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Front End Planning Tool: PDRI–Small Infrastructure Projects

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Front End Planning Tool: PDRI–Small Infrastructure Projects

**Prepared by
Construction Industry Institute
Research Team 314a, Project Definition Rating Index –
Small Infrastructure Projects**

**Research Summary 314a-1
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Contents

<i>Chapter</i>	<i>Page</i>
Executive Summary	v
1. Introduction	1
2. PDRI Development Methodology	5
3. Implementing the PDRI—Small Infrastructure Projects	19
4. Conclusions and Recommendations	23
Appendix A: Completed PDRI—Small Infrastructure Projects Validation Projects	27
Appendix B: PDRI—Small Infrastructure Projects Validation Projects in Process	29
References	31

Executive Summary

Past Construction Industry Institute (CII) research has found that tools measuring project scope definition and alignment among project participants are essential for facilitating good front end planning (FEP). These tools, developed by a number of research teams over more than two decades, help owners and contractors better achieve their business, operational, and project objectives. While this earlier research addressed FEP for large industrial, building, and infrastructure projects, it did not focus on the unique challenges and characteristics associated with small projects, or more particularly, with small infrastructure projects.

CII formed Research Team 314a (RT-314a), Project Definition Rating Index – Small Infrastructure Projects, to produce an effective, easy-to-use tool that identifies key scope definition issues for this type of projects. This research summary provides an overview of the research and development of Implementation Resource 314a-2, *PDRI–Small Infrastructure Projects*, the newest PDRI tool. The PDRI–Small Infrastructure Projects is a risk management tool that consists of 40 elements presented in a weighted checklist format. The tool provides a method for measuring the completeness of scope definition on small infrastructure projects. It is similar to the four other PDRI front end planning tools CII has produced: PDRI–Buildings (Cho et al. 1999; CII 2013); PDRI–Infrastructure (CII 2013a); PDRI–Industrial (CII 2014; Gibson and Dumont 1996); and PDRI–Small Industrial (CII 2015; Collins et al. 2015). It is a focused derivative of the PDRI–Infrastructure tool that allows project participants to quickly assess the scope of small infrastructure projects. The tool's weighted index, based on the input of 69 experienced project planners, enables users to measure the level of scope definition in support of more predictable project performance and success.

In addition to introducing the PDRI–Small Infrastructure Projects, this research summary also presents the research team's findings on the efficacy of the tool, based on a data sample of small infrastructure

projects. For this research, the team defined small infrastructure projects as those generally of less than \$20 million (U.S. dollars) in expenditure, of six to 12 months in construction duration, and of less overall complexity than large projects (based on several indicators discussed below). In most organizations that complete infrastructure projects, the organizations characterize about 50 percent of the total number of projects completed annually as "small"; these projects account for less than 30 percent of total project expenditure.

Users of the PDRI–Small Infrastructure Projects tool assess the level of scope definition of their projects, generating a weighted score for each that can reach up to 1,000 points—with a lower score being better. An analysis of 69 completed small infrastructure projects representing more than \$529 million of constructed cost showed that projects scoring lower than 300 (out of 1,000 total points) were significantly more successful than those that scored above 300. These projects saw 21-percent and two-percent differences between average and targeted cost and schedule, respectively.

Also, seven different organizations used the PDRI–Small Infrastructure Projects tool during the FEP process. Data from these projects showed that the tool provided the project teams with an understanding of risk and helped them to identify scope gaps. These exercises also proved the value, completeness, and capability of the tool, in each case helping project team members identify critical planning issues. The time needed to perform an assessment using the PDRI–Small Infrastructure Projects was typically 75 minutes or less (as opposed to the 150 minutes or longer durations typical with the other “large project” PDRI tools). The RT-314a research further showed that the tool can improve the FEP of small infrastructure projects while reducing the time necessary to complete an assessment, and that it is fully ready for use. This summary provides guidance on how best to use the PDRI–Small Infrastructure Projects tool for project planning.

