Construction Industry Institute®

CII Best Practices Guide:
Improving Project Performance

Implementation Resource 166-3
Version 4.0

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CII Best Practices Guide: Improving Project Performance

Prepared by the

Construction Industry Institute

Implementation Strategy Committee

Implementation Resource 166-3

Version 4.0

18 December 2012

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The University of Texas at Austin

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Preface to the Fourth Version

This fourth version of Implementation Resource 166-3 incorporates information on the CII Best Practices listed in the Table of Contents.

The main change reflected in this version is the introduction of the newly designated CII Best Practice "Project Risk Assessment." Another major change is the revision of the individual Best Practice Implementation Assessment forms to ensure alignment with the *CII Value of Best Practices* project assessment criteria. This change necessitated the corresponding performance charts that are now included for each one.

Other key changes throughout this version include the following:

- an updated Comprehensive Scoring Register
- complete incorporation of the Implementation Model descriptions previously included in CII Implementation Resource (IR) 166-2, *Implementation Model + Knowledge Structure Guide*
- a revised scale on the Implementation Thermometer to give proper recognition to a robust program of implementation of CII Best Practices
- data on the statistically significant relationship between individual CII Best Practices and project cost and schedule growth
- the latest available performance data on individual best practice implementation
- adjustment of the reference lists to include the latest CII publications in support of each best practice.

This edition has been made possible by the dedicated efforts of the CII Implementation Strategy Committee.

Reader comments are welcome at *mgarcia@cii.utexas.edu*.

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December 2012

Foreword

This publication is designed primarily to help CII Implementation Champions and others provide leadership in the implementation of CII Best Practices. It provides information for those who may be considering implementation or who have an interest in learning more about CII Best Practices and the implementation process. It is also a resource for planning the implementation of individual best practices and it provides a means of evaluating the completeness of implementation for each one.

CII defines a best practice as "a process or method that, when executed effectively, leads to enhanced project performance."

This publication provides a number of tools to assist in planning and executing the implementation of CII Best Practices. It also provides material on the current CII Best Practices, including the following:

- a description of each best practice
- a listing of essential elements for each best practice
- a summary of reported benefits realized through the use of each best practice
- a checklist for evaluating the degree of implementation of each best practice at project or organizational levels
- a list of pertinent cii references related to each best practice.

This publication may be used in a number of ways to enhance the implementation process, particularly as an introduction and reference source for each CII Best Practice. This publication can also be utilized to determine which CII Best Practices to implement and at which level (project, organizational, or both) a practice should be deployed. The list of CII references relating to each CII Best Practice is included; however, users are urged to check the most current listing at http://www.construction-institute.org/bp.cfm.

Implementers may evaluate and compare CII Best Practice use among several projects, either to make a one-time evaluation of implementation or to make periodic evaluations over time. Users may wish to reproduce selected portions of this publication for distribution to others (subject to the CII copyright provisions). Users may also want to include information on additional CII Best Practices selected in the future, or incorporate other material as it is made available.

Introduction

In order to better understand the CII Best Practices and recognize the potential benefits of implementing these practices, it is necessary to review the origins of CII and its body of work.

Construction Industry Institute

CII is a consortium of leading owners, engineering and construction contractors, and academics who have a singular mission: to measurably improve the cost effectiveness of capital projects, from front end planning through completion and commissioning. CII is a leader in the construction industry, creating and implementing research-based knowledge that measurably improves the effectiveness and sustainability of capital facilities delivery. The increased business success that CII member organizations experience enables these participating industry leaders to make breakthroughs in the life cycle value of capital facilities. By collaborating on important industry issues and by providing guidance on best practices discovered through research, CII members are collectively an industry forum for the engineer-procure-construct (EPC) process.

CII, through its research, implementation, education, and other initiatives, is a learning organization with a wealth of knowledge and information. The CII-funded research program, with more than 50 leading universities involved, is unique in the engineering and construction industry. The research results generate best practices for the entire industry to share and implement. The effective implementation of CII Best Practices improves the likelihood of capital project success.

One of the major sources of the value of CII research is in its implementation. CII has addressed implementation as a distinctive core competency in its strategic plan, which is quoted below:

> *CII is implementation-driven. CII develops and disseminates state-of-the-art concepts, best practices, and metrics for improving the safety, cost, schedule, quality, and sustainability of capital projects. CII publications, products, and services support a complete continuum of learning, practice development, implementation, leadership development, and performance assessment.*

Benefits

Published in 2011, the *CII Value of Best Practices Report*, BMM 2010-4, documents the major findings from the CII Best Practices study conducted from 2007 through 2010. This study had two primary objectives:

1. Measure the levels of best practice use among CII members.
2. Gauge the impact of best practices, especially the joint impact of multiple best practices, on project performance.

Among the 15 CII Best Practices, Disputes Prevention & Resolution, Materials Management, Quality Management, and Implementation of CII Research were not included in this study. BMM 2010-4 clearly demonstrates that high use of best practices provides a significant benefit for both owners and contractors in terms of cost and schedule performance. Summary results are shown in Figures 1-1 through 1-4.

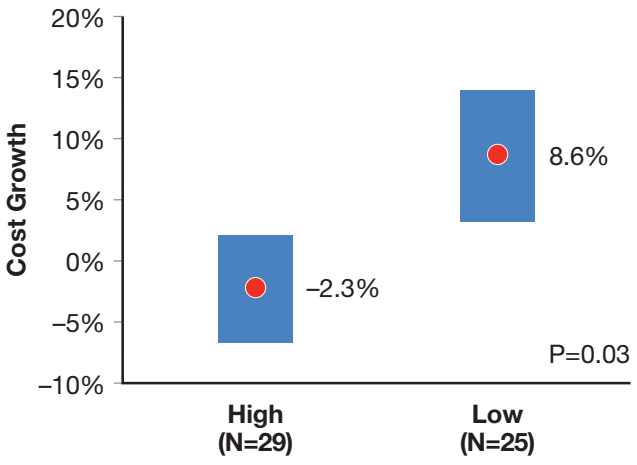

Figure 1-1. Comparison of CII Best Practice use on cost performance for owners (Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 24)

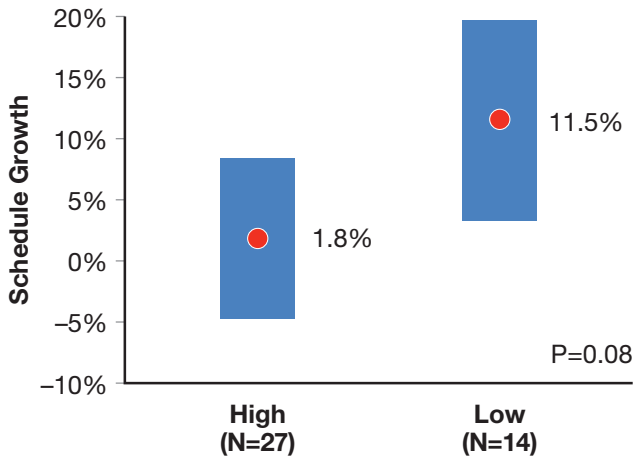

Figure 1-2. Comparison of CII Best Practice use on schedule performance for owners (Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 25)

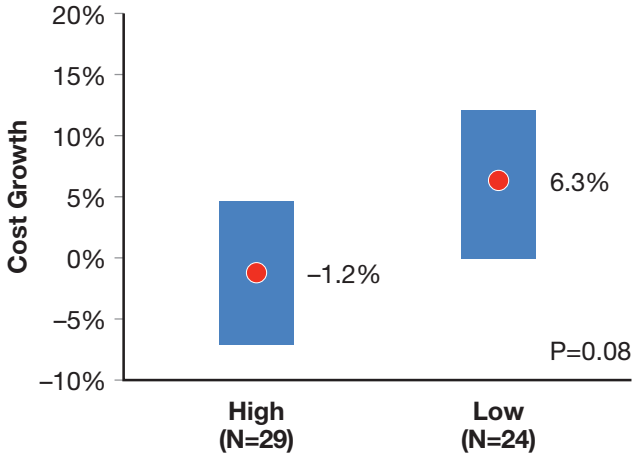

Figure 1-3. Comparison of CII Planning Best Practice use on cost performance for owners (Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 26)

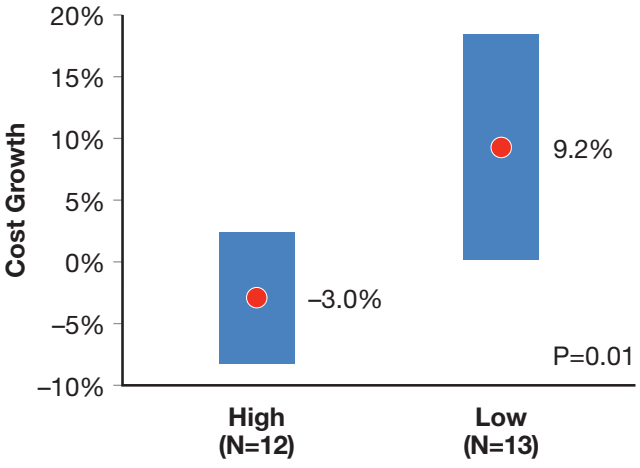

Figure 1-4. Comparison of CII Execution Best Practice use on cost performance for contractor (Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 27)

Implementation

The CII Implementation Program supports comprehensive, effective use of proven CII research/findings by member organizations. Implementation of CII Best Practices is driven by the member organizations and supported by the institute. Upon joining CII, each member organization makes a strong commitment to improve its business performance through the adaptive use of CII products.

