



CONSTRUCTION INDUSTRY INSTITUTE®

EFFECTIVENESS
OF INNOVATIVE
CREW SCHEDULING

Construction Industry Institute

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Effectiveness of Innovative Crew Scheduling

**Prepared by
The Construction Industry Institute
Effectiveness of Innovative Crew Scheduling Project Team**

**Research Summary 185-1
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Executive Summary

Several crew schedule options are available to owners and contractors when they select schedules for a project or when they find it necessary to compress or to accelerate a schedule. Techniques such as overtime, shift work, rolling or straight four-ten hour days, and other innovative schedules all have their own set of unique benefits and requirements for proper application.

Many studies have been funded on the impact of scheduled overtime on labor productivity. Information on innovative scheduling techniques (shift work, rolling or straight 4-10s, staggered 7-10 hour days, and others), however, is limited regarding its impact on safety, productivity, project duration, or cost. CII, therefore, established a project team to research innovative scheduling techniques. The objective of the study was to uncover best practices about when to apply them, conditions for their successful application, and the cost implications (including labor productivity losses and safety concerns) when using them.

The project team focused its efforts on determining if such schedules could provide sound choices for contractors and owners when planning their projects. The team gathered data from a sizable number of projects and found both “good and bad news.” The bad news was that not much is being done in the way of truly innovative schedule techniques; in fact, most supervisors and crews prefer the five day, eight hours a day traditional schedule. The good news was that during the research the team was able to collect an impressive amount of productivity data and then developed a predictive productivity model that can be of benefit in selecting schedules industry-wide. The project team’s work, including development of the predictive productivity model, is presented in summary fashion in this publication.

The project team also created an implementation tool (CII Implementation Resource 185-2) that is a summary of the information collected and is organized in tabular form (referred to as a “look up table”). The table compares each crew scheduling technique, the project characteristics, and the issues that may be impacted by the use of different crew schedules. The tool is intended to aid construction professionals in the selection of a crew scheduling technique that will meet the requirements of a specific project. After reading this research summary, readers should obtain the implementation resource from the CII website and use it to improve project planning.

Introduction

The focus of this research project was to document the impacts and proper applications of various crew schedule techniques as used in the construction industry. The research had five main objectives:

1. Review existing literature on crew scheduling techniques in the construction industry.
2. Survey contractors to obtain their responses on the use of specific scheduling techniques.
3. Determine the impact of crew scheduling techniques on safety, labor productivity, project cost, project duration and absenteeism rates.
4. Quantify the impact of scheduling techniques on labor productivity and the relationship between them over an extended period of time.
5. Develop a tool to aid industry professionals in the selection of the crew scheduling techniques that match the specific conditions and requirements of a project.

The information presented here was collected from two main sources. First, industry input regarding several crew schedule techniques was obtained through the use of surveys delivered to a diverse group of nearly 1,300 contractors, owners, and labor union representatives throughout the U.S. An analysis of the responses allowed a comparison of the scheduling techniques based on perceptions of the schedule impacts on safety, productivity, project cost, project duration and absenteeism. The surveys also provided responses on schedule characteristics and suggestions, based on experience, for the proper application of the schedules.

The second source of information came in the form of actual project productivity data collected from over 100 projects completed with a variety of crew scheduling techniques. While insufficient data was collected on innovative schedules, a wealth of data was collected on the more common schedules. The collected project productivity data was analyzed through statistical hypothesis testing and the use of linear regression techniques. The hypothesis testing provided a direct comparison of the average productivity levels of different crew scheduling options. The developed regression model shows the relationship between workforce productivity, the average number of hours worked per crewmember per week, and total project work hours. The regression model can be used before the project starts to estimate the productivity gain or loss associated with the crew schedule to be used. It may also be used during or after the project to verify if the actual productivity equaled the estimated productivity.

Research Methodology

The project team developed a series of questions for a pilot survey to gather data to address how innovative scheduling techniques impact safety of workers, productivity, project duration, and the cost impact to projects. The responses were reviewed to see if they provided the data necessary to analyze the schedules of interest and to check on the clarity of the questions. From the suggestions of the team and pilot survey respondents, a final survey was developed to collect qualitative information on crew schedule impacts on a variety of project characteristics. The final questionnaire was delivered to contractors and union representatives to obtain their input on these issues.