Introduction

Data captured during this research investigation showed that, in most organizations that complete infrastructure projects, more than 50 percent of these projects by number are considered small. This finding is consistent with those of past CII investigations, which showed that these small projects are handled differently than large projects and pose unique risks (CII 1991, 2001). By definition, a small infrastructure project has the following characteristics:

- total installed cost less than \$20 million (U.S. dollars)
- fewer than 5,000 hours of engineering effort
- construction duration between six and 12 months
- part-time management availability of core team members
- fewer than 10 core team members (i.e., project managers, project engineers, and owner representatives)

To develop a PDRI tool for small infrastructure projects, RT-314a extended the research and development thread of the four previous PDRI tools, particularly the PDRI–Infrastructure Projects, a resource now widely used as a planning tool in the infrastructure sector. (For a more extensive discussion of how RT-314a settled on the characteristics of a small infrastructure project, see Research Report 314a-11.)

Since most previous CII research efforts were not focused on small projects directly, limited research has been performed in the area of front end planning (FEP) for small infrastructure projects. Therefore, minimal attention has ever been placed on FEP for these small projects. Yet, the cumulative effect of poorly planned small infrastructure projects can have a major impact on an organization's bottom line. RT-314a developed the PDRI–Small infrastructure Projects specifically to address this highly important and common project type.

Many research studies have proven the importance of the FEP phase of the project life cycle (Collins et al. 2016; CII 2012; Elzomor et al. 2016b; Ray et al. 2006a). Specifically, the findings have shown that a complete scope definition improves project performance in the areas of cost, schedule, quality, and operational characteristics. However, because this past research focused on large projects, CII established RT-314a to ensure improved performance of the infrastructure sector's small projects. The team set forth the following objectives:

1. Produce a user-friendly, less time-consuming tool for appropriately measuring project scope development with the following characteristics and functions:
 - based on the PDRI–Infrastructure Projects, yet tailored to small infrastructure projects
 - easy to use, yet detailed enough to be effective
 - helps reduce total project costs
 - improves schedule performance
 - serves as a communication and alignment tool
 - supports decision-making
 - identifies risks
 - reliably predicts project performance
 - flexible for use on several infrastructure project types.
2. Validate the tool through testing on sample projects, by measuring the level of project scope definition during the FEP phases

The PDRI–Small Infrastructure Projects offers project teams a method for measuring the completeness of scope definition at any point prior to detailed design and construction. It identifies and describes in detail each critical element in a scope definition package. Using it, project teams can quickly identify project risk factors and scope definition gaps related to project performance. Users can then mitigate these gaps.

The central premise of the PDRI–Small Infrastructure Projects research effort was that project teams must work collaboratively (i.e., achieve alignment) on the right projects and perform the right work (i.e., define scope) during FEP.

The PDRI–Small Infrastructure Projects was developed to assess projects related to conveyance of people and freight, fluids, and energy. A people and freight project is any project in the infrastructure sector that conveys people and freight; small-project examples include runway resurfacing and intersection rebuilds. The second type of project conveys fluids. Small-project examples include reconditioning or new pipelines, pipeline relocations, and pumping stations. The third type of project conveys energy. Small-project examples include transmission lines, fiber optic lines, and electrical duct banks. (For more detailed definitions of people and freight, fluids, and energy projects, see CII Implementation Resource 314a-2, *PDRI–Small Infrastructure Projects*.)

PDRI Development Methodology

The initial work to develop the PDRI–Small Infrastructure Projects was based on the four existing PDRI tools. Early on, RT-314a conducted a detailed literature review to identify issues unique to small infrastructure projects. The team also surveyed CII member organizations involved in infrastructure construction projects as one of the initial steps of its investigation.

Small Infrastructure Project Front End Planning Survey

In its initial survey of CII members, RT-314a sought a better understanding of the following questions: Why are small projects are so prevalent in the infrastructure sector?; How do organizations plan for such projects?; and How do organizations define a “small infrastructure project?” The team developed the survey in an electronic format and distributed it to all CII data liaisons. Forty-seven of these survey recipients responded, a 23-percent response rate. Figure 1 shows the categories of all survey responses.

