



Construction Industry Institute®

Owner and Contractor Jobsite Organization

Construction Industry Institute

Abbott
Air Products and Chemicals
Ameren Corporation
American Transmission Company
Anglo American
Anheuser-Busch InBev
Aramco Services Company
ArcelorMittal
Architect of the Capitol
BP America
Cameco Corporation
Cargill
Chevron
ConocoPhillips
Consolidated Edison Company of New York
DTE Energy
The Dow Chemical Company
DuPont
Eastman Chemical Company
Ecopetrol
Eskom Holdings
ExxonMobil Corporation
General Electric Company
General Motors Corporation
GlaxoSmithKline
Global Infrastructure Partners
Huntsman Corporation
Intel Corporation
International Paper
Irving Oil Limited
Kaiser Permanente
Koch Industries
Eli Lilly and Company
Linde North America
LyondellBasell
Marathon Petroleum Corporation
National Aeronautics & Space Administration
NOVA Chemicals Corporation
Occidental Petroleum Corporation
Ontario Power Generation
Petroleo Brasileiro S/A - Petrobras
Petroleos Mexicanos
Petroliam Nasional Berhad
Phillips 66
Pioneer Natural Resources
Praxair
The Procter & Gamble Company
Public Service Electric & Gas Company
Reliance Industries Limited (RIL)
SABIC - Saudi Basic Industries Corporation
Sasol Technology
Shell Global Solutions US
Smithsonian Institution
Southern Company
Statoil ASA
SunCoke Energy
Teck Resources Limited
Tennessee Valley Authority
TransCanada Corporation
U.S. Army Corps of Engineers
U.S. Department of Commerce/NIST/
Engineering Laboratory
U.S. Department of Defense/
Tricare Management Activity
U.S. Department of Energy
U.S. Department of Health & Human Services
U.S. Department of State
U.S. Department of Veterans Affairs
U.S. General Services Administration
Vale
The Williams Companies

AMEC
AZCO
Aecon Group
Affiliated Construction Services
Alstom Power
Audubon Engineering Company
Baker Concrete Construction
Barton Malow Company
Bechtel Group
Bentley Systems
Bilfinger Industrial Services
Black & Veatch
Burns & McDonnell
CB&I
CCC Group
CDI Engineering Solutions
CH2M HILL
CSA Central
Coreworx
Day & Zimmermann
Dresser-Rand Company
eProject Management
Emerson Process Management
Faithful+Gould
Fluor Corporation
Foster Wheeler USA Corporation
GS Engineering & Construction Corporation
Gross Mechanical Contractors
Hargrove Engineers + Constructors
Hatch
Hilti Corporation
IHI E&C International Corporation
IHS
Industrial Contractors Skanska
International Rivers Consulting
JMJ Associates
JV Driver Projects
Jacobs
KBR
Kiewit Corporation
Kvaerner North American Construction
Lauren Engineers & Constructors
Leidos Constructors
Matrix Service Company
McCarthy Building Companies
McDermott International
Midwest Steel
Parsons
Pathfinder
POWER Engineers
Quality Execution
Richard Industrial Group
The Robins & Morton Group
S&B Engineers and Constructors
SBM Offshore
SNC-Lavalin
Technip
Tenova
TOYO-SETAL Engenharia
URS Corporation
Victaulic Company
WESCO International, Inc.
Walbridge
Wanzek Construction
Wilhelm Construction
Willbros United States Holdings
Wood Group Mustang
WorleyParsons
Yates Construction
Zachry Holdings
Zurich



Documents

Document Sharing Hub

Owner and Contractor Jobsite Organization

**Prepared by
Construction Industry Institute
Jobsite Organizations Research Team**

**Research Summary 261-1
Version 1.2
April 2014**

© 2014 Construction Industry Institute™

The University of Texas at Austin

CII members may reproduce and distribute this work internally in any medium at no cost to internal recipients. CII members are permitted to revise and adapt this work for their internal use, provided an informational copy is furnished to CII.

Available to non-members by purchase; however, no copies may be made or distributed and no modifications may be made without prior written permission from CII. Contact CII at <http://construction-institute.org/catalog.htm> to purchase copies. Volume discounts may be available.

All CII members, current students, and faculty at a college or university are eligible to purchase CII products at member prices. Faculty and students at a college or university may reproduce and distribute this work without modification for educational use.

Printed in the United States of America.

Version 1.0 (September 2011)

Version 1.1 (October 2013) – minor textual and graphical corrections

Version 1.2 (April 2014) – corrections to equation on page 4

Contents

<i>Chapter</i>	<i>Page</i>
Executive Summary	v
1. Introduction	1
2. Research Method and Data Sample	3
3. Findings	7
4. Application and Implementation	31
5. Conclusions and Recommendations	33
Appendix: Project Jobsite Roles and Functions Assessed	37

Executive Summary

Over the past 30 years, jobsite management functions and their associated staffing levels have increased in number and complexity for both owners and contractors. This change has been in response to demands for greater levels of jobsite planning, resource management, and performance oversight. However, there is little published guidance or clarity on jobsite organization metrics or approaches. The primary purpose of this research was to identify and describe industry norms for jobsite organizational functions and staffing levels for owners and contractors, with special focus on finding the norms that provide the best value for different types of projects under different circumstances.

