



CONSTRUCTION INDUSTRY INSTITUTE®

MAKING ZERO REWORK A REALITY

Construction Industry Institute

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Making Zero Rework A Reality

**Prepared by
The Construction Industry Institute
Do It Right the First Time Research Team**

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Executive Summary

The construction industry, led by CII members, has made great strides in improving its safety record over the last decade. The same cannot be said, however, regarding rework. Many industry participants have been claiming that rework and “doing it right the first time” are priorities, but the increasing rework activity on projects both large and small belies this claim.

The Construction Industry Institute formed the Do It Right the First Time Research Team to investigate field rework and find ways to improve this costly activity. The primary purpose of the research was to identify and describe the primary components of a comprehensive process for management and elimination of quality-error related costs for construction sites. While many errors and omissions occur in the scope development process and design, the focus of this project was limited to implementation of error-reduction activities on the project execution level and within the construction organization.

The research team first looked at methods and techniques that have been effective in implementing safety management and in reducing accidents and lost workdays in construction. It found that management support and pre-project tasks were consistent for both safety and quality activities. The difference occurs in the implementation level between planning and field execution. Most importantly, the research found that worker involvement is needed to resolve the continuing problem of rework. Specifically, the research team found that increasing training on quality issues, identifying quality rework problem areas, increasing full-time quality staff, and having field personnel analyze pre-task quality efforts all contribute to less rework.

Taking a cue from the CII research on safety, the research team now is urging the industry to take a similar look at rework. In addition to zero accidents, the industry needs an attitude of “making zero rework a reality.” If it does, the resulting low percentages of rework could pay for error reduction efforts.

Introduction

Background

On construction projects some amount of field rework often is accepted as a “cost of doing business.” This attitude is similar to the belief systems that supported the “accidents will happen” approach 20 years ago in regard to construction safety. Quality related mistakes or errors, like accidents, are preventable.

Field rework can be broadly defined as: *extra field work performed to rectify nonconforming work regardless of the source of the nonconformance*. This includes design changes and design, fabrication, and construction errors that caused the initial incorrect work. Methodically tracking the factors contributing to field rework has consistently shown that it has a significant direct cost impact, usually four to five percent of construction costs. The primary focus of the existing body of knowledge, however, is related to effective field rework measurement systems and reduction of field nonconformance, not reduction of field rework.

Extensive study and experimentation with improvement techniques in safety has resulted in dramatic reductions in the overall incident rates. Safety improvements have been brought about through corporate and field cultural changes and improvements to safety management system processes. The level of emphasis and accountability placed on all levels of corporate management and project participants has shifted with this increased knowledge. No longer is safety simply a set of regulations to comply with or a senior management “slogan.” Rather, most companies recognize that active management of safety plays a significant role in the process itself and results in significant cost savings in reduced total costs of injuries, workers’ compensation, and other insurance costs. Safety also is driven by ethics: saving lives, preventing potential disabling injuries, and protecting workers is a valuable and noteworthy effort. Thus, safety

management has been able to target “making zero accidents a reality” (as suggested by the CII publication title). The new safety management processes are resulting in reduced incidents, injuries, and deaths.

Reduced rework in the field will save associated direct and indirect costs and help to eliminate schedule disruptions. The fundamental questions for this research were: (1) What characteristics of safety management implementation can be implemented in rework management to yield rework reduction? And (2) what processes exist for “making zero field rework a reality”?

Rework Rates

Rework rates described in the literature have been described from various perspectives. Table 1 summarizes recent rework rates.

Table 1. Literature Summary of Rework Rates

References	Field Rework Percentage	Project Data
CII Research Summary 10-1 (1989)	12% (9.5% design, 2.5% construction)	9 industrial projects
<i>Benchmarking & Metrics Data Report</i> (1997)	3.4%	19 industrial projects
“Investigation of Field Rework in Industrial Construction” (CII Research Report 153-11, Rogge 2001)	4.4% (0%-25% Range)	109 industrial projects
<i>Impacts of Delivery Systems</i> (Benchmarking and Metrics Committee 2002)	2.8% DB Owners 5.0% DB Contractors 2.50% DBB Owners 3.0% DBB Contractors	CII Benchmarking Database 326 projects all types

In CII Research Summary 10-1, *Costs of Quality Deviations in Design and Construction*, rework and deviations were defined as *changes to the requirements, products, or results that do not conform to all specification requirements*. This publication is often referenced as the source for a cited 12 percent field rework value.

The CII Benchmarking & Metrics Data Report in Table 1 was identified in CII Research Report 153-11 (Rogge). The change is that overall field rework dropped significantly from the original nine-project study to this report. The studies that follow this report cite approximately the same percentages.

In Rogge's study, field rework is defined as *additional work done in the field to rectify work done incorrectly regardless of whether the incorrect work was originally done off or on site*. In this definition, it does not matter whether it was a design, fabrication, or construction error that caused the work to be initially incorrect.

All of the studies point out that these percentages are only the reported *direct* costs. Indirect costs of rework are not included in the percentages reported and the percentages may represent only the "tip of the iceberg." No clear data support what the impact of indirect costs may be.

Given the relative consistency in recent studies, the goal now is to further reduce or eliminate field rework.

Purpose of the Research

The purpose of this research was to identify a process for the management and elimination of quality costs due to field rework based on successful implementation elements used in field safety management. To accomplish this purpose, several research tasks were defined.

- a. Identify and evaluate safety program components that may be convertible to quality processes that have a likelihood of an acceptable outcome on the first try.
- b. Identify and evaluate quality processes for error reduction processes other than traditional quality management objectives.
- c. Conduct data collection from volunteer projects and conduct interviews with those projects showing implementation of field error reduction techniques.
- d. Formulate a comprehensive “zero-rework” management process based on the results of comparing the findings of the literature and data collected from active project systems in safety and active defect management processes.

Scope

The research here was preliminary. Key similarities and gaps between safety management and quality management systems with respect to rework still need further investigation. Given the relative depth of recent efforts and investment in preventive measures for safety compared to rework reduction, the expectation was that this work would identify the most promising approaches for a comprehensive rework management process. The key point of interest was how to eliminate field rework at the worker level using successes in safety management as a model.