



National Institute of  
BUILDING SCIENCES

Off-Site Construction  
Council

# Report of the Results of the 2014 Off-Site Construction Industry Survey





### National Institute of BUILDING SCIENCES

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### Off-Site Construction Council

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## Introduction

In 2014, the National Institute of Building Sciences Off-Site Construction Council set out to get an understanding of how the construction sector is using off-site construction techniques by conducting a survey of the building industry.

This document, *The Report of Results of the 2014 Off-Site Construction Industry Survey*, provides answers to the many relevant questions and offers insight into who is using off-site construction in the industry, how it is being used, as well as the perceived benefits and challenges of using off-site construction in projects. This data will serve as a baseline moving forward as the Council works to educate and support the industry in implementing off-site construction practices.

Thanks to the help of *Building Design and Construction* magazine and *Engineering News Record*, as well as Off-Site Construction Council members, the survey was able to reach a significantly wider audience. We appreciate their support in getting this survey out to the masses.

And, of course, thanks to the Off-Site Construction Council, who compiled this report and will be putting the data to work to help the industry to capture the benefits of off-site construction in practice. I have no doubt this is just the first of many reports to come out of this new Institute Council.



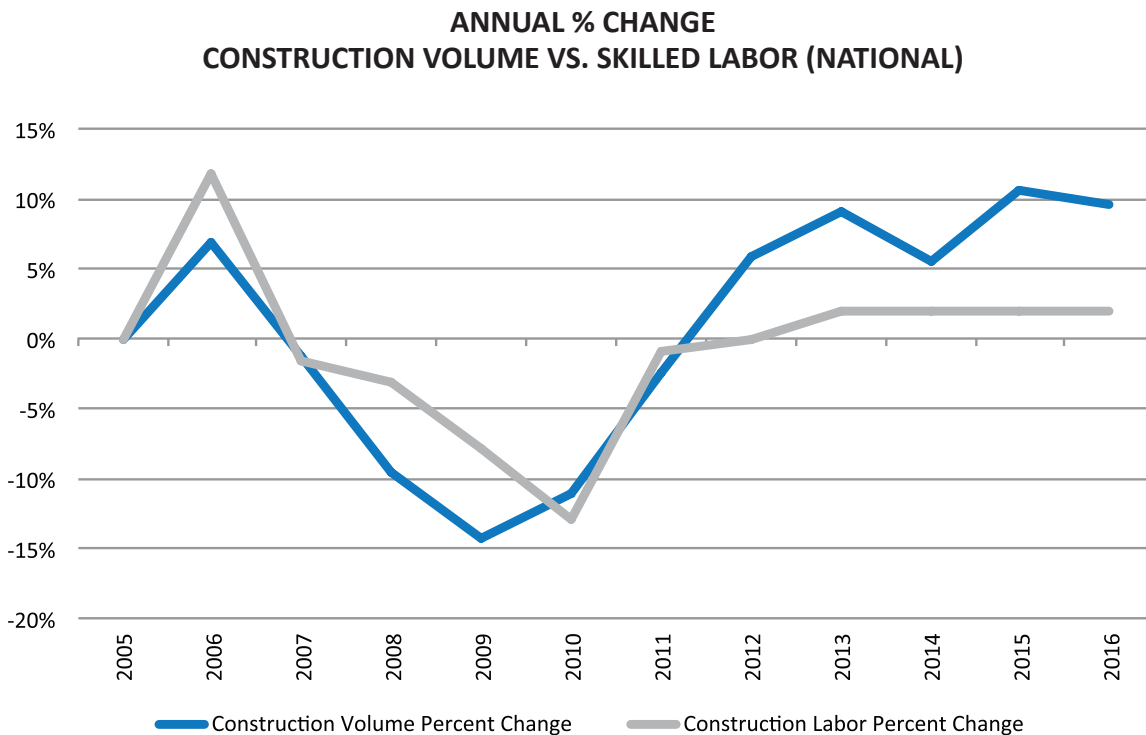
Henry L. Green, FAIA  
President  
National Institute of Building Sciences



# Report of the Results of the 2014 Off-Site Construction Industry Survey

Off-site construction is the planning, design, fabrication and assembly of building elements at a location other than their final point of assembly onsite. An integrated planning and supply chain optimization strategy characterizes off-site delivery.<sup>1</sup>

From heating, ventilation and air-conditioning (HVAC) duct fabrication to full volumetric modules delivered to a site and assembled, off-site prefabrication in the construction sector is growing and impacting projects at an increasing rate. With the looming shortage of skilled craft workers forecast to exceed 2 million by 2017, prefabrication in a controlled, off-site environment may become a necessity for many U.S. contractors attempting to remain competitive with a lower-skilled workforce.<sup>2</sup> (Fig. 1) Despite the need and increasing demand, uncertainties accompany the utilization of off-site construction, as with any new process or technology.



**Figure 1**  
*Annual Percent Change in Construction Demand versus Labor Supply.*  
(Data courtesy of Cumming Corp.)

<sup>1</sup> Glossary of Off-Site Construction Terms. National Institute of Building Sciences Off-Site Construction Council Website. Accessed February 18, 2015. [www.nibs.org/resource/resmgr/OSCC/GlossaryOffSiteConstructionT.pdf](http://www.nibs.org/resource/resmgr/OSCC/GlossaryOffSiteConstructionT.pdf)

<sup>2</sup> Cumming Corp. Report on labor and construction market forecast in the U.S. 2015.



In the fall of 2014, the National Institute of Building Sciences Off-Site Construction Council conducted a survey to identify the opportunities and challenges associated with the use of off-site construction processes and technologies in the United States and gain an understanding of how the National Institute of Building Sciences can foster the utilization of off-site construction to support the achievement of high-performance buildings. The Council, which recognizes that the transition from site-built to off-site construction will require a profound change in business planning and organizational development, felt a survey of off-site stakeholders would establish a baseline of the current state of practice.

The National Institute of Building Sciences distributed the survey through its communications network and both the *Building Design and Construction* magazine and *Engineering News Record* sent the survey to their subscribers. In addition, Off-Site Construction Council members disseminated the survey request to their personal contacts. This report summarizes the survey responses.

A total of 312 participants responded to the survey. Their answers, which were anonymous, are shown in the aggregate only. The results demonstrate the current markets, benefits and barriers, as well as next steps to be taken by the Council.

The companies who responded provide a number of services, including construction management/general contracting (46.7%), engineering (38.3%), trade contracting (27.3%), architecture (15.0%) and, finally, owners/developers (8.3%). (Question 12)

The survey responses indicate where off-site construction is most often being utilized. The participants (who could select multiple categories), are using off-site elements for commercial construction (57%), industrial (51%), healthcare (45%), education (37%), multi-family (24%) and hospitality (23%). Note: the survey was not intended to address single family residential construction (8.0%). (Question 14)

Most respondents (93%) indicated they had utilized off-site fabricated components to some degree over the past 12 months (Question 1), while 83% expected to utilize off-site construction more often or the same amount in the next 12 months (Question 9).

The survey responses delineate the perceived and realized benefits of off-site construction to project performance. The primary benefit the respondents identified is a reduction to the overall project schedule and, specifically, the duration of the construction phase (perceived 78.0%, actual 73.2%). Participants also noted other benefits, such as the quality of the product and cost effectiveness. Off-site construction has historically not been a lowest-cost solution for project delivery; however, the responses indicate that it is a cost-effective solution. (Questions 5, 6) When asked about the life-cycle benefits of off-site techniques, comments from respondents highlighted schedule reductions, overall cost benefits, reduced defects and increased quality.

Participants also experienced improved project stakeholder collaboration when employing off-site methods. According to 78% of respondents, off-site construction requires moderately higher or significantly higher levels of stakeholder engagement. However, that increased integration and collaboration throughout the delivery process can result in higher quality and reduced changes throughout construction. (Questions 7, 8) The benefits respondents recognized in this survey confirm previous evaluations by McGraw-Hill Construction.<sup>3</sup>

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<sup>3</sup> Prefabrication and Modularization: Increasing Productivity in the Construction Industry. SmartMarket Report. McGraw Hill, 2009.

The survey also reveals the barriers and challenges to implementing off-site construction. (Question 2) According to the respondents, one of the most significant barriers is transportation, and more specifically, how far away the factory is located from the construction site. The need for clear program requirements for the building was also seen as a major challenge. In addition, respondents noted that some projects, particularly those with long spans, may not be suited for utilization of pre-fabricated elements and each project has unique requirements that must be met through an appropriate technical solution. Respondents noted the lack of industry knowledge as a barrier to the uptake of off-site construction. Survey respondents also indicated that unions might hinder off-site utilization with factory non-union labor. (This has been an actual deterrent in projects on the East Coast.)<sup>4</sup>

The building component fabrication industry is maturing and will require time to more effectively integrate with site-built work. The survey points to the potential issues that the lack of supply chain integration can present for off-site construction. In addition, contractors are learning how to manage off-site products for assembly on-site. Interestingly, respondents stated that the most significant barrier to off-site construction is the design and construction culture. Comments indicate that late design changes, lack of collaboration and an adversarial climate for project delivery leads to difficulties in realizing the benefits of off-site construction.