Implementation Model

To help member companies effectively implement CII products, including best practices, the CII Implementation Strategy Committee (ISC) has developed an implementation model that specifies the steps of implementing a CII product. (See Figure 1-5.)

Follow the steps of the CII Implementation Model to craft your organization's implementation effort.

Figure 1-5. Implementation Model
(Ref.: IR 166-2, *Implementation Model + Knowledge Structure Guide*, p. 3)

These steps follow the traditional plan-do-check-act continuous improvement model. The building blocks of the implementation model are as follows:

Step 1: A Foundation of CII Products, Support, and Benchmarking & Metrics Data. CII products include implementation resources, research summaries, and educational materials that can be used to help individuals make process improvements. CII also provides other support such as staff assistance, the Implementation Champions program, and other resources to facilitate implementation within and across CII companies. (Find a list of these resources at http://www.construction-institute.org/impl.cfm.) The CII Benchmarking & Metrics program provides project performance and process-use metrics to help organizations understand improvement opportunities.

Step 2: Corporate Commitment. Any effective corporate implementation effort must begin with a clear and strong management commitment to improvement. This commitment may include the following:

- a statement that clearly informs employees what the organization expects relative to implementation of CII products
- directives and resources to implement specific CII products into existing processes, procedures, and practices within the organization

- implementation of CII Best Practices incorporated into employee performance reviews, with specific usage targets
- use of the Implementation Model as a guide.

Step 3: Corporate Implementation Champion. A corporate Implementation Champion (IC) guides and directs implementation of CII products to maximize organizational benefits. Essential duties of the IC include the following:

- providing leadership to identify the greatest corporate improvement needs, and directing resources to achieve maximum benefits
- facilitating communication of implementation benefits, successes, and opportunities
- spreading knowledge by enhancing the awareness and availability of CII Best Practices within the organization
- objectively measuring the results of CII Best Practice use.

Step 4: Self-audit. Self-audits should be performed periodically to determine the practices that are done well and those that are done poorly, in order to identify opportunities for improvement.

- Determine which CII products have been implemented and the degree to which each has been implemented.
- Use tools to make the self-auditing process efficient and consistent. (See the Self-assessment Guide, included within this publication.)

Step 5: Implementation Plan & Goals. In order to implement CII products effectively, an implementation plan should be developed, targeting goals that will measure success. (See "The Ten Stages to Implementation Success" in the following section.) The plan and goals should do the following:

- Reflect the corporate vision, identifying specific corporate goals for the use of CII Best Practices.
- Select strategies and formulate specific implementation steps.
- Focus on integrating CII Best Practices into the organization's processes, procedures, and culture.

Step 6: Review Boards/Product Champions. In order to determine which practices and products to adopt, a review board facilitates the review of CII Best Practices and other CII practices and, based on an understanding of the organization, makes recommendations for adoption. Product champions are then assigned to facilitate implementation of the specific product(s).

Among the duties of the review board are the following:

- Determine which CII Best Practices (or other CII practices) are applicable to the organization.
- Recommend specific application of the CII Best Practices within the organization's business process for capital development projects.

Among the duties of a product champion (selected early in the review process) are the following:

- Facilitate the understanding of a specific CII Best Practice.
- Frequently serve as the overall manager of the implementation process for the selected CII Best Practice.

Step 7: Product(s) Training. Effective implementation must be accompanied by training developed specifically for the practice to be implemented. This training should do the following:

- Provide knowledge necessary for successful implementation, including company-specific processes and practices.
- Include all key stakeholders of the project team affected by the best practice being implemented.
- Use CII resources available to support training.
- Have adequate resources to achieve the implementation goal.

Step 8: Product Implementation. The product/practice must be implemented, preferably first on a pilot application basis, with a good mechanism for measurement. Recommendations include the following:

- Select CII Best Practices for implementation on the basis of their potential for improvement in an organization or project.
- Identify possible barriers and plan enablers to counter barriers.
- Provide leadership, communication, resources, and support to make sure that the effort is a fair test of the product or practice.

Step 9: Measure Results. As in the case of implementation of any new tool, technique, or product, the results must be measured to make sure that the effort is worthwhile. Suggestions include the following:

- Use the same techniques that were used during the self-audit.
- Measure both the utilization of CII Best Practices and the impact of their use.
- Participate in surveys conducted by the CII Benchmarking & Metrics Committee or other benchmarking services; the results will give comparisons of your efforts with those of other organizations.

Step 10: Celebrate Success. To effectively integrate the practices into the corporate culture and to inculcate a culture of implementation, celebration of success is an effective tool. Recommendations include the following:

- Recognize and publicize successes in the implementation process in order to reinforce the usefulness of the process.
- Use media such as newsletters, intranet sites, team meetings, and the organization's process documentation to publicize successful implementation.

Systematically applying these building blocks and using the solid foundation of support that CII provides will improve implementation efforts.

The Ten Stages to Implementation Success

The key to the successful implementation of a new practice is to have a clear perspective on the overall stages of the entire implementation process. Figure 1-6 depicts the Ten Stages to Successful Implementation. The guidance offered in this section on these stages has been extracted from CII Implementation Resource 246-2, *The Implementation Planning Model*, Version 1.2, pp. 10–11.

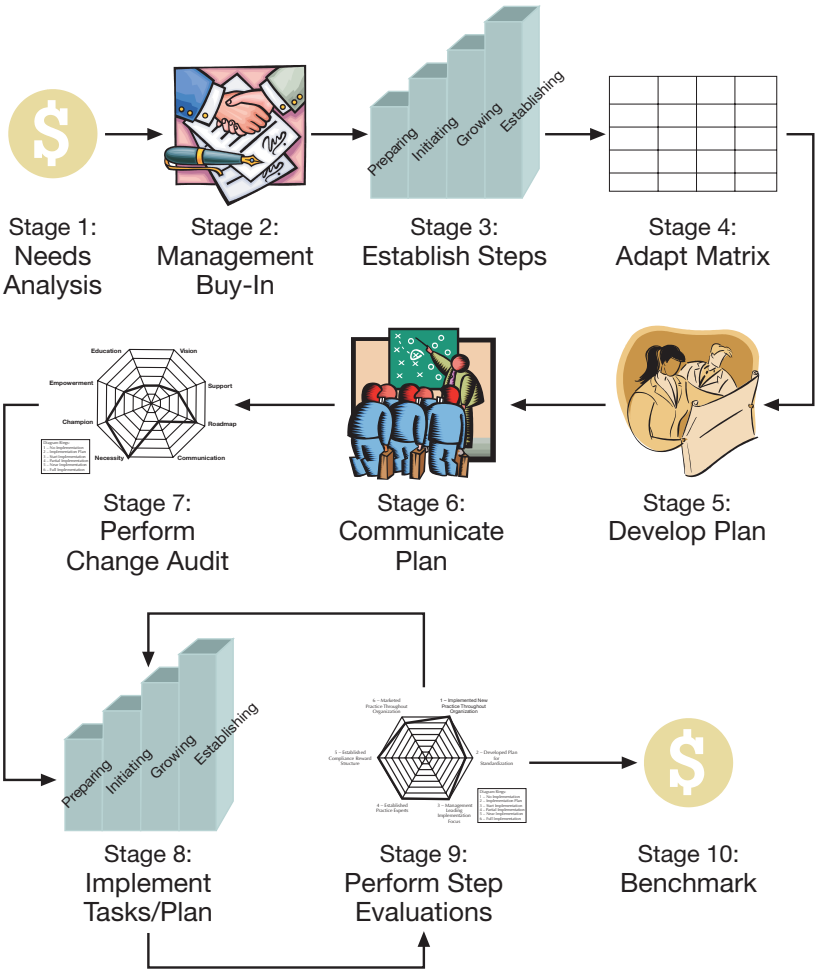

Figure 1-6. A Ten-stage Approach to Successful Implementation

Stage 1: Needs Analysis – The first stage in the process is to conduct a needs analysis that lays out the case for implementing a new practice. Since this case will need to be presented to both management and critical staff, a compelling argument is required as an output of this stage. Each organization will have a different methodology established for conducting a needs analysis, so the specifics of this stage are left to the individual implementer. However, the output of this stage remains consistent for all organizations: a case that establishes the need for the new practice.

Stage 2: Management Buy-In – The second stage of the implementation process is to obtain management buy-in for the new practice. This buy-in will be based on the needs analysis developed in Stage 1. At this stage, the prospective implementer must obtain the resources and backing that are required to proceed to the first test implementation of the practice.

Stage 3: Establish Steps – The Implementation Planning Model establishes a series of four critical steps that should be followed during the implementation process: 1) preparing, 2) initiating, 3) growing, and 4) establishing. The third stage in the overall process is to understand these steps and develop an approximate schedule for the implementation process based on them. This will provide an initial perspective on the proposed investment in time that the organization is undertaking for the new practice.

Stage 4: Adapt Matrix – Stage 4 is the first core element of the implementation process. At this stage, the implementation team must take the specifics within the Implementation Matrix presented on page 14 of Implementation Resource 246-2 and adapt them to the unique requirements of the organization's current implementation task. This process requires the implementation team to understand the steps introduced in the Implementation Planning Model and the specific requirements of the new practice.

Stage 5: Develop Plan – Once the Implementation Matrix has been adapted for a specific new practice, the implementation team will have all of the fundamental details required to develop an implementation plan. Stage 5 requires the team to translate these details into a plan that meets the requirements of the specific organization. Whether it is a simple or a comprehensive plan, the details identified in Stage 4 will provide the foundation for the plan completed in this stage.