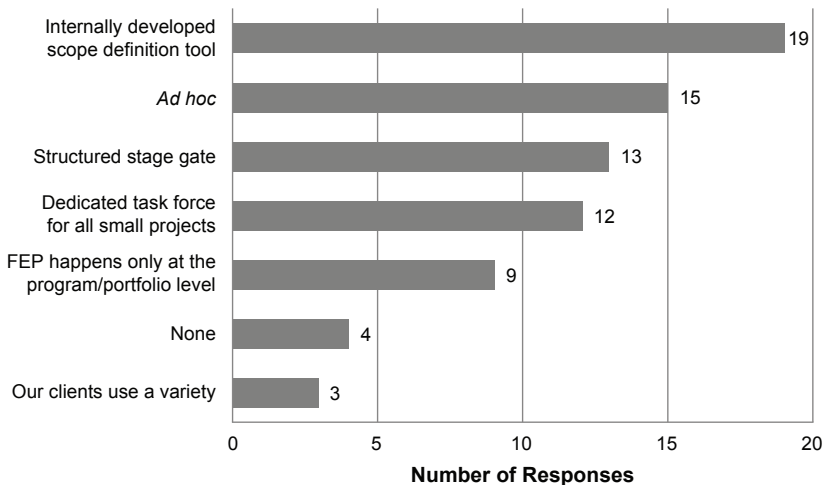


Figure 1. Survey Responses Regarding Typical FEP Processes Used on Small Infrastructure Projects

The respondents were asked to consider seven typical FEP procedures and select those used in their organizations to plan for small infrastructure projects. (Note that of the 47 respondents to the survey, 43 answered this question.) Overall, these responses indicate that the organizations commonly implemented more than one method, and most frequently include “structured stage gate,” “*ad hoc*,” and “internally developed scope definition tools.” From these results, the research team recognized that the planning processes for small infrastructure projects vary greatly across the infrastructure sector, and even within organizations.

Figure 2 presents the categories of the responses to questions on the cost and count of small projects in the survey respondents’ organizations during the prior fiscal year. small projects annually comprise less than 30 percent of project expenditure and approximately 50 percent of the total number of completed infrastructure projects in most organizations’ portfolios. These responses confirmed the team’s hypothesis that 50 percent of projects completed in the infrastructure sector were small. The data also illustrated that small projects make up a significant portion of completed projects, and account for a considerable amount of the capital expenditure in the infrastructure sector each year.

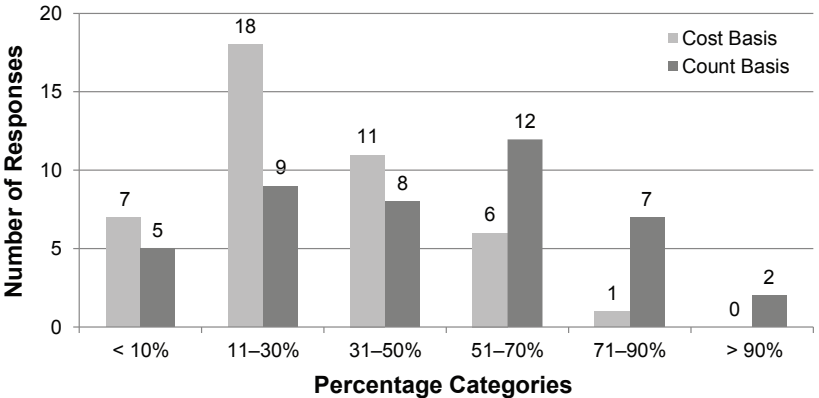


Figure 2. Prevalence of Small Infrastructure Projects in Survey Respondents’ Organizations

RT-314a developed and presented a list of 16 characteristics for differentiating small projects from large, based on literature review and team members' experience. The survey asked respondents to consider these 16 characteristics and indicate whether or not each characteristic differentiated small projects from large in their organization. Survey responses concluded that five characteristics (presented on page 1) differentiated small projects from large. Survey responses gave some indication that five additional characteristics are potential differentiators between small and large projects: source of funding, project visibility to owner management, external permitting required, local/state permits required, and the number of separate trade contractors. Several respondents explained that the characteristics identified would not necessarily be used to differentiate between small and large projects, but would be useful in their organizations for determining project complexity.

Draft Tool Development

Over the course of five months, RT-314a met multiple times to draft the PDRI–Small Infrastructure Projects elements. The final version of the PDRI–Small Infrastructure Projects consists of 40 elements, grouped into eight categories and divided into three main sections. Table 1 presents the three sections, eight categories, and 40 elements.