A significant find from the survey is pinpointing who is making decisions regarding off-site use. The respondents indicated that the construction manager (CM) or general contractor (GC) (a combined 57.1%) is the one most often to decide to implement off-site construction. This is followed by designers, including architects and engineers (A/E) (a combined 51.5%), then the client (27.9%) and others, primarily subcontractors (20.9%). (The survey team speculates this represents component fabricators, such as sheet metal suppliers, when prefabrication is held within a single subcontract agreement.) This finding is informative and suggests that additional education is needed for current decision makers (i.e. CM/GC and A/E), as well as owners, who have the potential to demand the use of off-site construction. (Question 4)

The barriers and challenges to off-site construction discovered in this survey point to gaps in building project stakeholder knowledge. (Questions 10, 11) To fill this deficiency, the Off-Site Construction Council plans to distribute more industry-based surveys to obtain additional data on the state of pre-fabrication in the construction sector. In addition, the Council is proposing to develop an “Off-Site Construction Implementation Guide” for the building industry. This proposed implementation guide will aid project teams in leveraging the use of off-site construction. The guide will include case studies with qualitative information to give project teams examples of how they might organize their projects to realize the benefits (such as improved schedule and cost effectiveness) of off-site construction. The implementation guide would primarily address the following areas: design parameters, standards, details and specifications; contracts; software utilization; phasing of construction; trade coordination; procurement methods; and transportation and installation logistics.

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<sup>4</sup> Atlantic Yards, a 32 story modular building in Brooklyn, faced a labor dispute between the union and developer of the project in 2013.

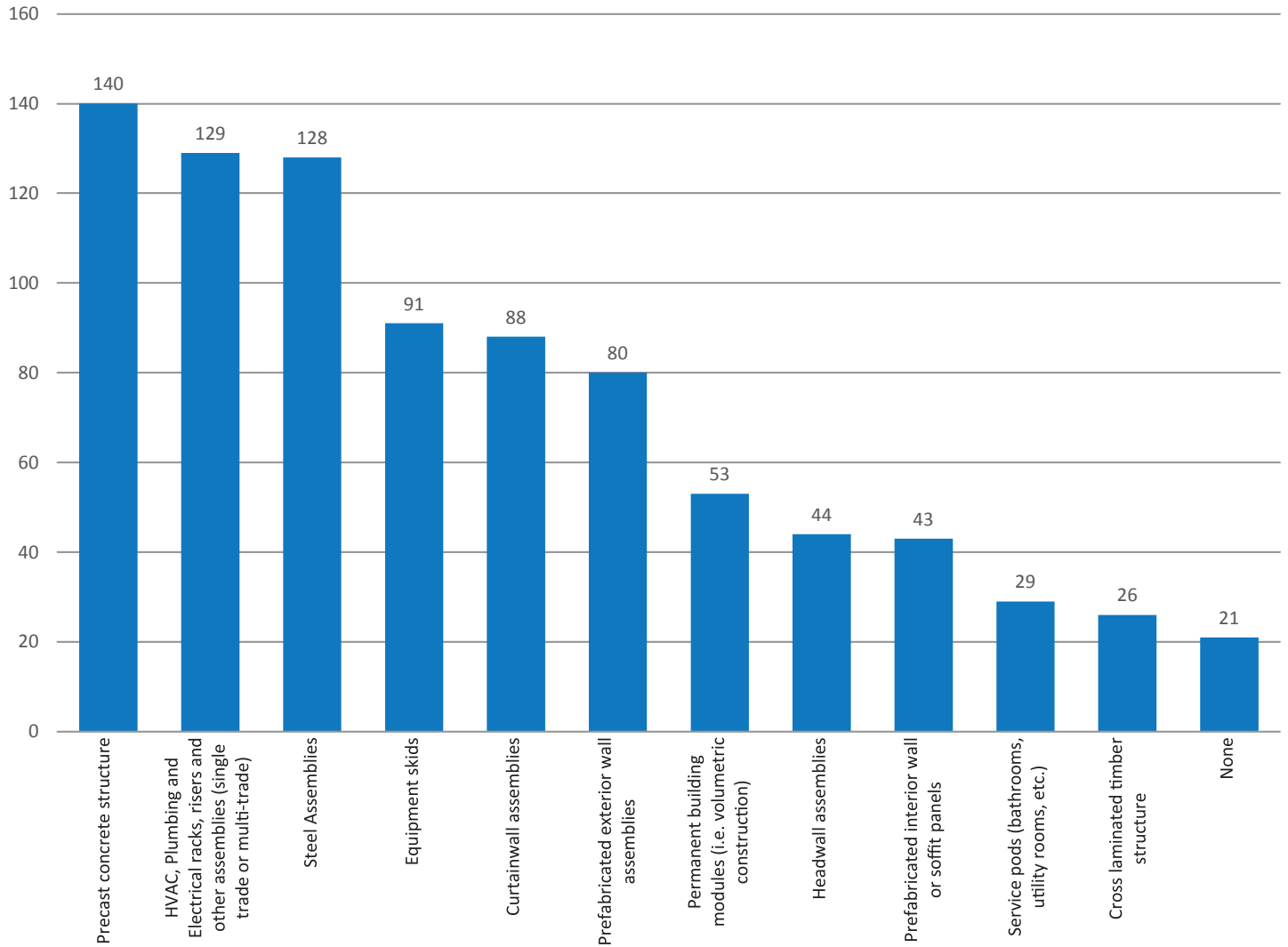
The Off-Site Construction Council is seeking additional support from companies and organizations in the building industry to assist in the research; collection of resources and potential case studies; and development of the implementation guide. The guide is intended to be a no-cost resource, broadly available to the construction sector.

For more information about the guide or to support its development, please contact Ryan Colker at [rcolker@nibs.org](mailto:rcolker@nibs.org). To learn more about the Off-Site Construction Council, including how to get involved, visit [www.nibs.org/oscc](http://www.nibs.org/oscc).



## QUESTION 1

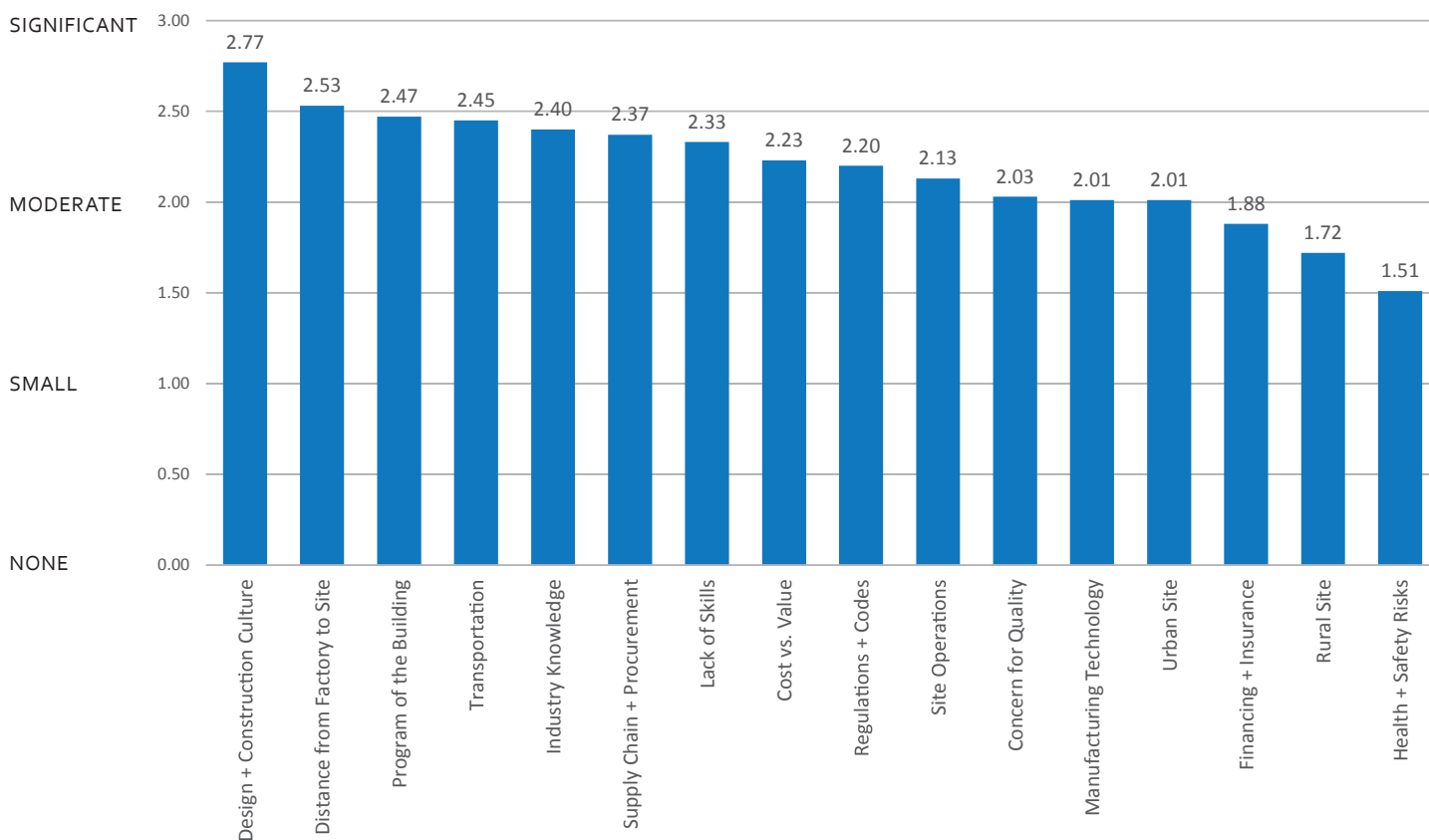
I have incorporated the following off-site elements in one or more projects in the last 12 months:



*Responses reflect the number of answers to the question. Respondents may select more than one option.*

## QUESTION 2

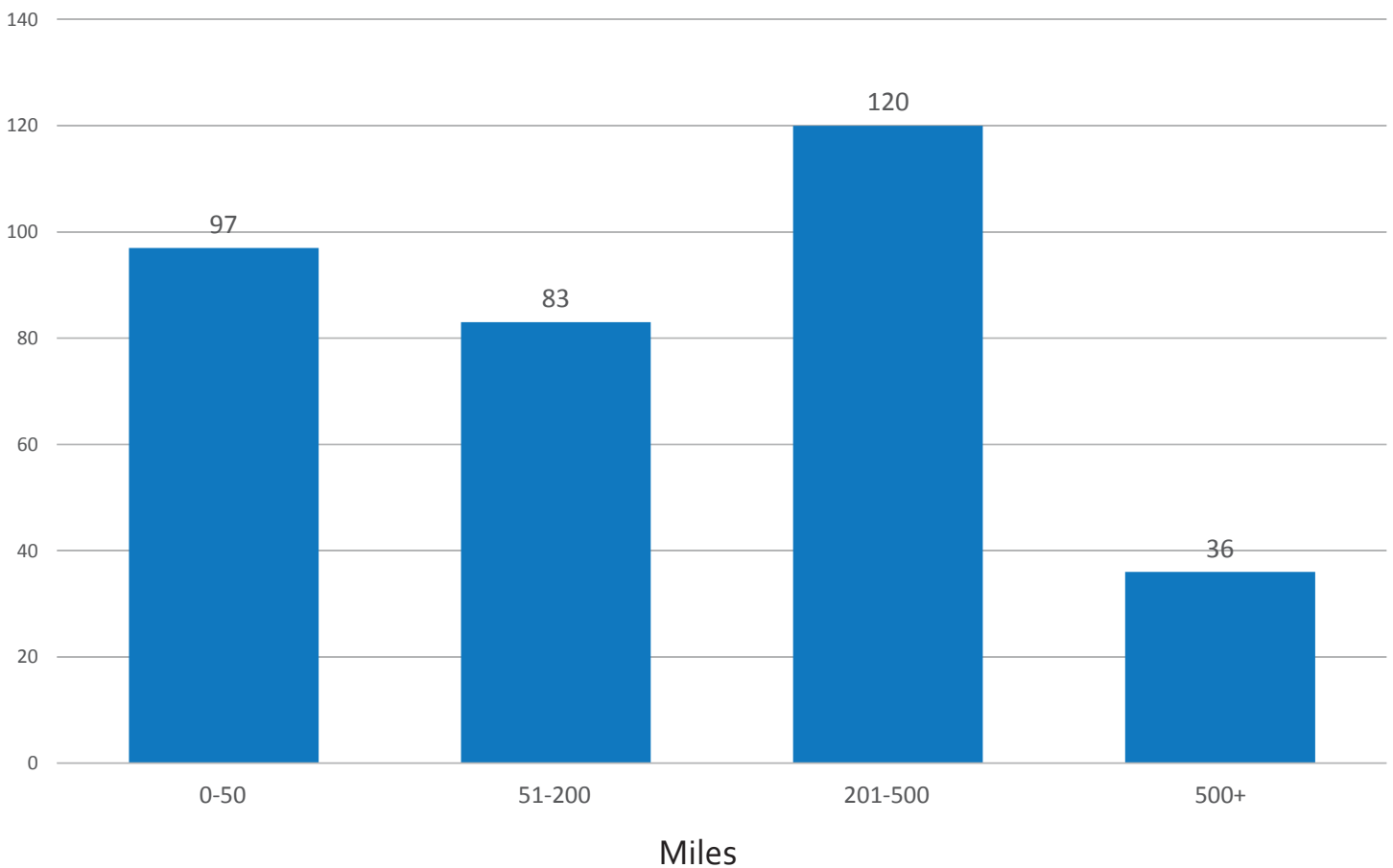
Rate the barriers to implementing off-site construction:



*The rating reflects the average out of 4 possible degrees of barrier responses:  
Significant, Moderate, Small and No Barrier.*

## QUESTION 3

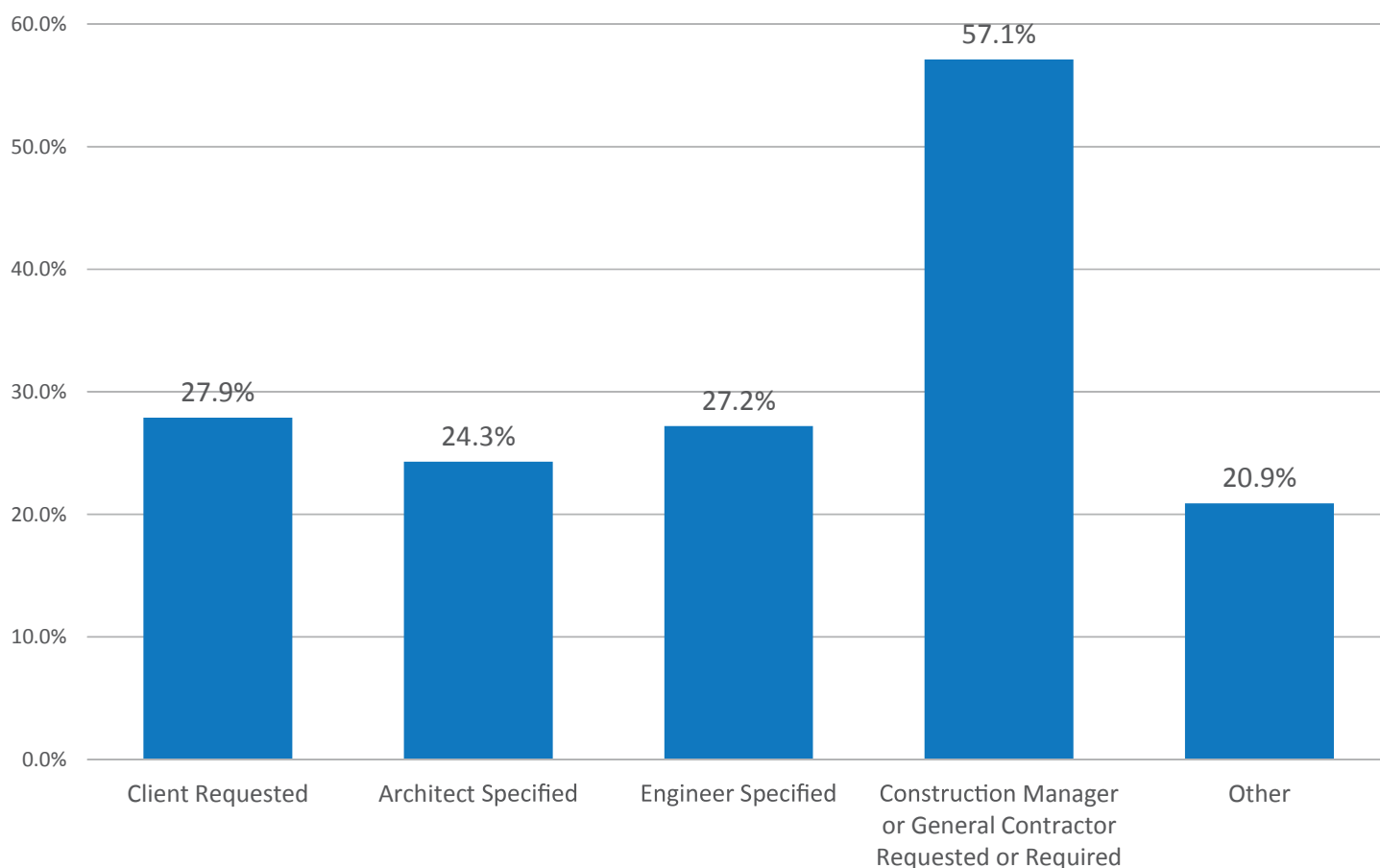
**Considering the most successful project that utilized off-site construction, what was the distance from the factory to the site:**



*The responses were sorted into 4 categories of miles.  
The graph reflects the number of responses within the particular category.*