Stage 6: Communicate Plan – Communication is a key strategy for successful implementation. Stage 6 spotlights this strategy by requiring the team to communicate the proposed implementation plan to both management and the proposed test group. The communication should be part of a communication plan that highlights the need for the new practice and that describes the scenario in which it will first be tested.

Stage 7: Perform Change Audit – In the majority of cases, the failure to prepare adequately for a new practice ultimately will lead to a failed implementation effort. Therefore, the first task in the implementation process requires the implementation team to perform a change audit that evaluates the readiness of the organization to undertake the implementation process. During this audit, the team should identify areas in which the organization requires further investment prior to embarking on the implementation process. The intent of this stage is to identify potential barriers prior to encountering them during the test implementation.

Stage 8: Implement Tasks/Plan – Stages 8 and 9 are iterative parts of the implementation process. Each step in this process has a set of three to five tasks that have been identified as critical for success in that step. Stage 8, the implementation team should follow the tasks laid out in the implementation plan for each step of the process. Concurrently, potential barriers and strategies are presented to enhance the implementation team's preparation.

Stage 9: Perform Step Evaluations – In conjunction with Stage 8, Stage 9 requires the implementation team to perform evaluations during each step of the implementation process. In these evaluations, the team should determine whether the process has achieved the required goals of that step. If the goals have not been reached, then the team will return to Stage 8 to identify areas in which additional work is required. If goals have been achieved, the team can proceed to the next stage of the implementation process.

Stage 10: Benchmark – The final stage in the implementation process is to benchmark the new practice both internally and externally. The intent of this benchmarking is to determine whether the process is returning the results expected by management and the implementation team. The specific benchmarks that are used in the process will be determined by the individual organization. This process should occur on a regular basis to determine whether the practice needs revisiting in terms of either updating the practice or replacing it with a new practice.

For a complete treatment of this topic, the reader should refer to IR 246-2, *The Implementation Planning Model*, Version 1.2. Another helpful resource is the Implementation Assistant, a web-based companion tool that is available on the CII website at http://www.construction-institute.org/impl.cfm.

Assessment Process

The assessment process involves the comparison of organizational needs, processes, procedures, and practices against the requirements of CII Best Practices, as provided in the checklists available in this publication. The checklists provide a starting point for assessing the level of implementation of a given process within an organization and for determining which areas require additional effort.

After the areas of improvement have been identified, the Implementation Champion and management team must weigh the potential benefit of each applicable CII Best Practice against the effort that will be required for implementation. Activities associated with the implementation process must be prioritized so that the organization can achieve the greatest benefit, considering the probability of success and the associated costs and benefits. Based on the results of this evaluation, the organization can develop an implementation plan that will provide a “blueprint” for reaching its CII Best Practices implementation goals.

The CII Implementation Thermometer provides a quick assessment process that is specific to CII implementation issues. This tool can be utilized to ascertain the overall status on the organization’s use of the CII implementation process. (See Figure 1-7.) Using the results of this assessment, implementers can identify the areas needing more attention and perform any additional detailed analysis necessary.

Step 1. Circle the number in the column that best shows your level of agreement with each of the following statements:

Level of Agreement: Strongly Disagree ← → Strongly Agree

Implementation Issues	1	2	3	4	5	Score
1. My organization has established a corporate commitment to the implementation of CII Best Practices.	0	3	5	8	10	
2. My organization has established a corporate CII Implementation Champion.	0	3	5	8	10	
3. My organization has conducted a self-audit to determine which CII products have been implemented, and the degree to which each has been implemented.	0	3	5	8	10	
4. My organization has an implementation plan and goals for CII implementation.	0	3	5	8	10	
5. My organization has an active board or process to review CII products and determine their application in our work processes.	0	3	5	8	10	
6. My organization provides for either internal or external training on CII products.	0	3	5	8	10	
7. My organization has implemented and makes extensive use of at least five CII products.	0	3	5	8	10	
8. My organization measures both the utilization and results of project best practices including CII's.	0	3	5	8	10	
9. My organization recognizes individuals and teams that utilize project best practices including CII's.	0	3	5	8	10	
10. My organization contributes to and uses the results of the CII Benchmarking and Metrics Program.	0	3	5	8	10	
Total Score:						

Step 2. Place the circled number in the score column. Add the column to obtain your total score.

Step 3. Find where your total score fits within the three sections of the Implementation Thermometer.

Step 4. Regardless of your score, commit yourself to improving your project performance by implementing CII concepts.

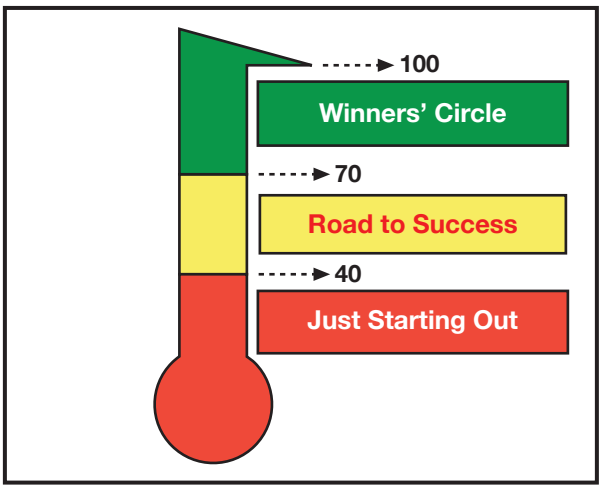

Figure 1-7. CII Implementation Thermometer

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Additional assistance on the implementation process can be obtained by participating in the CII Implementation Champions program.

One approach to starting your implementation journey is to first examine your work flow and take a process-oriented perspective. Assess your operations using the Section 2 "Best Practice Assessment" portion of each CII Best Practice chapter in this guide. Low scores reveal areas with improvement opportunities. CII suggests performing these assessments as follows:

- Above all, work safely. Refer to **11.01 – Zero Accident Techniques** and insure that you have an embedded safety culture within your projects.
- Attention to quality ensures that your goals are met within the established parameters in safety, schedule, cost and client satisfaction. Examine **8.01 – Quality Management**.
- Start off your projects right by insuring that your project team is aligned with common goals and objectives established in agreed priority order. Refer to **1.02 – Alignment** for key criteria.
- Ensure that your team is working in an environment of interdependence and trust. Refer to **7.01 – Team Building** for key criteria.
- Plan your project thoroughly and carefully—from business planning to execution. Refer to **1.01 – Front End Planning** to start things out right.
- Identify and proactively manage project risks throughout the life cycle of capital projects. Refer to **10.06 – Project Risk Assessment** for international and domestic projects.
- Avoid repeating prior project development mistakes. **8.03 – Lessons Learned** provides a process to reinforce good practices and avoid past errors in execution.
- In your planning, begin with the end in mind. **5.01 – Planning for Start-up** provides a methodology to avoid problems that delay putting your investment to work and that disrupt end of project construction activities.
- Ensure that your execution partners (engineering and construction firms, as well as major suppliers) are focused on project priorities and working for the benefit of the project. Review **7.02 – Partnering**.
- Minimize the direct and indirect costs of contract disputes. Review **10.01 – Disputes Prevention & Resolution** to ensure that you have the mechanisms to prevent project disputes and the means to facilitate dispute resolution.
- Build in the means for projects that are both safe and constructible within cost and schedule goals. Use **2.01 – Constructability** to identify opportunities.
- Look ahead to the supply chain, from long lead items to jobsite logistics. Assess your practices with **3.01 – Materials Management**.
- Once your project is approved, institute a program to maintain tight control over budgets, schedules, and project scope. Review your process using **8.09 – Change Management**.
- Ensure that your projects execute as "best in class." **8.05 – Benchmarking & Metrics** provides guidance on key project execution metrics to assess performance against peers and maintain continuous improvement in project execution.
- Stay on top of the latest capital project execution research. **8.02 – Implementation of CII Research** provides guidance on proven practice implementation techniques and introduces innovations as they emerge.

Performance Assessment

The CII Benchmarking & Metrics Program provides practice use and performance norms, and quantifies the value of CII Best Practices. The program provides quantitative feedback to members on the project performance impacts that may be attributable to CII Best Practices, as well as information about statistical measurements that can help improve capital project effectiveness.

Increased use of best practices positively affects cost, schedule, and safety performance. Table 1-1 summarizes some of the analysis completed in publication BMM 2010-4, *CII Value of Best Practices Report*. A check-mark (√) indicates that a statistically significant difference was observed at the level of $p \leq 0.1$. The reader should note that, due to the small sample size, some of the analysis is limited. However, Table 1-1 does provide additional guidance on the selection of implementation starting points.

Table 1-1. Summary of statistically significant relationships between CII Best Practices implementation and project performance (Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 37)

Group	Best Practices	Owner		Contractor	
		Cost Growth	Schedule Growth	Cost Growth	Schedule Growth
Planning		√			
	FEP	√			
	Alignment During FEP	√			
	Planning for Start-up	√	√	√	
Execution				√	
	Constructability			√	
	Change Management	√			
Organization and Behavior					
	Partnering	√			
	Team Building		√		

Additional information about the CII Benchmarking & Metrics Program is available on the CII website at http://www.construction-institute.org/bmm.cfm.

Path Forward

Regardless of where an organization is in the process of implementing the CII Best Practices, it can use the information and tools presented in this document. An organization, for instance, may proceed with its current configuration or it can tailor the process to suit specific needs. The contents presented here will be modified as new CII Best Practices are validated and as the implementation process is further developed.

