



Construction Industry Institute®

Craft Productivity Research Program Phase II

Construction Industry Institute

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Craft Productivity Research Program Phase II

**Prepared by
Construction Industry Institute
Craft Productivity Research Program Research Team**

**Research Summary 252-1a
September 2010**

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The University of Texas at Austin.

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Printed in the United States of America.

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Executive Summary

Finding the elusive “pot of gold” at the end of the rainbow—i.e., discovering a way to improve craft productivity by 50 percent—was the challenge presented to Research Team 252 (RT 252) by the Construction Industry Institute (CII) in 2007. Realizing the magnitude of this challenge, CII gave the team a unique six-year research charter. This research summary describes the second phase of the CII Craft Productivity Research Program.

In this phase, to accomplish its objective of identifying opportunities to significantly improve craft performance, the team is using a three-pronged strategy:

1. Find ways to increase the time spent on direct work through activity analysis.
2. Recommend the implementation of innovations with the potential to reduce the number of work-hours required to complete one unit of work.
3. Investigate strategies for reducing the amount of rework.

Further, to strengthen this three-part approach, the team is continuing to develop the Best Productivity Practice Implementation Index (BPPII), a tool designed in Phase I to provide initial and in-progress assessments of how much a project’s planning and best practice implementation influence craft productivity. Meant to provide the basis of a comprehensive productivity improvement roadmap, the BPPII roadmap incorporates data from CII’s Benchmarking and Metrics (BM&M) program on the following six broad improvement areas:

- materials management
- equipment logistics
- craft information systems
- human resource management
- construction methods
- environment, health, and safety.

During Phase I of the Craft Productivity Research Program, RT 252 developed the “infrastructure” for the BPPIL roadmap. In this phase, the team formulated the BPPIL’s categories, sections, and elements. In Phase II, the team concentrated on developing the weightings for these components of the index. Work continues on the BPPIL, and RT 252 plans to test and validate it through work studies on actual projects in Phases III and IV.

Analysis of the CII Benchmarking and Metrics data in this second phase investigated the relationship between particular management practices and reported productivity of the electrical trades. The overall results of the BM&M analysis of electrical crafts indicates that projects with a high level of implementation of safety programs, automation and integration of information systems, materials management systems, team building, and constructability experienced better labor productivity. Once these results were compared to the Phase I analysis of the best practices that yielded improved productivity in the mechanical trades, five common practices began to emerge as having significant positive impacts on productivity. These five best practices for improved productivity are 1) safety programs, 2) system integration, 3) system automation, 4) materials management, and 5) team building. (See Figure 4.) The RT 252 analysis indicates that successful implementation of these cross-cutting best productivity practices can make a difference between a weak or strong project. In the light of this promising finding, RT 252 continues to move forward with its investigation of the relationship between best practice implementation and productivity and its development of the BPPIL.

Along with its long-term effort at developing the BPPIL and its trade-by-trade analysis of the BM&M data, the RT 252 team evaluates innovations that could prove valuable as stand-alone products to improve productivity for each craft studied. This phase involved an extensive set of activity analysis field studies on six industrial construction projects. An extension of work sampling, activity analysis is a continuous improvement method for observing work activity and then categorizing it based on that observation, (e.g., direct work, prep work, tools and equipment receiving or preparation, material handling, waiting, travel, or personal time).

Results indicated that one of the six projects stood out, experiencing significantly higher direct work rates than the others. That project was the only one of the six to be actively engaged in on-going activity analysis. Recognizing the potential for productivity improvement but not finding a readily accessible guide on conducting activity analysis, RT 252 developed an implementation resource that outlines an implementation program. RT 252's *Guide to Activity Analysis* (IR 252-2a) presents activity analysis as a continuous improvement process, a comprehensive approach to project management that can make jobsites significantly more productive.

There are two parts to activity analysis: (1) workplace assessment and (2) the continuous improvement process. The workplace assessment portion of activity analysis is the application of work or activity sampling. The methods developed by RT 252 are a comprehensive and up-to-date version of work sampling. However, it is the coupling of this updated workplace assessment method with a continuous improvement process that is the strength of activity analysis, and that differentiates it from work sampling. The implementation resource discusses how the workplace assessment results can be interpreted to provide recommendations for improvements, how these improvements should be applied, and how to monitor activity levels for continuous improvement.