### QUESTION 4

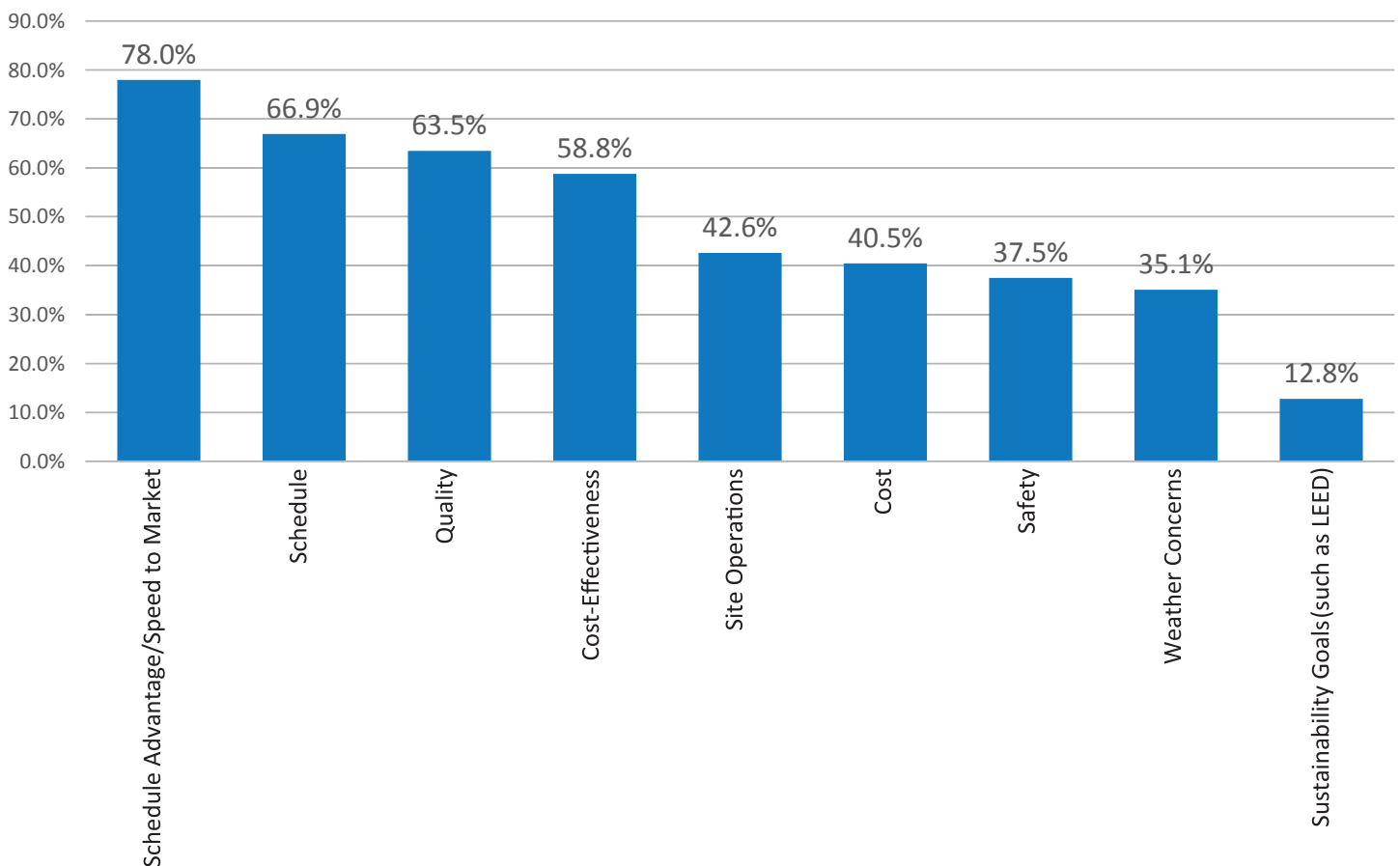
**During the project planning phase for this project, who was responsible for the decision to use off-site?**



*Most responses in the "Other" category were either "all of the above" or "the subcontractor suggested using off-site construction."*

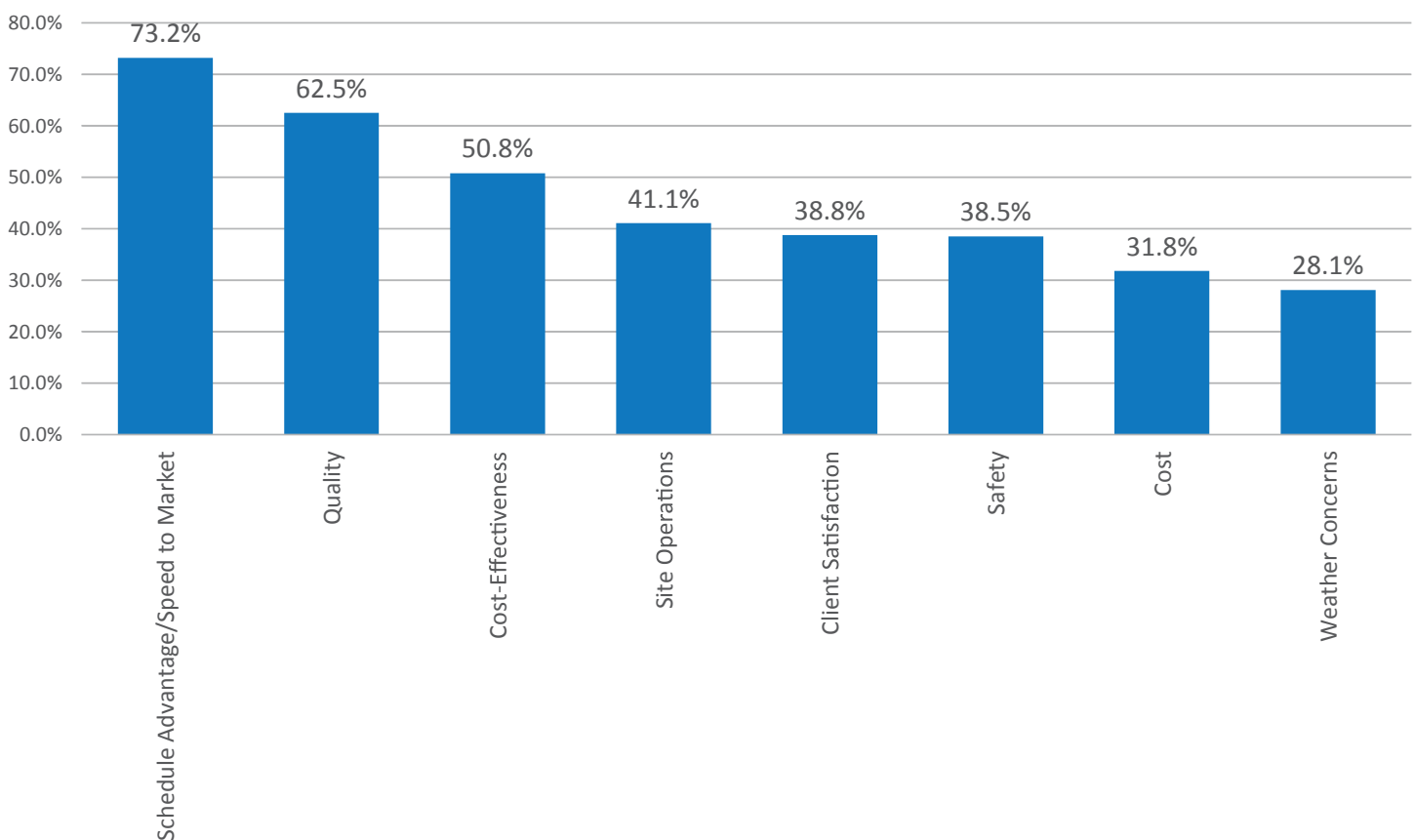
## QUESTION 5

Considering your most successful experience with off-site construction, what were the pre-construction expected benefits of using off-site?



