Construction Industry Institute®

Productivity Research Program – Phase I

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CRAFT PRODUCTIVITY RESEARCH PROGRAM – PHASE I

by

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EXECUTIVE SUMMARY

Achieving a 50% improvement in construction craft productivity in six years would break a century-old tradition of stagnation that has been interrupted by periodic improvement. The first phase of a six-year research program tasked with trying to do just that is reported here.

Direct work typically amounts to no more than 35-45% of a craftsman's time on the job. To improve craft productivity, direct work time must be improved. To increase direct work time, the availability of materials, information and tools at the workface must be improved. There will be no "magic bullet" that will make this happen, but rather a series of innovations that together produce change. They will include a combination of broad improvements in practice and focused improvements in technology and process.

To achieve these improvements, Research Team 252's (RT 252's) rolling, five-phase program injects innovations annually via a sequence of innovation workshops, field trials, analysis, and implementation tool delivery. Each phase of the program involves: 1) analyses of the CII BM&M data to identify best practices that appear to have an impact on productivity, 2) exploring opportunities for productivity improvement through craft information, technology support for labor, work packaging/organization, and human behavior, and 3) soliciting innovation input from structured workshops and team members' expertise.

Analysis of BM&M data in the first phase was focused on investigating the relationship between particular field practices and productivity of the mechanical trades. Significant relationships were found between improved productivity and best practices in materials

management, safety, team building, front end planning, and automation and integration. These practices, however, are not additive; they are highly correlated and interdependent. Projects that were advanced implementers of these practices experienced as much as a 50% average productivity advantage over projects that were weak implementers. Clearly, implementing these best productivity practices can make all the difference between a weak and a strong performer. But, it is natural to ask whether CII's BM&M database includes all the best practices or primarily those for which CII has produced products, and whether relatively conventional best practices exist with similar impact.

Thus, RT 252's efforts in the first research phase also focused on a thorough search and definition of best productivity practices. When these practices have become rigorously weighted and properly structured, they will become part of a Best Productivity Practices Implementation Index (BPPII). The BPPII will be thoroughly validated in Phases 2 and 3, and will be delivered as an implementation tool in the final phase of the program. No existing CII tool addresses productivity as directly as the BPPII will. Until it is fully developed, however, exciting innovations will continue to emerge and this research program will continue to track them.

For this phase of the program, emerging productivity improvement innovations for the mechanical trades were identified by the team and prioritized. Thorough analyses, including field data analysis, were conducted on each innovation in a structure that includes: 1) the problem addressed; 2) definition of the innovation in terms of technology, process, and organizational change; 3) analysis of field data and risks associated with implementing the innovation, and; 4) guidelines for implementation. Six significant innovations are delivered, including: 1) weldless

and modularized pipe supports, 2) laser scanning, 3) quick connect structural steel pipe supports, 4) cut-length elimination on modules, 5) innovative scaffolding systems, and 6) weldless pipe joining. While these innovations are focused primarily on the mechanical trades, innovations in Phase II are expected to be more cross-cutting, including craft training and work planning innovations.

Implementing the best productivity practices identified in this first phase, as well as the innovations listed above, is expected to result in significant productivity improvement on your project. More is yet to come in subsequent project phases. This report includes five chapters. Chapter 1 provides an overview of the Craft Productivity Program. Chapter 2 identifies filed practices which relate to construction productivity improvement. Chapter 3 introduces six significant innovations used in mechanical trades as well as their impact on construction productivity. Chapter 4 introduces the Best Productivity Practices Implementation Index (BPPII). Chapter 5 is the conclusions of this report.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 : INTRODUCTION

1.1 Background

Despite a century of sporadic advances in equipment, tools, materials, and prefabrication strategies, direct work still typically amounts to no more than 35-45% of a craft worker's time on the job. Increasing direct work time would offer an opportunity for achieving a breakthrough in craft productivity in construction. To enable such a breakthrough is beyond the scope of a typical CII research team. For any substantial chance of this kind of success, a research program would be required. And, such a program would have to have a clearly defined first phase, one that initiates a sustained effort at achieving a breakthrough.

As a whole, the United States has enjoyed almost continuous productivity growth for the last several decades, with especially strong growth in this past decade. Recent research by the Brookings Institute has determined that much of the nation's productivity growth could be attributable to improved production and use of information technology, increased competition due to globalization, and changes in workplace practices and firm organizations. However, the research also points out that construction bucked this trend by experiencing negative productivity growth within the timeframe of their analysis, 1995 to 2001.

Other studies have produced contradictory data. For example, research conducted through the Sloan Center for Construction Industry Studies at the University of Texas at Austin, examined labor and partial factor productivity trends using microeconomic data for