An additional form was sent to contractors to gather quantitative data from actual projects. Hypothesis testing was applied to the data collected to provide evidence of the relative productivity levels of a variety of crew scheduling techniques. Finally, a model was developed through the use linear regression showing the expected labor productivity, given the average number of hours worked per crewmember per week and the total actual work hours to complete the project.

Contractor Survey and Characteristics

A total of 110 surveys were returned. Twenty-three of the respondents did not include their companies’ locations, but as Figure 1 indicates, the responding companies represent a good spectrum of the U.S.

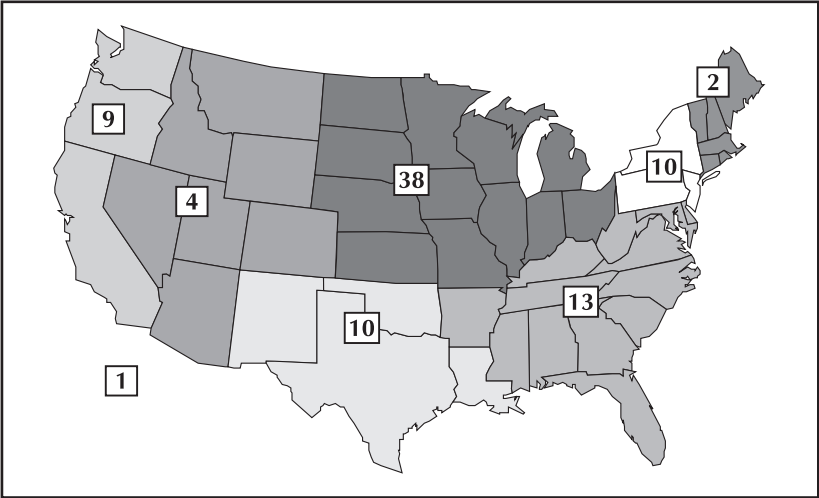


Figure 1. Geographic Distribution of Contractor Survey Responses by State

The types of construction these contractors performed are listed in Table 1. Most of these companies performed more than one type of construction, and therefore the percentages do not add up to 100 percent.

Table 1. Contractor Respondent Construction Types

Construction Type	Percent (%) Respondents Performing
Industrial	81
Commercial	79
Manufacturing	45
Residential	20
Other	10

Union Survey and Characteristics

A total of 35 labor union representatives responded to the final questionnaire. Three of the respondents did not include their companies' locations, but as Figure 2 indicates, those that did respond represent a good spectrum of the U.S.

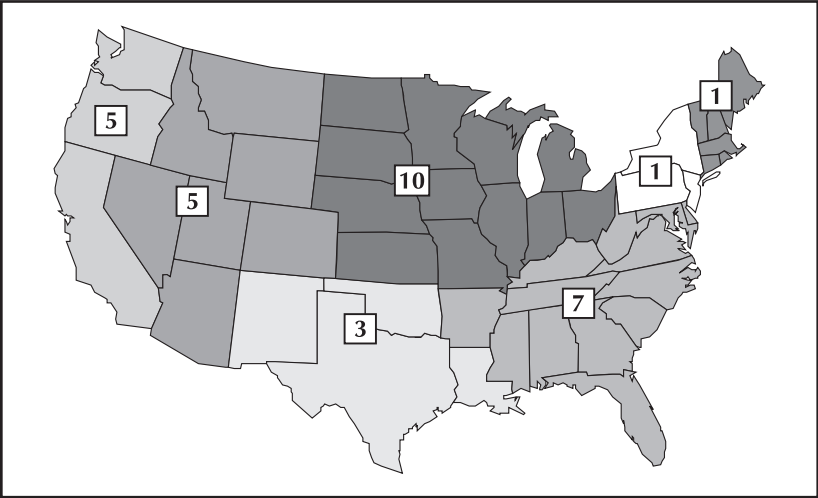


Figure 2. Geographic Distribution of Union Survey Responses by State

The type of construction performed by the labor force represented by the union respondents is listed in Table 2. A large majority of the respondents reported involvement in two or more types of construction, so once again the percentages do not add up to 100 percent.

Table 2. Union Respondent Construction Types

Construction Type	Percent (%) Respondents Performing
Commercial	97
Industrial	94
Residential	44
Manufacturing	28
Other	16