## QUESTION 6

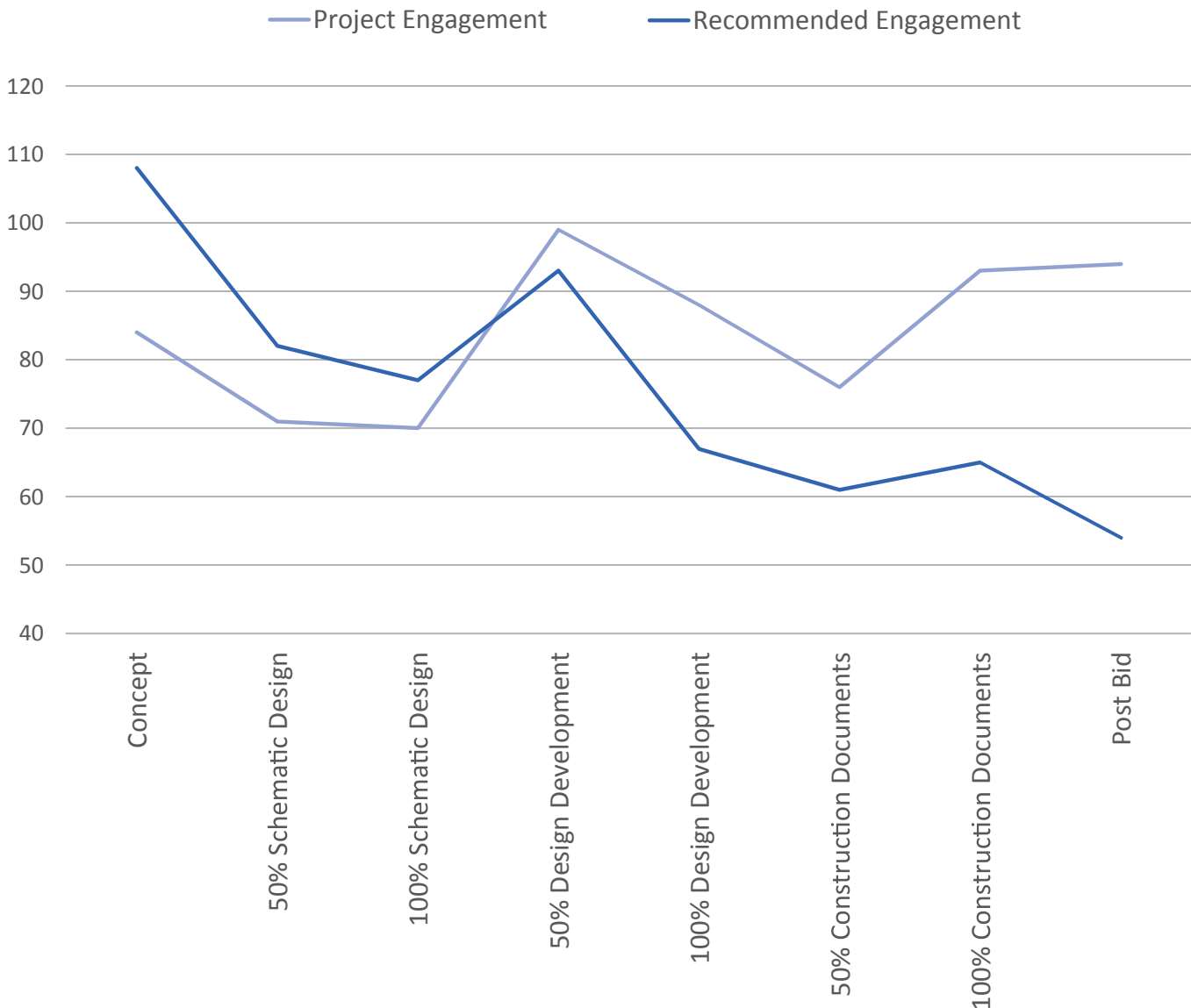
For this project, what were the actual benefits realized by using off-site construction?





## QUESTION 7

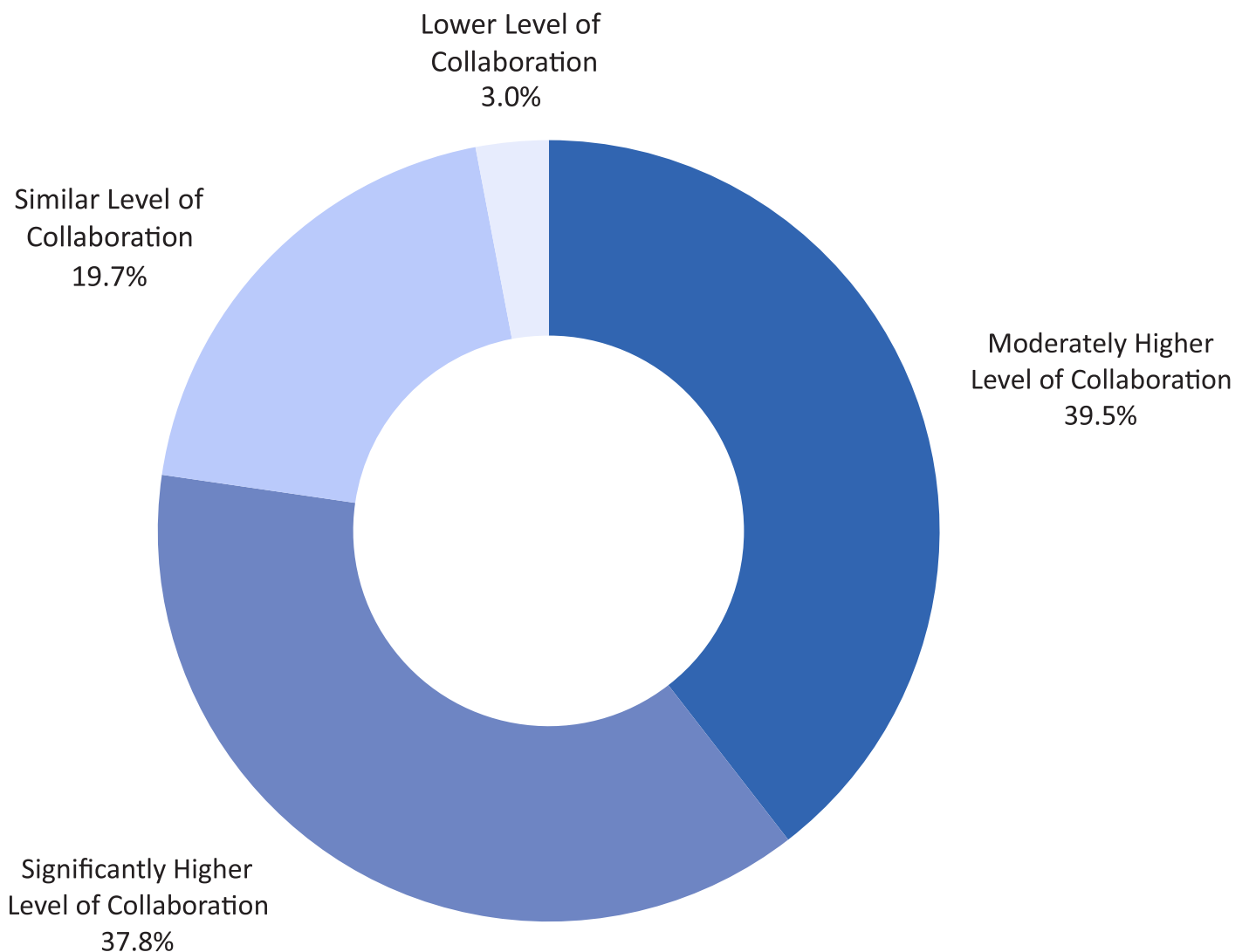
**For the considered project, when did you collaborate with the contractor performing the off-site work and, based on your experience, when do you recommend engaging the off-site contractor?**



*The results of this question show that, based on their experience, the respondents recommend engaging the off-site contractor prior to 50% Design Development to ensure the value of off-site construction.*

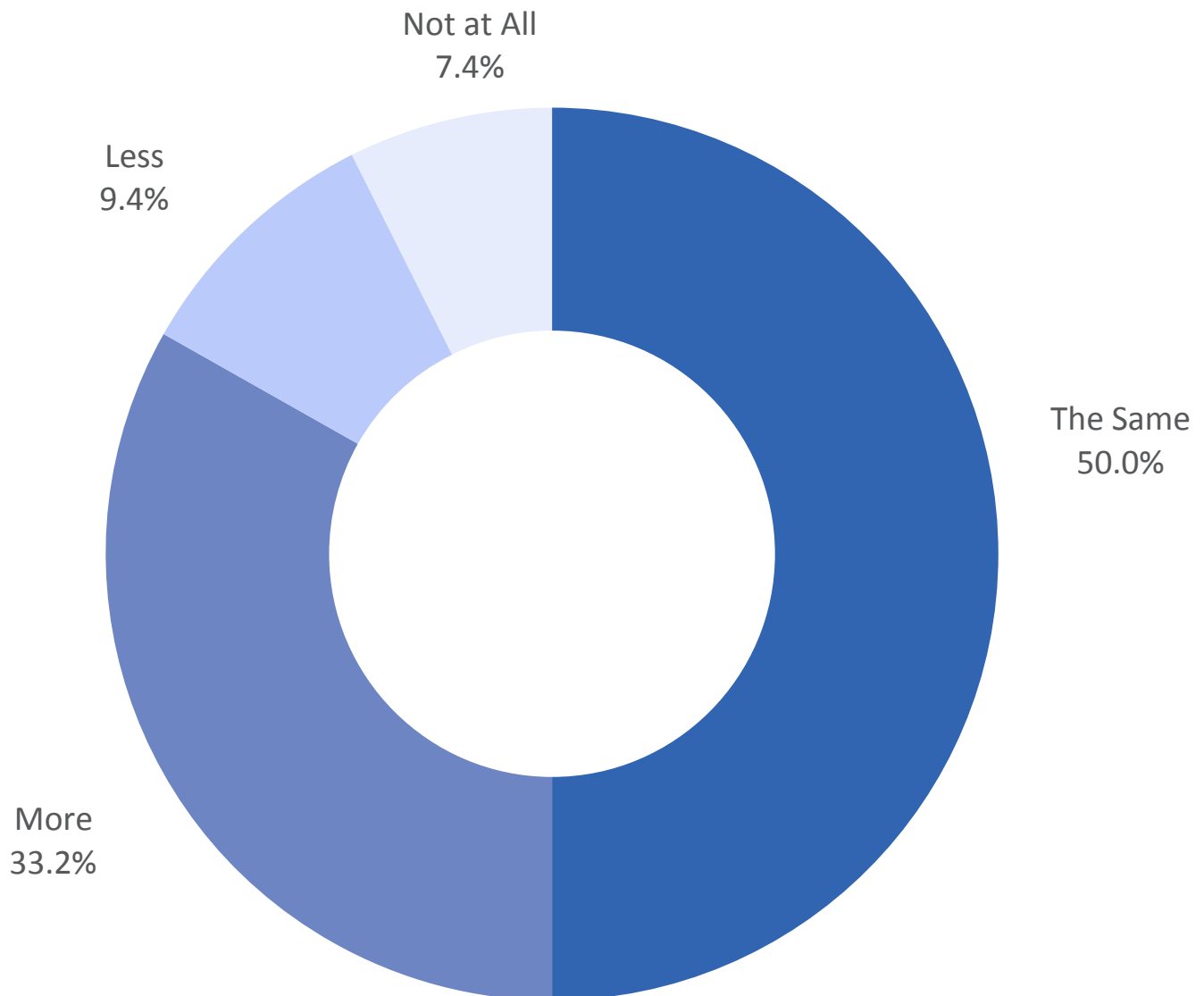
## QUESTION 8

**What level of stakeholder collaboration is required to implement off-site construction in comparison to traditional construction methods?**