Improved productivity need no longer be an imaginary goal; organizations can now approach it from several effective angles—combining proven best practices, craft innovations, rework reduction, and activity analysis. RT 252 is investigating all of these approaches and will continue to present its findings from its future phases of research.

Craft Productivity Research Program

The CII Craft Productivity Research Program (RT 252) is a sustained effort to develop and validate a productivity improvement roadmap for the construction industry. Because achieving this objective is not easy nor is it feasible within the scope of a typical CII research team, CII launched the program as a five-phase six-year project. By investigating productivity improvement methods and innovations for one construction craft per phase, the program will present the industry with comprehensive guidance for significant improvements in productivity.

What is construction productivity?

Because there are many ways to define construction productivity, many questions surround it: What is the best way to measure construction productivity? Has construction productivity been improving or declining over the past several decades? What is the best way to improve it? From the perspective of governmental agencies, productivity is typically viewed as the ratio of outputs to inputs. Such formulas are usually expressed as labor productivity (industry real output per work hour) or multifactor productivity (industry real output per total cost of inputs, including labor, equipment, and materials). In order to control a jobsite's productivity, a site construction manager likely measures productivity differently—as a performance ratio (e.g., actual quantities installed per estimated quantities installed), direct work rate (i.e., tool or wrench time), or as labor productivity (e.g., work hours per quantities installed).

The CII Benchmarking and Metrics (BM&M) committee measures construction productivity as the number of work hours per unit of installed work. What complicates any discussion of construction productivity is that all of the above-mentioned measures are correct and effective at controlling productivity, if used correctly. For the Craft Productivity Research Program, the team adopted the CII BM&M's definition of construction productivity as work hour per unit of installed work. The reader should keep in mind one nuance of this definition:

because it is in a project's best interest to use as few work hours as possible to install a given quantity of work, a lower measure is better.

Objectives

The primary objective of RT 252 is to improve construction worker productivity in order to reduce costs, leverage available skilled labor, and improve project schedule performance. The program's approach revolves around improving craft performance in three areas: 1) the percentage of time spent on direct work; 2) the number of work hours to complete one unit of work; and 3) the percentage of construction rework. To achieve these kinds of improvements, RT 252's rolling, five-phase program introduces process innovations. These innovations present opportunities for productivity improvement through craft information systems, equipment logistics, materials management, human resources, construction methods, and environment, safety, and health. Each phase of the program focuses on a specific trade, including mechanical, electrical, concrete, and steel. Each phase involves analysis of the CII BM&M data to identify the management practices that appear to have an impact on the productivity of the craft studied. Objectives for Phases I–V include the following:

1. Use statistical analysis to identify practices described in the CII Benchmarking and Metrics database that have significant positive relationship with craft productivity.
2. Conduct field validations of the most promising innovations.
3. Develop a comprehensive roadmap to help contractors plan and implement the necessary methods and innovations for improved craft productivity.

Research Strategy

The research approach was to use the following three-pronged strategy to identify opportunities to improve craft performance:

1. increasing the time spent on direct work through **activity analysis**
2. implementing **innovations** with potential to reduce the number of work hours required to complete one unit of work
3. developing **rework reduction** programs.

In addition to this three-part approach, the team also made a plan to develop the Best Productivity Practice Implementation Index (BPPII) as the basis of its comprehensive productivity improvement roadmap. (See Figure 1.)