This is the first jobsite organization benchmarking study of its kind. The study targeted 31 industrial projects under construction over the last two years with total installed cost between \$50 million and \$800 million. The projects were examined in terms of jobsite organization parameters, project characteristics, execution parameters, and project success parameters. Benchmarking metrics derived from this research pertain to owner and contractor jobsite organization size and constituent roles. The research team collected and analyzed data on organization size in terms of both staff full time equivalent (FTE) and craft-to-staff ratio (CSR).

For the sample of projects examined, jobsite organization team sizes and CSR metrics vary significantly. These values range from three to 69 FTEs for owners, and from five to 143 FTEs for contractors. The mean craft-to-staff ratio for owner teams is 13.0 and 4.3 for contractor teams. From an FTE perspective, petrochemical projects have the largest owner teams, while construction-only projects have the smallest owner teams. EPC/design-build projects have the largest contractor teams, while construction-only projects have the smallest contractor teams.

High CSR values translate to smaller jobsite management teams. Power utility and construction-only projects have the largest owner CSR values, while cost reimbursable and EPC/design-build projects have the smallest

owner CSR values. Lump sum projects have the largest contractor CSR values, while petrochemical, power utility, and EPC/design-build projects have the smallest contractor CSR values. CSR variability is quite large for owners, but much less so for contractors. Regression analyses indicate strongly correlated predictive equations for estimating contractor staff size (FTE) on the basis of either project capital cost or construction craft work hours.

The sampled projects suggest that there are six core jobsite organization roles with FTE > 1.0 for owners, and 16 such roles for contractors. Owner jobsite staffs are dominated by three management functions: quality, coordination, and commissioning. The predominant functions on contractor jobsite staffs are the following: field engineering, quality, materials management, safety, craft superintendents, procurement/supplier coordination, and area superintendents. Staff support for four contractor roles—area superintendent, craft superintendent, HSE management, and QA/QC management—are generally scalable or correlated with project size. Accordingly, mean craft-to-staff ratios have been provided for these individual roles.

Two-thirds of the owner projects examined outsourced jobsite staff functions, and this approach appears to be a growing trend. The amount of outsourcing for these projects ranged from 7 percent to 92 percent. Contractor project managers have a mixed opinion on their level of satisfaction with outsourced owner staff. Projects with larger owner and contractor jobsite staffs appear to be safer than projects with smaller staffs. Both owners and contractors should ensure that their management staffs are sufficient to promote worker safety.

Association trends have been analyzed for projects that perform better than average with smaller-than-average jobsite teams. Enabling factors appear to be the growth of trust between owner and contractor, higher quality of technical documents, and thoroughness of team role definition, change management, start-up planning, constructability planning, and front end planning, among others. Thus, there appear to be links between team effectiveness and implementation of CII Best

Practices. Because it is widely believed that an organization's approach to jobsite organization can play a key role in project success—at a time when there is little tolerance for underperformance—it is important to better understand quantitative and qualitative dimensions of jobsite organization and their links to project performance.

Introduction

Background on Jobsite Organizations

Over the past 30 years, jobsite management functions and their associated staffing levels have increased in number and complexity for both owners and contractors. This change has been in response to demands for greater levels of jobsite planning, resource management, and performance oversight. For example, there is now much greater effort directed toward safety management, and cost and schedule control efforts have grown in complexity.

Jobsite management teams are currently structured in a wide variety of ways—with different implications on performance. For instance, there is growing use of the owner-managed approach, and owners are involving greater numbers of contract personnel to supplement their staff at the jobsite. However, there is little published guidance or clarity on jobsite organization metrics or approaches. In fact, jobsite organization benchmark information remains mostly closely held at the company level. As a result, this information is generally not well understood at the project or industry levels. Because it is widely believed that an organization's approach to jobsite organization can play a key role in project success—at a time when there is little tolerance for underperformance—it is important to better understand quantitative and qualitative dimensions of jobsite organization and their links to project performance.

Research Purpose and Objectives

The primary purpose of this research was to identify and describe industry norms pertaining to jobsite O-E-P-C organizational functions and staffing levels. The team focused particularly on finding the norms

that provide the best value for different types of projects under different circumstances. Specific objectives of the effort included the following:

1. Collect field data to better understand why some jobsite organization approaches are more effective or more responsive to project needs and objectives.
2. Understand how project jobsite organizations vary in size and makeup; seek insights into how they vary with respect to project type, contract type, and other parameters.
3. Examine associations between size of jobsite organizations and project performance measures.
4. Acquire lessons-learned regarding the structuring and optimal staffing of jobsite organizations.
5. Identify ways in which owner/contractor jobsite organizations can work together more synergistically.