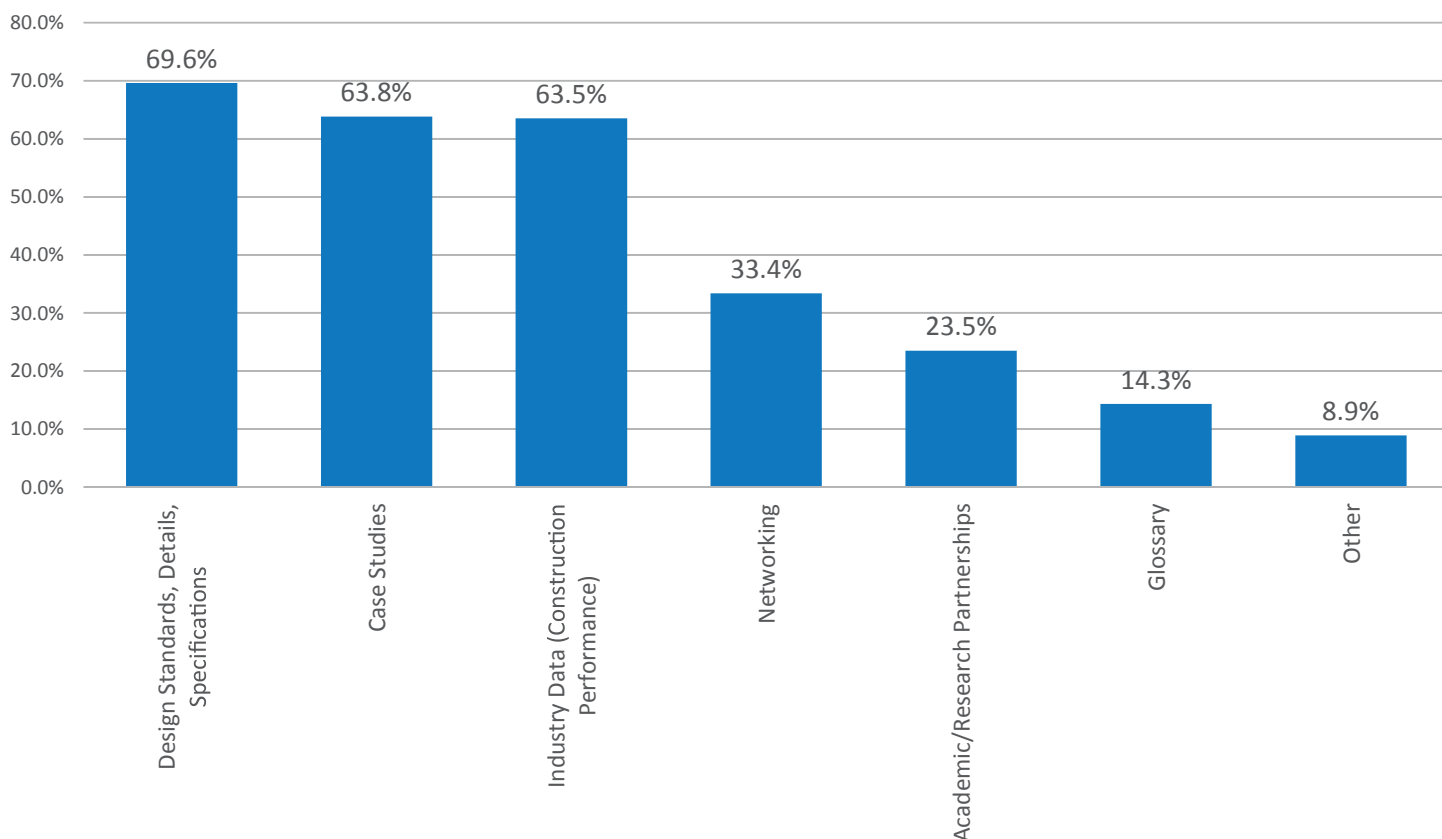
## QUESTION 9

**In the next 12 months, how often do you anticipate using off-site construction?**



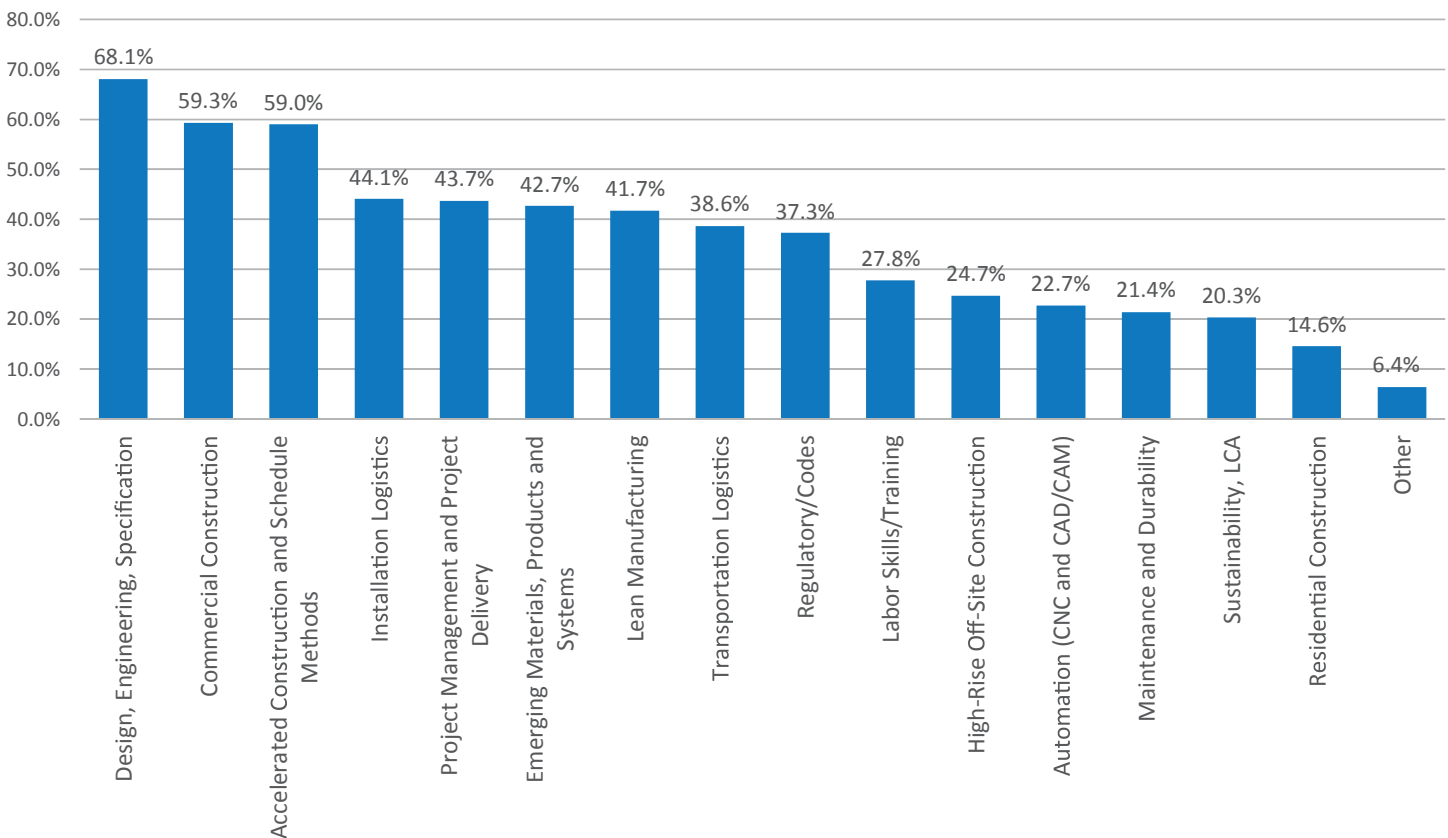
## QUESTION 10

What types of support could the National Institute of Building Sciences Off-Site Construction Council offer that would benefit your company's utilization of off-site construction?