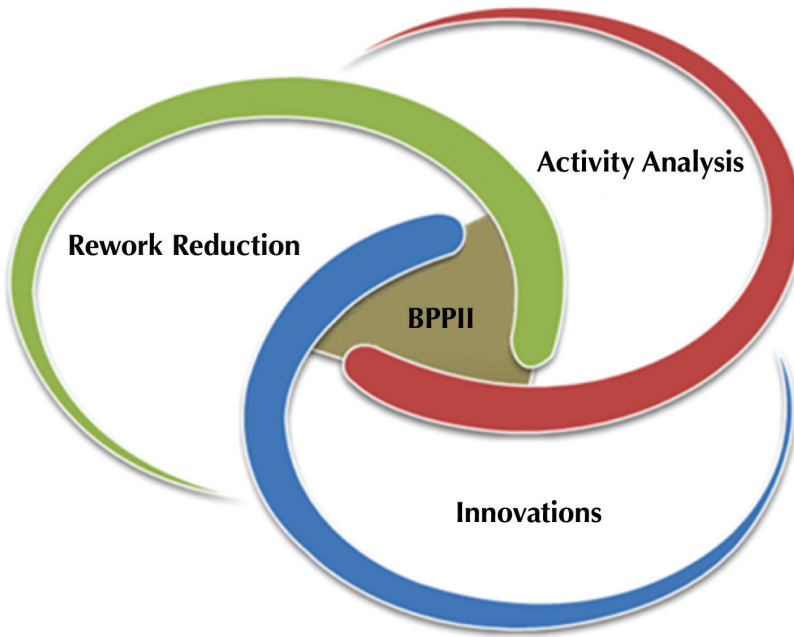


Figure 1. Craft productivity program strategy

Research Program Thrusts

The team’s vision for promoting significant productivity improvement called for research efforts along three thrusts that are shown in Figure 2. The following sections provide a brief update regarding the following RT 252 lines of inquiry:

1. innovations
2. benchmarking and metrics data analysis
3. best productivity practices.

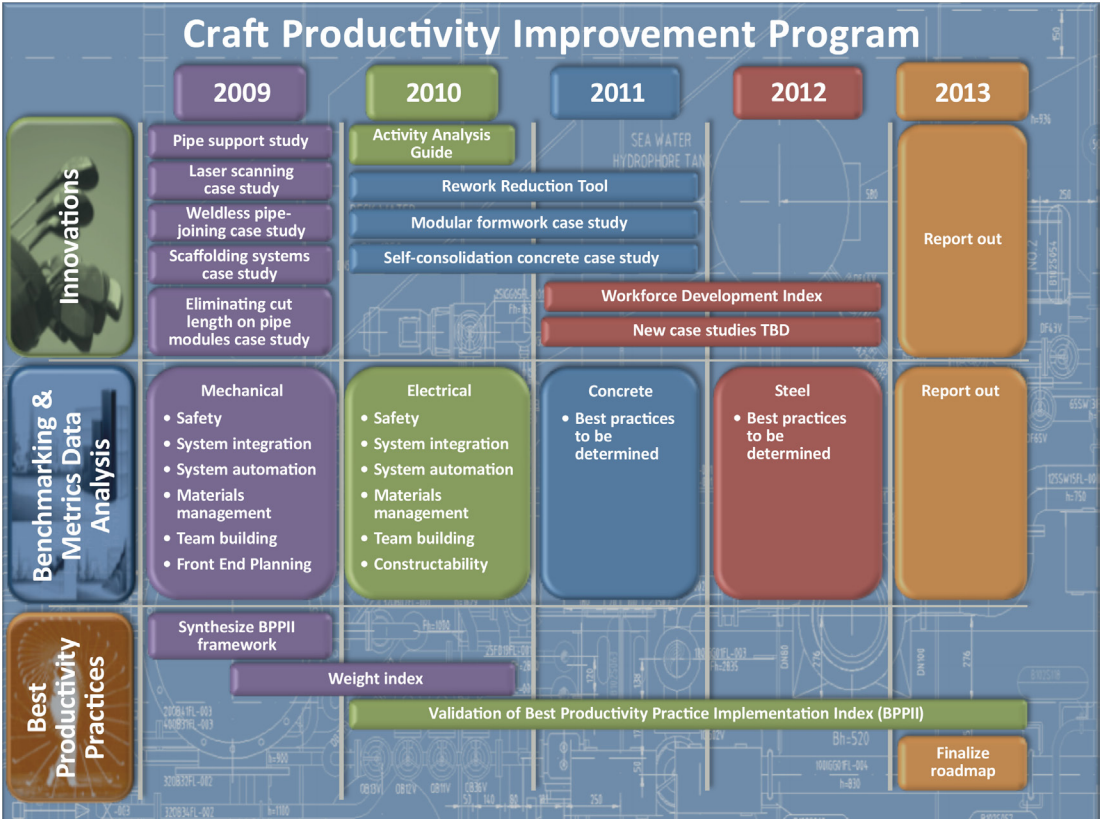


Figure 2. Craft productivity program timeline