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Use of the Self-assessment Guide

The self-assessment guide presented here was developed to facilitate implementation of the CII Best Practices to improve project and construction safety, quality, schedule, and cost effectiveness. Three key factors are essential to the successful implementation of CII Best Practices: 1) knowledge of the CII Best Practices, 2) a plan for implementation, and 3) a process for implementation. This guide may be used as a reference for management and individual project professionals, and as a training and education aid for all professionals in the implementation of CII Best Practices. Use of the guide will vary, depending on the experience level and objectives of the person or group charged with assessment and implementation. Three levels of experience are described below.

Level 1 Users

New or inexperienced project or construction managers faced with the challenges of controlling and improving the safety, quality, schedule, and cost of a project, or those interested in or specifically directed to incorporate "CII recommendations."

- Refer to Section 1 of each best practice to gain familiarity with that best practice.
- Use designated checklists for the applicable CII Best Practices as implementation guides.
- Refer to referenced CII publications for additional information and related topics.

Level 2 Users

Experienced project/construction individuals or those familiar with CII Best Practices.

- Compare the organization's existing procedures with the CII Best Practices' checklist requirements for implementation.
- Consider revising the organization's procedures to comply with the CII Best Practices as listed in the checklists. Review the applicable references for specific details.
- Enhance the level of implementation on projects by following the checklists as guides.

Level 3 Users

Management or project personnel charged with the success of a project or operation.

- Use the CII Best Practices checklist(s) for self-assessment.
- Use initial scores as a benchmark against future project implementation levels.
- Identify barriers to implementation within the project and/or organization.
- Formulate improvement strategies to overcome barriers.
- Use this publication as a communication and training tool for project and management personnel.

Limitations

The CII Best Practice summaries and checklists were drawn from the content of various CII publications related to a specific CII Best Practice. The checklists are not to be considered a complete and thorough distillation of the materials related to a particular best practice. Rather, each checklist should be viewed as a reasonable summary of the major requirements related to a specific CII Best Practice. Further research and investigation of the subjects are required of those persons responsible for implementation of the CII Best Practices, including the review of applicable CII tools, products, and references.

Scoring the Best Practice Implementation Assessments

CII has created an assessment form for each of its best practices. (See Figure 1-8 for an example.) The assessment scores are derived from structured subjective scoring methods, and can be used for the following purposes:

- Match a level of implementation to the conditions indicated for each question.
- Identify opportunities for improvement in the implementation of CII Best Practices.
- Compare normalized assessment scores among several similar projects to identify areas both of strength and in need of improvement.

Section 2: Implementation Assessment

Best Practice: 10.01 Disputes Prevention & Resolution
Knowledge Area: 10.0 Risk Management

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Disputes Review Board (DRB) consistently stipulated in contract and subcontract documents.	IR 23-2		
2.0 Partnering principles consistently used on project.	IR 23-2		
3.0 DRB team consistently included in partnering.	IR 23-2		
4.0 DRB team established in early stages of all projects.	IR 23-2		
5.0 Neutral team members on DRB.	IR 23-2		
6.0 DRB team members experienced on this type of project.	IR 23-2		
7.0 DRB team operating procedures established.	IR 23-2		
8.0 Limits to authority of DRB team established.	IR 23-2		
9.0 DRB team compensation established.	IR 23-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (9 x 3 = 27)		**27**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Figure 1-8. Sample Best Practice Implementation Assessment

CII Implementation Thermometer Scores can be totaled for a single CII Best Practice or as a normalized score for the selected number of CII Best Practices being implemented or reviewed. The scoring is based on a range from 0 to 3, with points defined as follows:

0 = Strongly Disagree

1 = Disagree

2 = Agree

3 = Strongly Agree.

To compute a normalized assessment score (NAS) for any best practice:

1. Determine the appropriate raw score (0 through 3) and enter that value in the blank provided for each question in the checklist.
2. Determine the sum of the raw scores selected for the entire checklist.
3. Divide the preliminary assessment by the maximum attainable score and multiply the result by 100 to calculate the normalized assessment score (NAS).
4. Enter the NAS for that practice in the comprehensive scoring register that follows.

If a different scoring scale is selected, the same scale must be used for all projects in the group in order to have a common basis for comparability of normalized assessment scores.

The NAS may be used to evaluate a projects at many points during its cycle. The first evaluation should occur early in the project. Additional evaluations may occur at selected points in the project life cycle. For example, evaluations are appropriate when the project enters a new project phase or at other points in the project life cycle that are common to all projects.

Regardless of the frequency of the evaluations, the results may be compared among projects as long as the scoring guidance is consistent among the projects being compared and the project parameters are reasonably similar. Scoring may be accomplished by a single individual with knowledge of the project details or it may be accomplished by a consensus developed among several individuals knowledgeable of the project and best practice elements.

Table 2-1 may be copied for use in consolidating the NAS scores.

Table 2-1. Comprehensive Scoring Register

Comprehensive Scoring Register

CII Best Practices

Project Name: _____

Date of Evaluation: _____

Name of Evaluator(s): _____

BP#	BP Title	Normalized Assessment Score (NAS)
1.01	Front End Planning	_____
1.02	Alignment	_____
2.01	Constructability	_____
3.01	Materials Management	_____
5.01	Planning for Start-up	_____
7.01	Team Building	_____
7.02	Partnering	_____
8.01	Quality Management	_____
8.02	Implementation of CII Research	_____
8.03	Lessons Learned	_____
8.05	Benchmarking and Metrics	_____
8.09	Change Management	_____
10.01	Disputes Prevention & Resolution	_____
10.06	Project Risk Assessment	_____
11.01	Zero Accident Techniques	_____
	Total	_____

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1.01 Front End Planning

Section 1: CII Best Practice Summary Sheet

Best Practice: **1.01 Front End Planning**
Knowledge Area: **1.0 Project Planning**

Definition

Front End Planning is the process through which owners develop sufficient strategic information to address risk and commit resources in order to maximize project success. Front End Planning is also known as front end loading, pre-project planning, feasibility analysis, conceptual planning, programming/schematic design, and early project planning.

Elements

- Front End Planning is an owner-driven process that must be tied closely to business goals.
- Front End Planning is a complex process that must be adapted to the business needs of the organization, tailored to specific projects, and applied consistently to all projects in order to gain full benefits.
- Organizational goals and guidelines for both Front End Planning and the project must be well defined and aligned among project participants. Alignment requires involvement of operations, business, and project management personnel early in the Front End Planning process.
- Front End Planning is divided into three main phases, as shown in Figure 1.01-1:
  1. Feasibility
  2. Concept
  3. Detailed Scope.

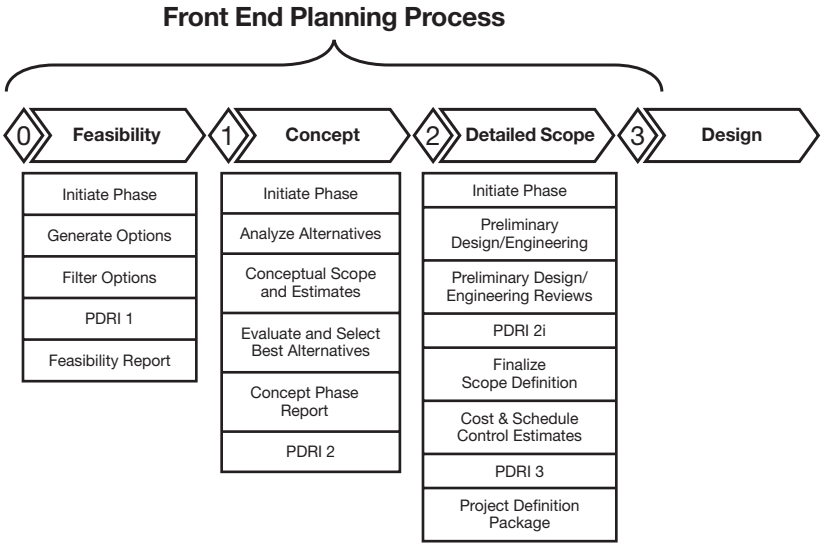

Figure 1.01-1. Front End Planning Process Map
(Ref.: RS 213-1, *Front End Planning: Break the Rules, Pay the Price*, p. 29)

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- The Front End Planning effort is typically identified with two to five percent of the project total installed cost (TIC), depending on the type and complexity of the project.
- Typical activities and products of Front End Planning may include the following:
  - options analysis
  - scope definition and boundaries
  - life-cycle cost analysis
  - cost and schedule estimate
  - site investigation
  - environmental analysis
  - process design basis
  - initial engineering design
  - space planning, including room data sheets and stacking diagrams
  - site layout
  - project execution approach, including project control plan
  - procurement plan
  - architectural renderings
  - appropriation submittal package.

The following are critical "rules" of Front End Planning:

- Develop and consistently follow a defined Front End Planning process.
- Ensure adequate scope definition prior to moving forward with design and construction.
- Use Front End Planning tools.
- Define existing conditions thoroughly.
- Select the proper contracting strategy early.
- Align the project team, including key stakeholders.
- Build the project team, including owner stakeholders and consultants.
- Include involvement from both owners and contractors.
- Staff critical project scoping and design areas with capable and experienced personnel.
- Identify and understand risks of new project types, technologies, or locations.
- Address labor force skill and availability during planning.
- Provide leadership at all levels for the Front End Planning process, including executive and project, and owner and contractor.

Project teams and organizations that break these "rules" will pay the price in terms of disappointing results.

Benefits

- According to the Value of Best Practices Survey completed in 2010, owners with high Front End Planning usage on average spend eight percent less than those with low usage. (See Figure 1.01-2.)