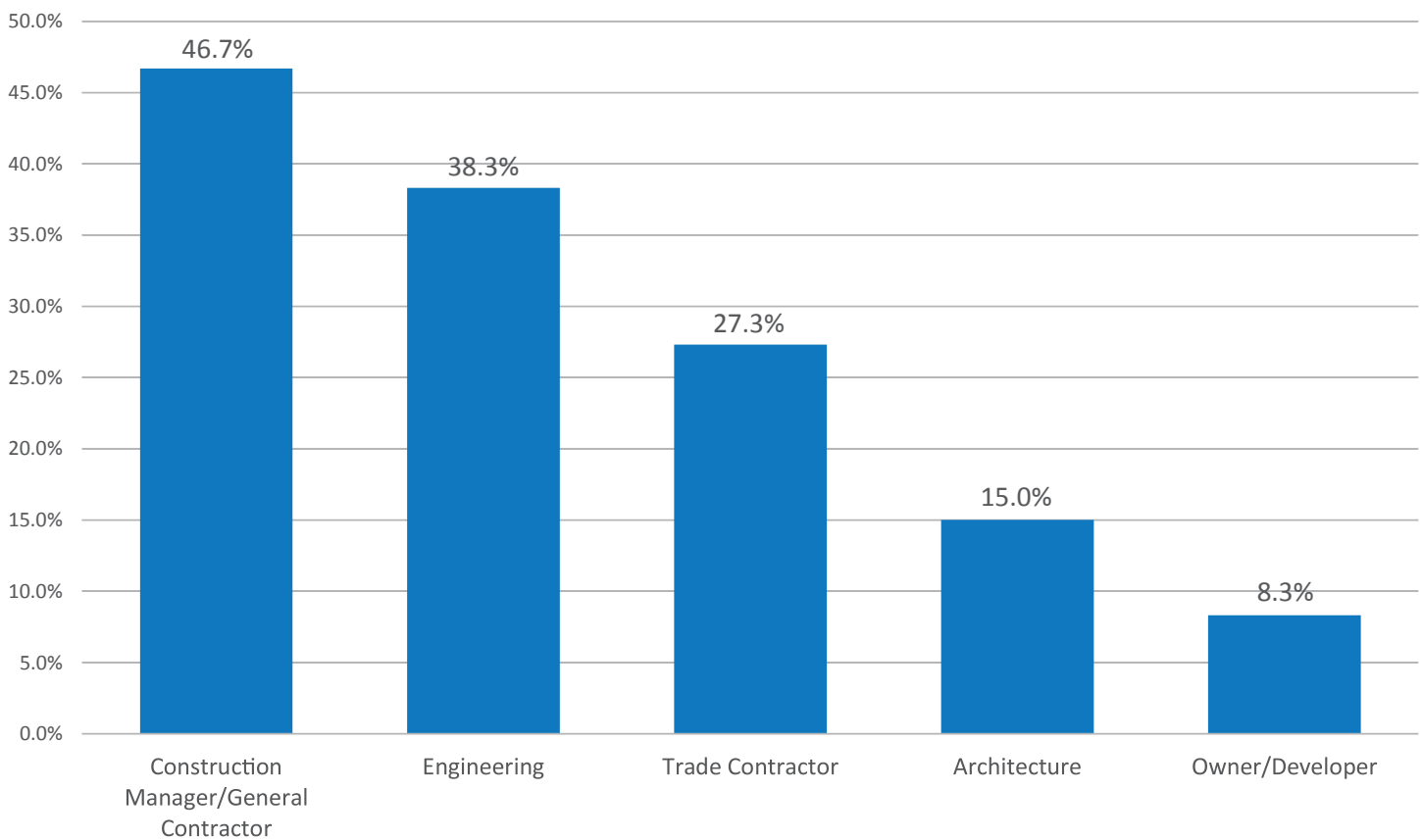
## QUESTION 11

What aspects of off-site design and construction information and data are you interested in?



## QUESTION 12

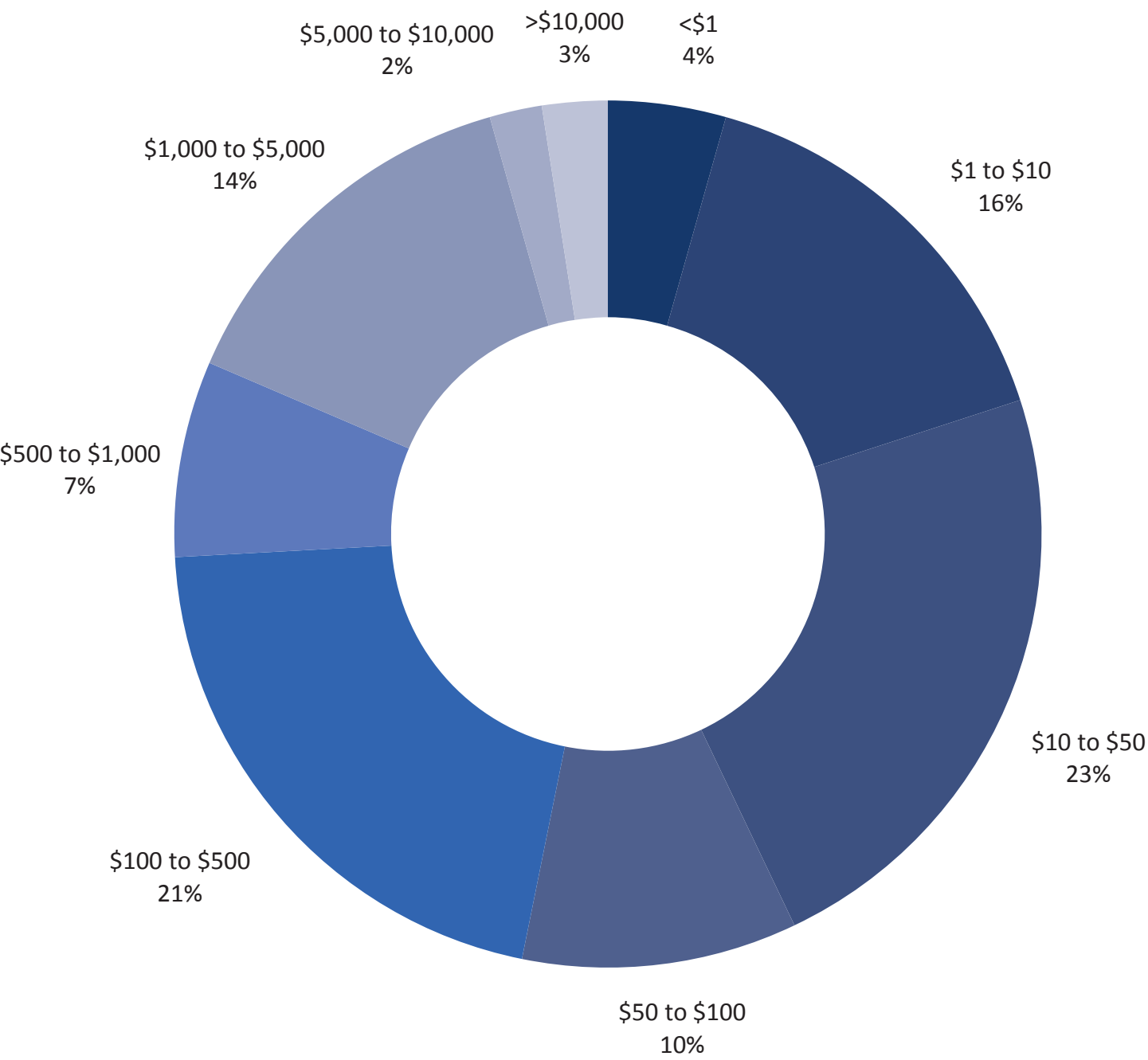
**The company I represent primarily provides the following services:**





