksheet
 - Countermeasure Worksheet
 - Process Checklist Worksheet
 - Assessment/Audit Protocol Worksheet

BIQ process control Poka-Yoke (Mistake Proofing) example



- in-wall electrical installed in the spray painted backing layout
- Had the layout been in marker rather than bright orange, it might not have been so obvious

Task No. 3 - Develop an implementation framework outlining BIQ procedures and best practices

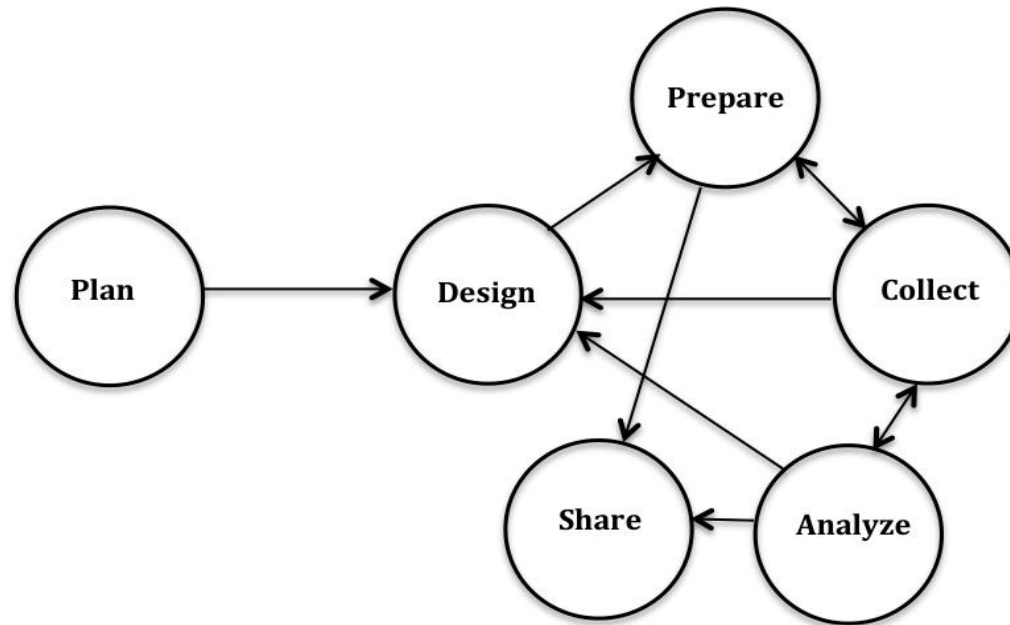
- Develop a framework for implementation that is independently applicable to any project, without the need for full company adoption
- Use data from our Task 1 survey along with the BIQ documents from our Task 2 process development worksheets to create a template for BIQ procedures and best practices
- The goal will be to assist in improving an electrical contractor's construction quality by creating the framework for an interactive, real-time Quality Management System (QMS)
- ISO 9001 certification of a company's quality program is becoming increasingly more important; a contractor's quality assurance system is essential in preventing both problems and the reoccurrence of problems
- This work offers the potential to validate a contractor's ISO 9001 quality process

Task No. 4 – Prepare a final report and develop an MEI course

- Prepare a final report that establishes a BIQ process and develops an implementation framework outlining BIQ procedures and best practices
- Develop an MEI course that will focus upon tools and techniques for electrical contractors to create a project-based BIQ

Work Plan

Our work plan will follow a modified Plan-Do-Check-Act (PDCA) approach-



Case Study Research - A Linear but Iterative Process³

3. Yin, R. K. (2009). Case study research: design and methods (4th ed.). Sage Publishing, Thousand Oaks, CA.

Work Schedule

	Q1	Q2	Q3	Q4
ELECTRI Council July 2013 Meeting				
Task No. 1 – Survey of current quality standards				
<i>NECA Convention Presentation</i>				
Task No. 2 – Establish a BIQ process				
Task No. 3 - Develop a framework for implementation				
Task No. 4 - Final Report and MEI course development				
<i>ELECTRI Council July 2014 Meeting Presentation</i>				

Note: The exact dates for starting and completing all work will be based upon the needs of ELECTRI International and NECA. The researchers are available to immediately begin the work.

Project Budget

Total Project Cost = \$44,975, which includes-

- Compensation for the PI and Co-PI
- Tuition stipend for a graduate student
- General administrative costs
- Travel costs to attend and present at an EI mid-year meeting
- All cost for equipment, supplies, and reproduction
- Fringe benefit and indirect burdens

Product Information Dissemination

- The research output will be a final report and roadmap for electrical contractors to use in establishing a BIQ program
- Dissemination of the work could be introduced at the NECA National Convention
- The work will be assembled as a future NECA Management Education Institute (MEI) course, with workshops offered throughout the US
- MEI course content will focus upon tools and techniques that electrical contractors could establish to create a project based BIQ
- This project is intended to be complete and self-contained and leverages the current and prior work of the researches

Benefit to the Industry

The electrical contracting industry would benefit from the following objectives, which are inherent within the BIQ process⁴

- Simplifying production and assembly will enable cost-effective quality
- Eliminating product and the process variability will make production-to-expectations easier
- Quality depends upon craft workers understanding each internal customer's expectations
- If you focuses upon building quality in (to the product), productivity improvement will follow

Implementing a BIQ process would demonstrate a level of quality excellence and provide assurance to all parties in the supply chain that the equipment is being installed safely, in compliance with all codes

⁴ Kuprenas, J. (2008). "Influence of quality on construction costs." AACE International Transactions, CS51-CS59

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THANK YOU!