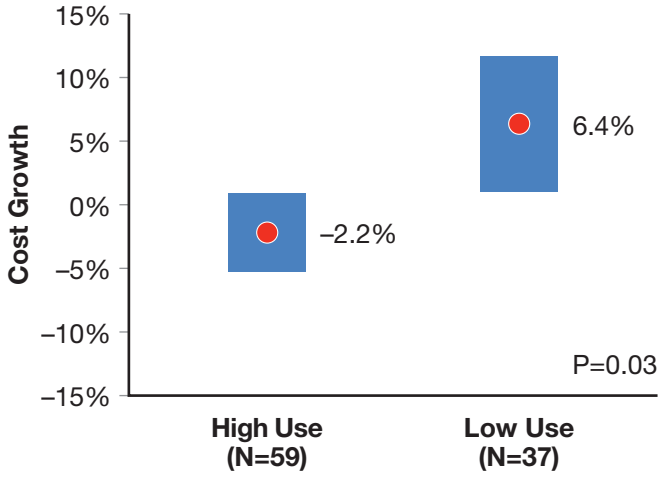

Figure 1.01-2. Impact of Front End Planning on Cost Growth—Owners
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 28)

- CII Research Team 213, Support for Pre-Project Planning, analyzed a data sample of 609 projects from the CII Benchmarking & Metrics database. The results of the analysis were as follows:
  - cost performance*: 10% better
  - schedule performance: 7.2% better
  - change performance: 5.2% better

  * statistically significant $p < 0.05$

  (Ref.: RS 213-1, *Front End Planning: Break the Rules, Pay the Price*, Table 5)

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Section 2: Implementation Assessment

Best Practice: **1.01 Front End Planning**
Knowledge Area: **1.0 Project Planning**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 My company has a formal gated approval process for capital projects.	IR 213-3		
2.0 Front End Planning in my organization is adequately funded.	IR 213-3		
3.0 The roles and responsibilities of the Front End Planning team were well defined.	IR 213-3		
4.0 The Front End Planning team members communicated effectively.	IR 105-2, IR 113-3		
5.0 The Front End Planning documentation was complete and of a high quality.	IR 213-3		
6.0 The owner's objectives, needs, and expectations were clearly communicated to the Front End Planning team.	IR 213-3, IR 113-3		
7.0 Existing and emerging process and/or building technologies were analyzed thoroughly and in detail.	IR 213-3		
8.0 Appropriate risk mitigation strategies were identified and clarified during Front End Planning.	IR 213-3		
9.0 All necessary regulatory permits were addressed during Front End Planning.	IR 213-3		
10.0 The project team uses Front End Planning tools, such as the PDRI, so that the FEP process provides sufficient scope definition and defines existing conditions thoroughly. This allows decision makers to evaluate the viability of a project prior to moving forward with design and construction.	IR 213-3		
11.0 Project team members adequately represent the project stakeholders, including involvement from both owners and contractors.	IR 213-3		
12.0 The FEP process aligns key stakeholders with the project team.	IR 213-3		
13.0 Project team members have the expertise and ability to contribute to the team and the project.	IR 213-3		

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Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
14.0 The FEP process identifies the risks of new project types, technologies, and locations.	IR 213-3		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (14 x 3 = 42)		**42**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 1.01 Front End Planning
Knowledge Area: 1.0 Project Planning

Implementation Resources

IR 268-2 *PDRI: Project Definition Rating Index – Infrastructure Projects*
IR 242-2 *Front End Planning of Renovation and Revamp Projects*
IR 213-3 *Front End Planning Process*, Version 2.0
IR 213-2 *Front End Planning Toolkit*, Version 2.0
IR 155-2 *PDRI: Project Definition Rating Index – Building Projects*, Version 3.2
IR 113-3 *Alignment During Pre-Project Planning: A Key to Project Success*, Version 2.1
IR 113-2 *PDRI: Project Definition Rating Index – Industrial Projects*, Version 3.2
IR 105-2 *Compass: Communications Project Assessment Tool*, Version 2.1

Education Modules

EM 242-21 *Front End Planning of Renovation and Revamp Projects*, Instructor's Guide
EM 242-21A *Front End Planning of Renovation and Revamp Projects*, Participant Handbook
EM 241-21 *Construction Input Assessment in Front End Planning*, Instructor's Guide
EM 241-21A *Construction Input Assessment in Front End Planning*, Participant Handbook
EM 213-21 *Front End Planning*, Instructor's Guide
EM 213-21A *Front End Planning*, Participant Handbook
EM 155-21 *Project Definition Rating Index (PDRI) for Building Projects*, Instructor's Guide
EM 155-21A *Project Definition Rating Index (PDRI) for Building Projects*, Participant Handbook
EM 113-23 *Project Definition Rating Index (PDRI) for Industrial Projects*, Instructor's Guide
EM 113-23A *Project Definition Rating Index (PDRI) for Industrial Projects*, Participant Handbook
EM 113-22 *Scope Control and Change Management*, Instructor's Guide
EM 113-22A *Scope Control and Change Management*, Participant Handbook

Online Education Courses

TAL 39-31 *Pre-Project Planning 1: Implementing A Pre-Project Planning Program*
TAL 39-32 *Pre-Project Planning 2: Organizing for Pre-Project Planning*
TAL 39-33 *Pre-Project Planning 3: Selecting among Project Alternatives*
TAL 39-34 *Pre-Project Planning 4: Developing the Project Scope Definition Package*
TAL 39-35 *Pre-Project Planning 5: Decide Whether to Proceed with Project*

Research Summaries

RS 268-1 *Front End Planning Tool: PDRI for Infrastructure Projects*
RS 242-1 *Front End Planning for Renovation and Revamp Projects: An Overview*
RS 213-1 *Front End Planning: Break the Rules, Pay the Price*
RS 155-1 *Pre-Project Planning Tool: PDRI for Buildings*
RS 113-1 *Pre-Project Planning Tools: PDRI and Alignment*
RS 39-1 *Pre-Project Planning: Beginning a Project the Right Way*

Research Reports

RR 268-11 *Development of the Project Definition Rating Index (PDRI) for Infrastructure Projects*
RR 242-11 *Analysis Supporting Front End Planning for Renovation and Revamp Projects, Part 1*
RR 242-12 *Analysis Supporting Front End Planning for Renovation and Revamp Projects, Part 2*
RR 221-11 *Information Flow to Support Front End Planning*

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Research Reports (continued)

RR 213-12	*Case Study Analysis in Support of Front End Planning Implementation*
RR 213-11	*Data Analysis in Support of Front End Planning Implementation*
RR 155-11	*Development of Project Definition Rating Index for Building Projects*
RR 113-11	*Project Definition Rating Index (PDRI)*
SD-105	*Analysis of Pre-Project Planning Effort and Success Variables for Capital Facility Projects*
SD-102	*Perceptions of Representatives Concerning Project Success and Pre-Project Planning Effort*
SD-94	*Modeling Pre-Project Planning for the Construction of Capital Facilities*

1.02 Alignment

Section 1: CII Best Practice Summary Sheet

Best Practice: **1.02 Alignment**
Knowledge Area: **1.0 Project Planning**

Definition

Alignment is the condition under which appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives. Aligning the project team involves developing clearly understood objectives for all team members and gaining the commitment from each to work toward those goals. At the end of the alignment process, each member is focused on the same set of project objectives.

Elements

Alignment exists in three dimensions, as seen in Figure 1.02-1.

- The first dimension, vertical, involves top-to-bottom alignment within an organization. The company executives, business manager, project managers, and functional specialists within each stakeholder organization must all be well aligned.
- The second dimension, horizontal, involves the cross-organizational alignment between functional groups within the organization. Different organizations with a stake in the project must also be well aligned. For example, the business, project management, and operations groups as well as other stakeholder groups such as outside contractors must be well aligned with the project objectives and priorities.
- The third dimension, longitudinal, involves alignment of objectives throughout the project life cycle.

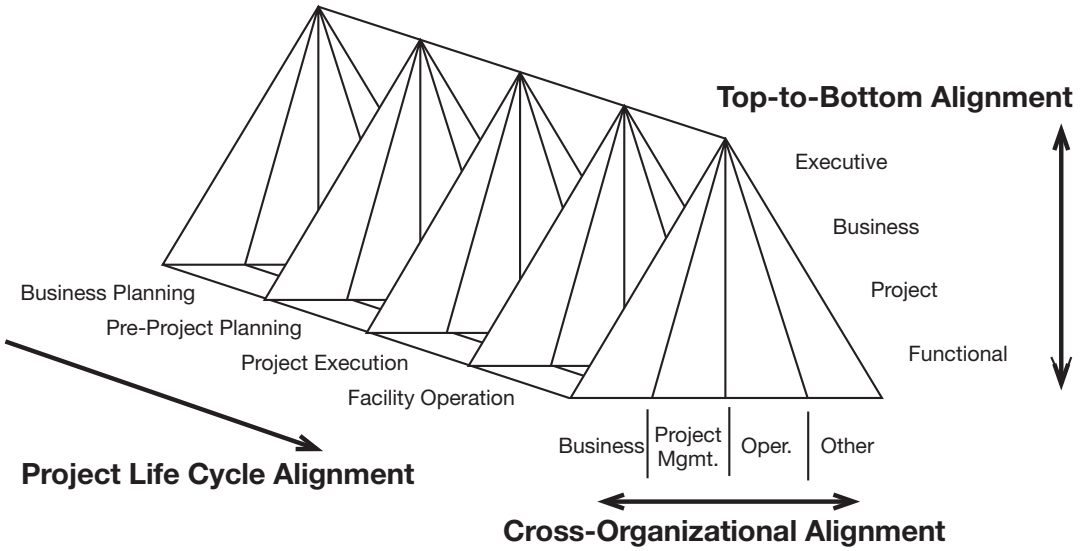

Figure 1.02-1. 3-D Schematic Organizational Alignment for a Project
(Ref.: RS 113-1, *Pre-Project Planning Tools: PDRI and Alignment*, p. 1)

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- Issues that affect alignment during project planning can be divided into five categories:

  1. **Culture**: Includes the attitudes, values, behavior, and environment of the owner organization, the contractor(s), and the front end planning team.
  2. **Execution Processes**: The project systems, processes, and procedures that are used to develop and deliver the project.
  3. **Information**: The data elements, including business objectives, that are used to define the scope of the project.
  4. **Project Planning Tools**: Software programs, checklists, and *aide-memoirs* that are typically used to develop and manage projects.
  5. **Barriers**: The obstacles to creating and maintaining the alignment of the project team.