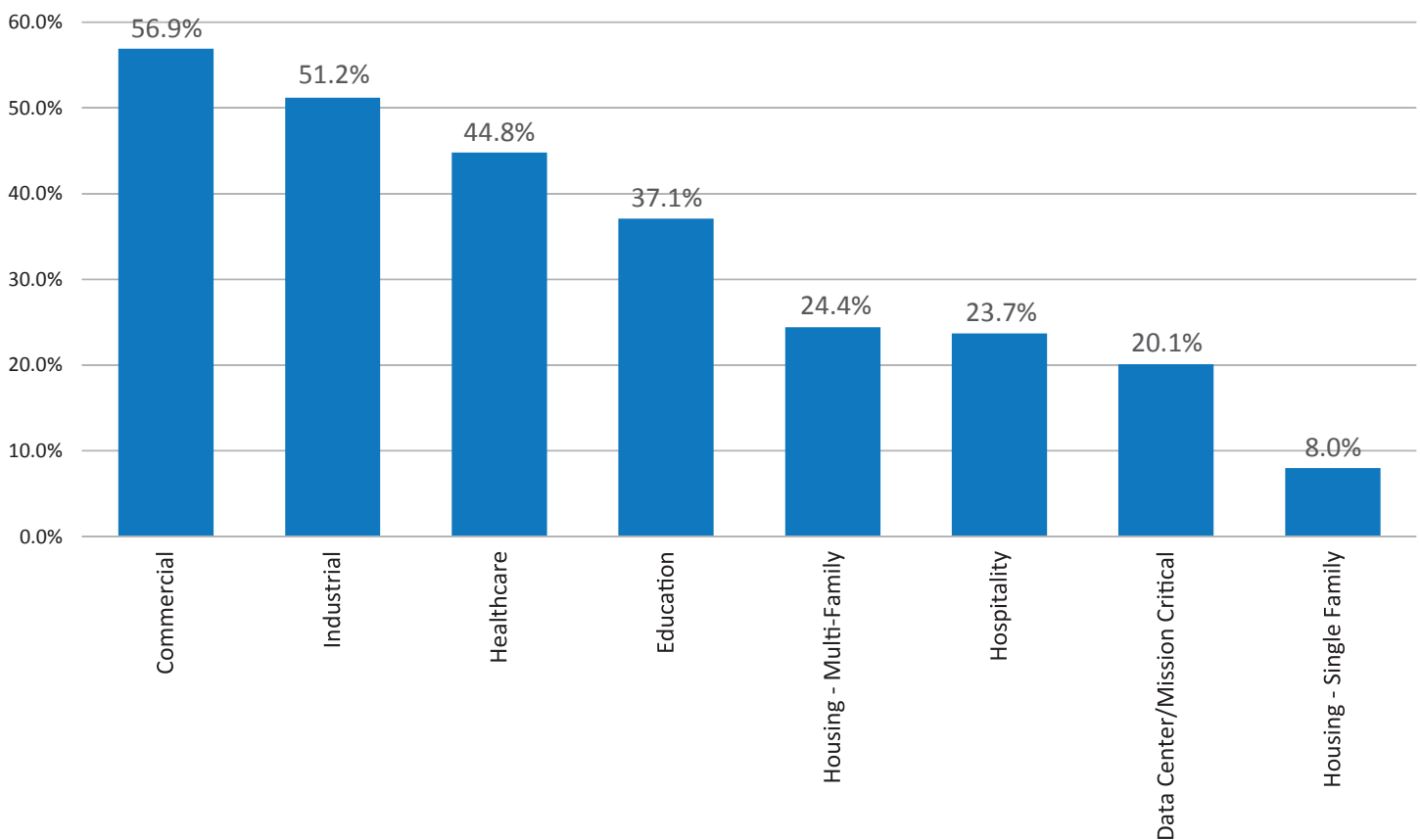
QUESTION 13

What is your company’s annual revenue (in millions)?



## QUESTION 14

The project types where my company has utilized off-site construction include:



## QUESTION 15

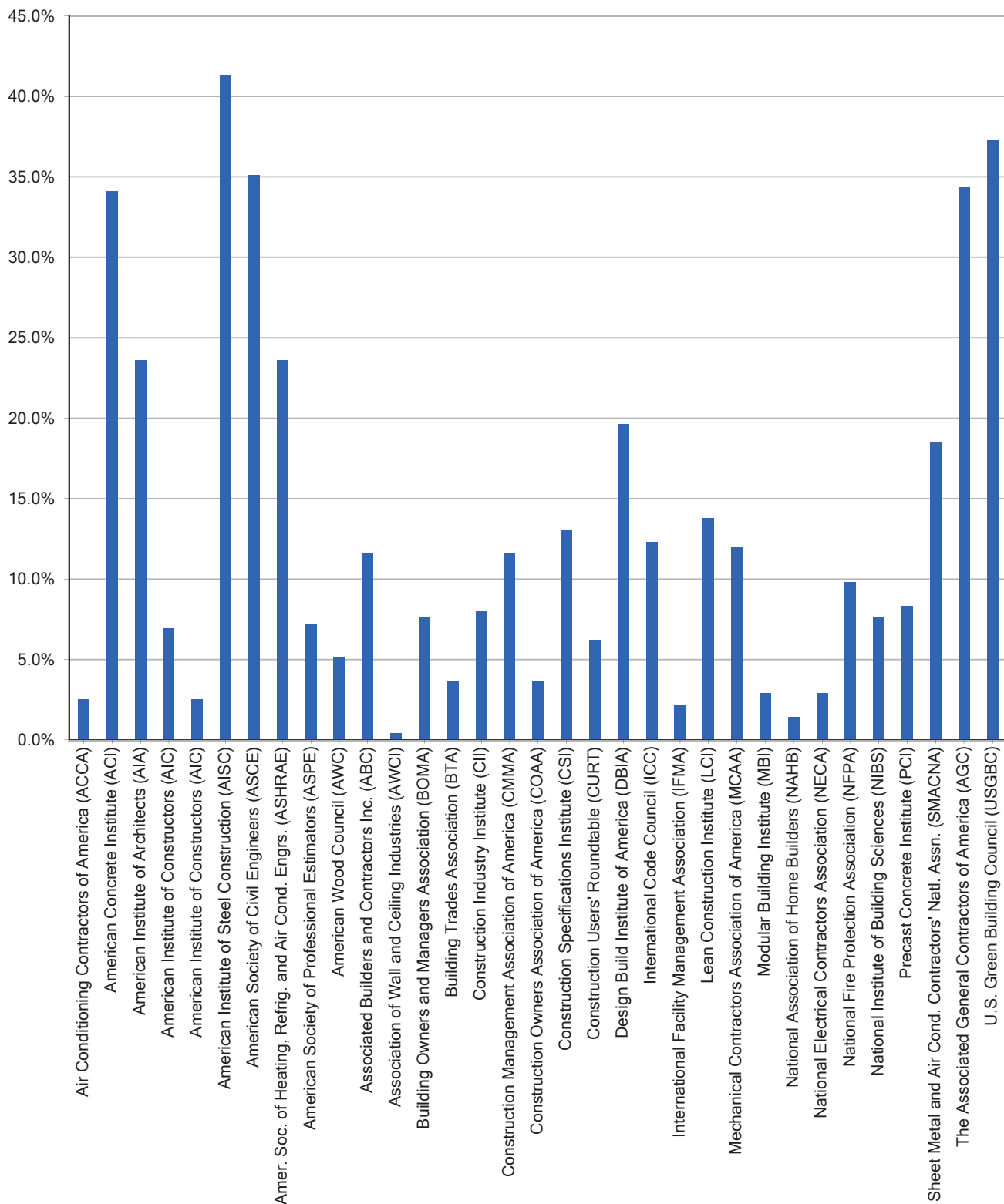
In which state(s) was/were the project(s) that utilized off-site construction located?

| State         | Number of Projects in State |
|---------------|-----------------------------|
| Alabama       | 2                           |
| Alaska        | 6                           |
| Arizona       | 7                           |
| Arkansas      | 5                           |
| California    | 32                          |
| Colorado      | 16                          |
| Connecticut   | 8                           |
| Delaware      | 3                           |
| Florida       | 12                          |
| Georgia       | 9                           |
| Hawaii        | 2                           |
| Idaho         | 8                           |
| Illinois      | 22                          |
| Indiana       | 11                          |
| Iowa          | 4                           |
| Kansas        | 10                          |
| Kentucky      | 3                           |
| Louisiana     | 10                          |
| Maine         | 4                           |
| Maryland      | 10                          |
| Massachusetts | 16                          |
| Michigan      | 9                           |
| Minnesota     | 6                           |
| Mississippi   | 3                           |
| Missouri      | 13                          |

| State          | Number of Projects in State |
|----------------|-----------------------------|
| Montana        | 2                           |
| Nebraska       | 3                           |
| Nevada         | 1                           |
| New Hampshire  | 3                           |
| New Jersey     | 13                          |
| New Mexico     | 3                           |
| New York       | 21                          |
| North Carolina | 13                          |
| North Dakota   | 2                           |
| Ohio           | 14                          |
| Oklahoma       | 7                           |
| Oregon         | 12                          |
| Pennsylvania   | 21                          |
| Rhode Island   | 3                           |
| South Carolina | 3                           |
| South Dakota   | 0                           |
| Tennessee      | 8                           |
| Texas          | 32                          |
| Utah           | 3                           |
| Vermont        | 1                           |
| Virginia       | 20                          |
| Washington     | 17                          |
| West Virginia  | 6                           |
| Wisconsin      | 7                           |
| Wyoming        | 6                           |

## QUESTION 16

Which organizations does your company belong to?



## About the Off-Site Construction Council:

The U.S. off-site design and construction industry has made significant advances in implementing processes and materials to build and deliver more sophisticated and complex facility types by virtue of system prefabrication, unitization, modularization and panelization. More and more owners are turning to off-site methods for multi-story wood construction, steel framed structures, healthcare facilities, educational structures and large-scale military projects. As an industry, however, owners, architects, engineers and contractors up until now have lacked an unbiased source for evaluating the applicability and potential benefits for use of such methods; for determining where and when fabrication is appropriate; and for identifying the range of choices inherent in integrating and collaborating with fabricators.

In 2013, the National Institute of Building Sciences established the Off-Site Construction Council (OSCC) to serve as a research, education and outreach center for relevant and current information on off-site design and construction for commercial, institutional and multifamily facilities.

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## About the Institute:

The National Institute of Building Sciences is a non-profit, non-governmental organization that successfully brings together representatives of government, the professions, industry, labor and consumer interests, and regulatory agencies to focus on the identification and resolution of problems and potential problems that hamper the construction of safe, affordable structures for housing, commerce and industry throughout the United States. Authorized by the U.S. Congress, the Institute provides an authoritative source and a unique opportunity for free and candid discussion among private and public sectors within the built environment. The Institute's mission to serve the public interest is accomplished by supporting advances in building sciences and technologies for the purpose of improving the performance of our nation's buildings while reducing waste and conserving energy and resources.



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