Study Scope and Limitations

The study scope included the sizing and design of owner and contractor jobsite organizations for capital projects with targeted construction costs between \$50–800 million. Actual costs of projects included in the study varied slightly outside those limits.

The study scope did not include or address the following issues:

- small projects
- craft foremen and craft labor staffing levels
- recruitment and assignment of team members
- training and orientation of team members
- day-to-day aspects of team leadership of jobsite organization
- purely manual staffing ratios, such as general foreman/foreman ratios, foreman/craft-worker ratios, and manual skilled/manual unskilled worker ratios
- labor camp staffing issues (projects with labor camps not explicitly excluded).

Research Method and Data Sample

Study Methodology

The methodology used to accomplish the research objectives involved the following elements:

- preparation and pilot testing of two lengthy interview guides—one for owner project managers, and one for contractor project managers
- separate in-depth phone interviews of both owner and contractor project managers regarding details of their respective organizations
- collection of four types of project-oriented data—project characteristics, project execution details, project performance measures, and jobsite organization size and constituent roles
- assessment of 37 different possible jobsite roles/functions, excluding foremen and craft labor (tabulated in the appendix)
- data on prime contractors only one-tier in depth; no assessment of data on subcontractors
- use of two different metrics for computing/reporting jobsite organization size norms—full time equivalent (FTE) and craft-to-staff ratio (CSR)
- data analyses that focused on FTE and CSR norms, FTE and CSR variations and associations with project characteristics, owner and contractor core team roles, and links or associations between team size and variations in project performance, among other analyses.

Early on, the research team examined existing jobsite organization data that had been collected by CII through the Benchmarking and Metrics (BMM) program. These efforts, however, produced no significant findings

because such data had only recently been added to the BMM process, and the small sample size available was dominated by a small number of owner organizations. In addition, the data set did not incorporate any detailed contractor staff measures.

Formalized Jobsite Organization Metric: Craft-to-Staff Ratio

To offer a normalized, comparable jobsite organization metric that takes into account variation in project size (as indicated by craft work hours and construction duration), the research team formalized the craft-to-staff ratio (CSR) as follows:

$$CSR = \left(\frac{WH}{DUR} \right) \times \left(\frac{1}{FTE} \right) \times \left(\frac{1}{50} \right)$$

CSR: Craft-to-staff ratio	DUR: Duration from site mobilization to mechanical completion in weeks
FTE: Full time equivalent of staff	50: Approximate typical work hours per week
WH: Total onsite craft work hours	

High CSR values translate to smaller jobsite management teams. As the equation indicates, the CSR metric varies approximately as the inverse of the FTE metric.

By examining alternative metric formulations, the team found anecdotal evidence that there is industry precedent for using the CSR metric, or something similar, but not at a widespread level. However, no coverage of such a metric was found in published industry literature.

Characteristics of the Data Sample and Applicability of Observations

The four types of project data described above were collected over an 18-month period for 31 different projects. These 31 projects include several projects with either individual owner or contractor organizations that were not included in the study. For example, four projects were owner-managed, with no dominant prime contractor involved in the study. Another four projects involved either contractors that declined to participate or owners that did not want the contractor to participate. One

owner declined to participate in the study. To reflect these variations, data set sizes (N-values) are indicated wherever appropriate. Salient characteristics of the data sample are as follows:

- Projects in the sample are diverse in size.
 - Mean cost is \$338.1 million; median cost is \$300.0 million.
 - Lowest cost is \$38.0 million; highest cost is \$1,200.0 million.
 - WH mean is 1.71 million; WH median is 0.98 million.
 - Petrochemical project mean cost is \$309.5 million (N=10).
 - Power utility project mean cost is \$426.6 million (N=10).
 - EPC/design-build project mean cost is \$473.4 million (N=13).
 - Private project mean cost is \$342.6 million (N=22).
 - Public project mean cost is \$259.3 million (N=7).
- Projects in the sample are dominated by (but not limited to) the following varying characteristics:
 - domestic locations (84%)
 - power utility and petrochemical projects (20 of 31, 65%)
 - teams comprised of mostly highly experienced individuals, with low staff turnover
 - contractors selected by best value (57%)
 - projects judged in general as *difficult* or *extremely difficult* (63%), and often upset by weather, scope change, and/or delays.
- Projects in the sample are generally balanced in terms of the following contract, project, and organizational types:
 - lump sum and cost reimbursable
 - EPC/design-build and construct-only
 - greenfield and addition/revamp
 - owner line organizations and owner matrix organizations.

As the data sample size in this pioneering study is limited, those study findings associated with low N-values should be viewed as observations rather than as definitive conclusions.