In order to enhance alignment, management must ensure the following:

- Stakeholders are appropriately represented on the project team.
- Project leadership is defined, effective, and accountable.
- The relative priorities among safety, required project features, schedule, and cost are clear.
- Communication within the team and with stakeholders is open and effective.
- Team meetings are timely and productive.
- The team culture fosters trust, honesty, and shared values.
- The front end planning process includes sufficient funding, schedule, and scope to meet the project objectives.
- The reward and recognition system promotes meeting or exceeding the project objectives.
- The teamwork and team building programs are effective.
- Planning tools (e.g., checklists, simulations, and work flow diagrams) are effectively utilized.

Benefits

Alignment ensures that the participants of a team are working toward a common goal. Alignment of objectives must be in three directions, top to bottom, horizontal, and longitudinal (carried out throughout the project life cycle). Analysis affirms that alignment during front end planning has a significant impact on project cost growth. Figure 1.02-2 shows an analysis of cost growth for projects with high and low use of alignment during front end planning.

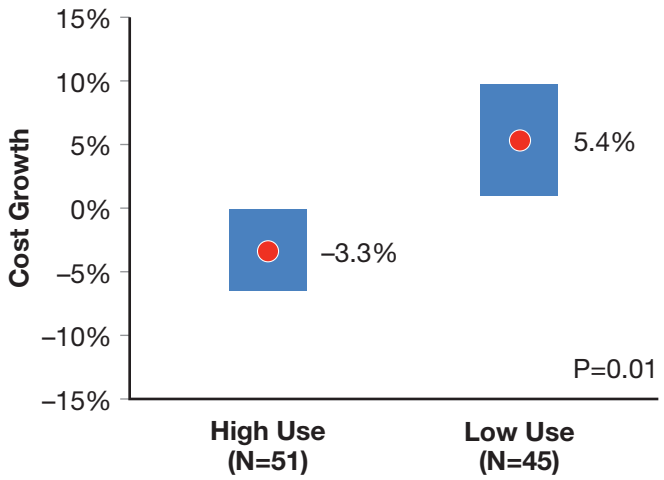

Figure 1.02-2. Impact of Alignment during Front End Planning on Cost Growth—Owners
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 29)

The CII Alignment Thermometer is a tool that will determine the alignment of a project at anytime during the project life cycle. It is most effectively utilized during the front end planning phase. See Figure 1.02-3.

Further, CII Research Team 213 completed an analysis of project alignment versus cost, schedule, and change performance. The data set contained 70 projects with a total installed cost of $6 billion. A higher alignment index score indicates a more aligned project. The results are shown below in Table 1.02-1.

Table 1.02-1. Alignment Index vs. Performance Analysis
(Ref.: RS 213-1, *Front End Planning: Break the Rules, Pay the Price*, Table 6)

	Alignment Index Score Alignment During Pre-Project Planning (Front End Planning)	
Performance	**Greater than Median**	**Less than Median**
Cost*	6.5% below budget (N=34)	3.3% over budget (N=30)
Schedule**	8.4% behind schedule (N=35)	24.5% behind schedule (N=33)
Change orders	7.6% of budget (N=27)	8.2% of budget (N=26)

* performance was statistically significant $p < 0.05$
** performance was statistically significant $p < 0.10$

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Front End Planning (FEP) Alignment Thermometer

(Five Steps to Greater Success)

Step 1. Circle the number in the column that best shows your level of agreement with each of the following statements: Legend: 1 = Strongly Disagree, 5 = Strongly Agree

Project Name:	LEVEL OF AGREEMENT					
ALIGNMENT ISSUES	1	2	3	4	5	SCORE
1. Stakeholders are appropriately represented on the project team.	0	3	5	8	10	
2. Project leadership is defined, effective, and accountable.	0	3	5	8	10	
3. The priority between safety, quality, required project features, schedule, and cost is clear.	0	3	5	8	10	
4. Communication within the team and with stakeholders is open and effective.	0	3	5	8	10	
5. Team meetings are timely and productive.	0	3	5	8	10	
6. Our team culture fosters trust, honesty, and shared values.	0	3	5	8	10	
7. The FEP process includes sufficient funding, schedule, and scope to meet our objectives.	0	3	5	8	10	
8. Reward and recognition systems promote meeting project objectives.	0	3	5	8	10	
9. Teamwork and team building programs are effective.	0	3	5	8	10	
10. Planning tools (e.g., checklists, simulations, and work flow diagrams) are effectively used.	0	3	5	8	10	
TOTAL SCORE						

Step 2. Place the circled number in the Score column. Add the column to obtain your total score.

Figure 1.02-3. Alignment Thermometer, page 1 of 2

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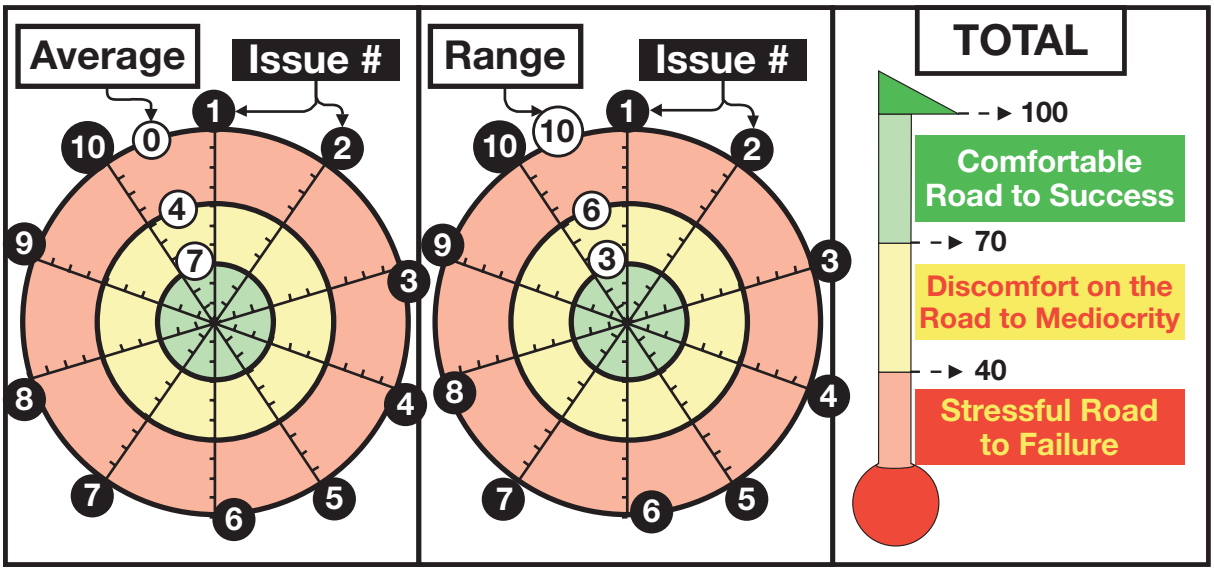
Step 3. **Plot your team's answers in the appropriate column and calculate the average, range (high score – low score), and ratio of range to average.**

TEAM SCORE	Respondent									
Issue	1	2	3	4	5	6	7	Calculated Average	Calculated Range	Range/ Average
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
						TOTAL				

Step 4. **Plot the average and range for each question and the total on the thermometer.**



Step 5. **All questions with results in the outer ring require discussion to either improve the situation or to determine why it is not an important issue for this project. A large range-to-average ratio likely indicates an issue of special concern.**

Helpful Hints:

- **Poll all appropriate stakeholders (including business and operations).**
- **Poll periodically and keep track of score (e.g., monthly or quarterly team meetings).**
- **Identify issues for discussion and areas for remedial action.**
- **Use the results to facilitate/design team building activities.**
- **Modify questionnaire and substitute project-specific issues, as required.**

Figure 1.02-3. Alignment Thermometer, page 2 of 2

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Section 2: Implementation Assessment

Best Practice: **1.02 Alignment**
Knowledge Area: **1.0 Project Planning**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Project team is established and all team members clearly understand project objectives and have committed to work toward these goals.	IR 113-3, IR 213-3		
2.0 Team members know and employ three key issues of culture: • Project leadership is defined, effective, and accountable. • Communication within the team is open and effective. • Team culture fosters trust, honesty, and shared values.	IR 113-3		
3.0 Team members know and employ three key issues for alignment of execution processes: • Stakeholders are appropriately represented on project team. • Front end planning (FEP) process includes sufficiently funded schedules and scope to meet objectives. • Reward and recognition systems promote meeting project objectives.	IR 113-3		
4.0 Team members know and address key issues regarding data elements and business objectives used to develop project scope during FEP. • Clear priority between costs, schedule, and required project features. Project sponsors explicitly spell out priorities between cost, schedule, and required features.	IR 113-2, IR 113-3		
5.0 Team members understand three key issues related to planning (e.g., tools, software programs, checklists, and *aides-memoirs*, to assist in alignment during FEP: • Team meetings are timely, productive, and designed to inform and obtain input. • Teamwork and team building programs are effective. • FEP tools (checklists, simulations, and workflow diagrams).	IR 113-3		

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
6.0 Team members know and utilize the alignment thermometer, which helps the project team evaluate and improve its performance on critical alignment issues.	IR 113-3		
7.0 The project operations and maintenance philosophy was clearly communicated.	IR 113-3, IR 213-3		
8.0 Team alignment was promoted through a rewards/recognition program during front end planning.	IR 113-3		
9.0 The rewards/recognition system was tied into the overall project objectives and priorities.	IR 113-3		
10.0 All members of the FEP team and relevant internal groups and contractors were included in the reward/recognition system.	IR 113-3		
11.0 The planning tools used for promoting alignment (e.g., checklists, simulations, software programs, and work flow diagrams for planning, developing, controlling and managing projects) were effective.	IR 113-3		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (11 x 3 = 33)		**33**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 1.02 Alignment
Knowledge Area: 1.0 Project Planning

Implementation Resource

IR 113-3 *Alignment During Pre-Project Planning: A Key to Project Success*

Education Modules

EM 113-21 *Development and Alignment of Project Objectives*, Instructor's Guide
EM 113-21A *Development and Alignment of Project Objectives*, Participant Handbook

Online Education Course

TAL 113-31 *Development and Alignment of Project Objectives*

Research Summaries

RS 113-1 *Pre-Project Planning Tools: PDRI and Alignment*
RS 12-1 *Project Objective Setting*

Research Report

RR 113-12 *Team Alignment During Pre-Project Planning of Capital Facilities*

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2.01 Constructability

Section 1: CII Best Practice Summary Sheet

Best Practice: **2.01 Constructability**
Knowledge Area: **2.0 Design Optimization**

Definition

Constructability is the optimal use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.

Elements

Constructability within an organization can be implemented at the organizational and project levels, with areas of program overlap. (See Figure 2.01-1.) The roadmap highlights six milestones in the constructability process:

- Commit to implementing constructability.
- Establish corporate constructability program.
- Obtain constructability capabilities.
- Plan constructability implementation.
- Implement constructability.
- Update corporate program.

Establishing a Corporate Program involves the following:

- owner and manager commitment to the concepts of constructability
- performing self-assessment and identifying barriers
- recognizing and assessing constructability benefits
- developing implementation policy
- understanding and communicating constructability objectives, methods, concepts, and barriers to all levels of the organization team
- establishing a constructability program
- identifying a constructability sponsor/champion
- establishing a functional support organization and procedures
- developing a main database and lessons-learned system
- updating the organizational program using the lessons-learned tool.

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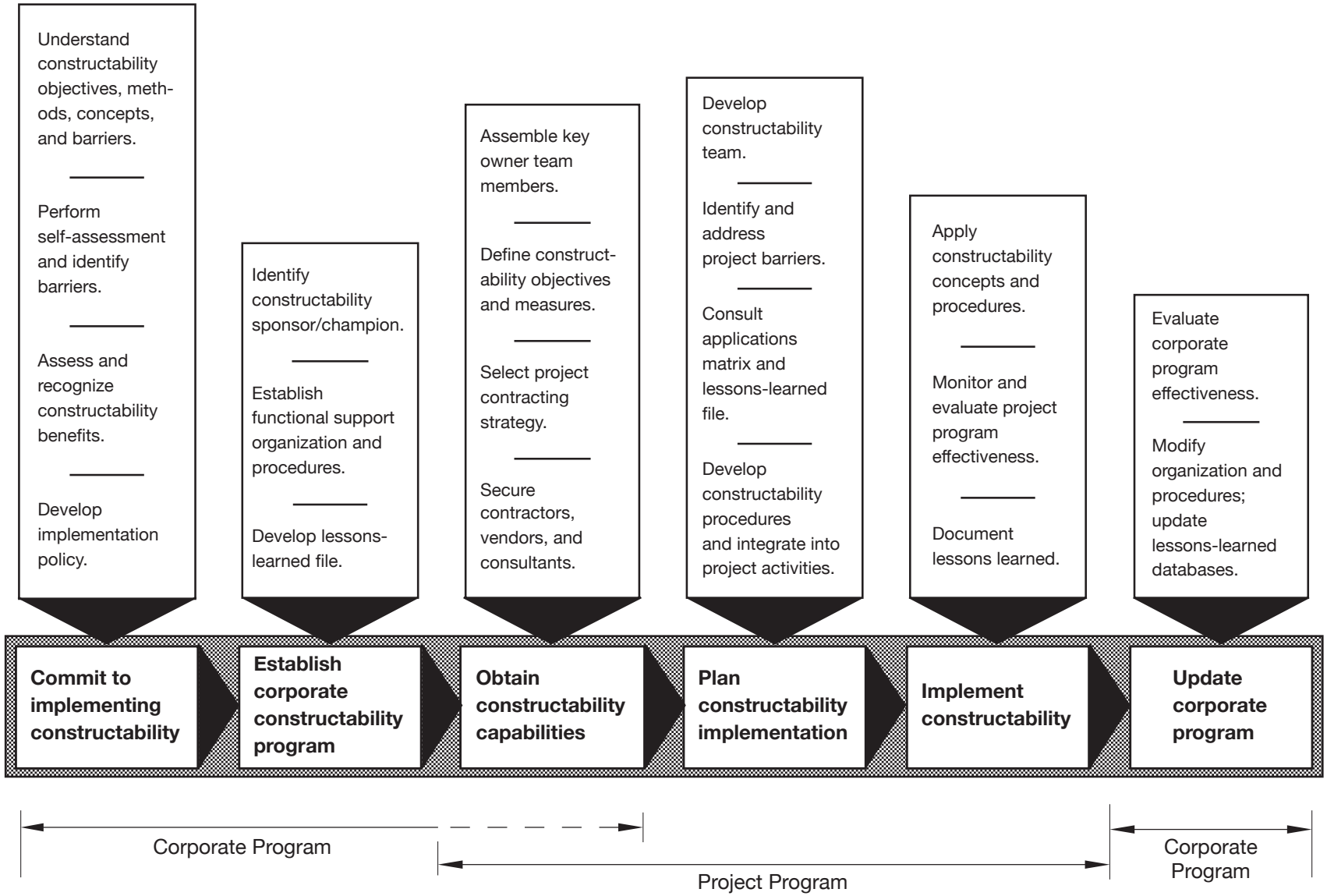

Figure 2.01-1. Constructability Implementation Roadmap

Establishing a Project Program involves the following:

- understanding and communicating constructability objectives, methods, concepts, and barriers to all levels of the project team
- obtaining constructability capabilities by the following means:
  - selecting and assembling key owner team members with the following skills and characteristics:
    - expertise and experience
    - communication and team-work skills
    - openness to new ideas
  - establishing project objectives with a constructability perspective in mind
  - selecting an organization responsible for constructability
  - determining the desired level of formality of the constructability program
  - selecting a project contracting strategy that affects project constructability
  - identifying the owner's available in-house constructability resources
  - developing the constructability team
  - identifying and addressing project barriers
  - consulting the applications matrix and lessons-learned file
  - developing constructability procedures and integrating them into project activities
  - requiring constructability as part of contractor pre-qualification process
  - securing contractors, suppliers, and consultants
  - considering use of incentive clauses tied to constructability performance
  - implementing constructability
  - applying constructability concepts and procedures
  - monitoring and evaluating project program effectiveness
  - updating the organizational program using the lessons-learned tool
  - considering issues of plant and personnel security that could affect construction execution.

The analysis of contractor-submitted projects in the 2010 *CII Value of Best Practices* study shows that the implementation of constructability has the potential to significantly improve cost performance. (See Figure 2.01-2.)

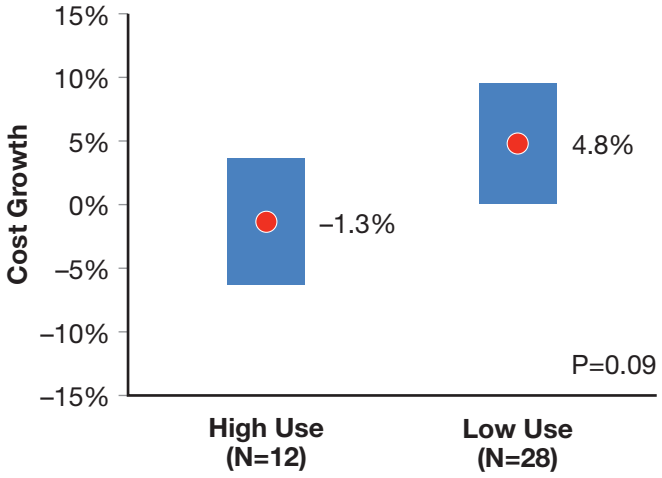

Figure 2.01-2. Impact of Constructability on Cost Growth—Contractors
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, Figure 27, p. 34)

Benefits

Several CII research studies have shown significant benefits to the implementation of constructability, including the following:

- Reduces overall project costs 4.3 percent on average.
  - Affects design, procurement, construction, and operations and maintenance costs.
- Reduces project schedule 7.5 percent on average.
- Improves project security, safety, and environmental impact.
- Increases project quality.
  - Improves operability, functionality, and reliability.
- Improves project team relationships.
- Minimizes rework and rescheduling on the project.
- Enhances the progress of the work.
  - Promotes fidelity in the planning, design, construction, and start-up schedules
- Results in repeat business.

Section 2: Implementation Assessment

Best Practice: **2.01 Constructability**
Knowledge Area: **2.0 Design Optimization**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Constructability defined and owner/management committed to it early in project development.	SP 34-1		
2.0 Constructability benefits assessed and recognized, and implementation procedure developed.	SP 34-1		
3.0 Scope of constructability program established and constructability concepts selected, understood, and agreed upon by all parties. Program geared to construction contract type, project size, and project complexity.	SP 34-1		
4.0 Environment conducive to constructability participation on project; well funded, with dedicated staff with the right expertise.	SP 34-1		
5.0 Constructability program implementation an integral part of project execution.	SP 34-1		
6.0 A constructability coordinator assigned to each project, with well defined responsibilities, adequate time to exercise them, and an opportunity to play a major role on projects.	SP 34-1		
7.0 The constructability team incorporates relevant information from the lessons learned database into the project execution plan.	SP 34-1		
8.0 Matrices with detailed documentation utilized for evaluation.	SP 34-1		
9.0 Self-assessment and barrier identification performed.	SP 34-1		
10.0 Constructability barrier assessment checklist used as tool in self-assessment/barrier identification.	SP 34-1		
11.0 The engineering deliverables reflect the recommendations for constructability from the construction personnel.	SP 34-1		
12.0 Method established to track and record lessons learned.	SP 34-1		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (12 x 3 = 36)		**36**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Section 3: CII Publication References

Best Practice: 2.01 Constructability
Knowledge Area: 2.0 Design Optimization

Implementation Resource

SP 34-1 *Constructability Implementation Guide*

Education Modules

EM-11 *Implementing Project Constructability*, Instructor's Guide
EM-11A *Implementing Project Constructability*, Participant Handbook

Online Education Courses

TAL 34-31 *Constructability 1: Implementing Constructability*
TAL 34-32 *Constructability 2: Implementing a Constructability Program*
TAL 34-33 *Constructability 3: Conceptual Planning Phase*
TAL 34-34 *Constructability 4: Design, Procurement, and Field Operation Phases*

Research Summaries

RS 3-1 *Constructability: A Primer*

Research Reports

SD-85 *Constructability: Program Assessment and Barriers to Implementation*
SD-83 *Benefits and Costs of Constructability: Four Case Studies*
SD-82 *Project-level Model and Approaches to Implement Constructability*
SD-72 *Computerized Decision Support for Modularization of Industrial Construction*
SD-4 *Constructability Improvement during Conceptual Planning*

3.01 Materials Management

Section 1: CII Best Practice Summary Sheet

Best Practice: **3.01 Materials Management**
Knowledge Area: **3.0 Procurement and Materials Management**

Definition

Materials management is a complex and comprehensive process that consists of people, organizations, technology, and processes used to manage the definition, sourcing planning, quantification, supplier qualification, purchasing, supplier QA/QC, expediting, transportation, logistics, and controlling of materials and associated information across the life cycle of a capital project. Materials and related services account for a large percentage of a capital project's total installed cost (TIC). Implementation of a comprehensive materials management program contributes to predictable project outcomes, reduced costs, improved productivity and quality, and a safer working environment. Such factors make the study of the materials management process crucial.

Elements

Corporate Strategy

The corporate strategy establishes the framework for implementing a successful organization-wide materials management program. Policies and standards are developed and maintained at the corporate level and communicated throughout the organization. The corporate strategy should include guidance on the company's position regarding strategic sourcing or supplier relationships.

Personnel and Organization

The success of the materials management program depends on commitment, personnel, and organization. Those involved in materials management must be able to function well in the project environment; they must be involved in the requirements and planning portion of the process and take the initiative to influence the policies and procedures that affect materials. A properly structured materials management organization clearly defines responsibilities and eliminates any conflict that may arise due to overlap of areas of control and responsibility across project functions.

IT Systems

Effective materials management IT systems are essential to achieving the well-coordinated orchestration of the individual functions of materials management. To achieve these benefits, the IT systems must effectively combine and integrate all of the individual functions of materials management. Even though further progress is desirable, major improvements have been achieved in this area in the last decade.

Materials Requirements Planning

Materials requirements planning (MRP) encompasses the identification, quantification, and scheduling of project materials and equipment acquisition. Determining which of these are required is key to project success, since planning for acquisition influences all project activities and has a particular impact on the resultant project schedule. MRP spans the organizational groups of owners, engineers, constructors, fabricators, and suppliers.

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Project Acquisition Strategy

The project acquisition strategy (PAS) articulates the project's approach to sourcing the necessary materials, equipment, and subcontracts. It should identify the process for selecting the right suppliers for the project and the types of commercial arrangements to be undertaken with these suppliers. A successful PAS requires that sourcing managers have the following kinds of knowledge: their own organization's procedures, limitations, and strategies; project objectives and business drivers; the commodities they are sourcing; and the suppliers' market.

Purchasing

The purchasing function has the responsibility for procuring **goods** (i.e., the materials and equipment) for the project in alignment with specifications and in compliance with the project schedule and budget. It typically includes the following: identifying and qualifying suppliers; issuing requests for quotations; evaluating bids and awarding the contract; and executing and managing purchase orders. The purchasing group will often play two roles: 1) strategic, whereby it performs comprehensive market surveillance, manages supplier utilization, and develops relationships with key supplier organizations—all of which are necessary to compete in the marketplace today; and 2) tactical, whereby it has responsibility for procuring the project's materials and equipment.

Subcontracting

Subcontracting has the responsibility for procuring **services** (i.e., contracts and subcontracts) for the project in alignment with specifications and in compliance with the project's schedule and budget. It typically includes identifying and qualifying subcontracts, issuing requests for proposal, proposal evaluation negotiation and award, and executing and administering contracts.

Expediting

Expediting has the responsibility for on-time delivery from suppliers, consistent with the terms of the purchase order or contract. It typically includes delivery of the following goods: engineering and data deliverables; materials and equipment; and spares and consumables. Expediting must be a planned, orderly, and systematic process that achieves the following: information is secured and distributed on a timely basis; detailed elements of supplier and contractor performance are planned and reviewed regularly; problems are avoided or detected proactively; deficiencies are corrected; and compliance is secured. Upon arrival on site, deliveries must be checked to ensure completeness of dispatch and to detect potential damage occurring during shipment.

Supplier Quality Management

Supplier quality management (SQM) is the system of processes and procedures used by the project organization to ensure that the quality of procured materials and equipment actually meets the project's requirements. In today's environment, many organizations see poor SQM as one of the greatest risks to successfully delivering their project portfolios. When quality is poor and has to be put right after the fact, a project will suffer delays in schedule that directly affect profitability, reputation, prospects for repeat business, customer relationships, operational and maintenance costs, and, most importantly, public and plant safety. A modern project team should consider the risks of poor quality and establish cost-effective strategies to both mitigate and manage quality risk.

Transportation and Logistics

Transportation and logistics is the planning, controlling, and executing of materials delivery to the project jobsite. These activities must be coordinated with engineering, procurement, and construction schedule requirements, and they must be considered during budget planning. While transportation costs often make up a substantial percentage of the cost of materials, the financial impact of schedule delays can be much greater. A properly developed and executed transportation and logistics plan will substantially increase the likelihood of providing the materials a project construction team needs in a timely manner.

Site Materials Management

Site materials management is an extension onto the construction site of the material management processes, procedures, and systems that were initiated in the earliest stages of a project. It includes receiving, inspecting, warehousing, and controlling the release of the incoming materials. The purpose of such management programs is to ensure that the right quantities of the right materials and equipment are provided at the right time to the project's construction forces in a cost-effective manner. With proper planning and true system integration, material shortages can be identified well in advance; this early notice ensures that required materials are acquired in sufficient time to support the needs of construction forces and surplus inventory is kept to a minimum.

Materials Management for Operations and Maintenance (O&M)

Materials management for operations and maintenance of the project equipment begins with project scope selection. Long-term O&M responsibility for the equipment normally lies with the owner after acceptance from the contractor. However, depending on the project, some or all of the equipment may remain under a contractor's operation for a period of time prior to handover to the owner or the owner's agent. In either case, it is important that the necessary equipment spares and capable labor be in place following start-up to ensure that the equipment is available and is being serviced per the original equipment manufacturer guidelines. O&M materials management requirements typically include the following: materials (spares); labor and warehousing necessary for project commissioning; start-up; early operation of the equipment; and provisions for integrated facilities management transitions.

Other Materials Management Observations

- Early project planning should incorporate global market studies that not only identify the least expensive sources of equipment and materials of verifiable quality, but also consider the costs and complexity of global logistics in more detail than has been customary in the early planning stages.
- Project planning should include the emerging topic of sustainability, and contractors should develop their ability to contribute to owners' requirements in this area.
- The refinement and standardization of interfacing among IT systems offers great potential for improvement. Materials managers should influence IT systems selection and their integration during front end planning. Training programs should be better integrated into project schedules so that the use of materials management IT systems continuously improves.
- Managers should proactively address quality issues in global sourcing by planning to import from qualified suppliers or by developing the local supply base to achieve desired quality standards before the start of the project.

Benefits

Tangible benefits can be derived from implementing a properly structured materials management program that is used by the crafts to plan work around labor availability. See Table 3.01-1.

Table 3.01-1. Benefits of Materials Management
(Ref.: IR 7-3, *Procurement and Materials Management: A Guide to Effective Project Execution*, pp. 1–6)

	Average % Improvement
Reduced bulk supplies	40
Improved supplier performance	24
Cash flow savings	23
Reduced site storage and handling	21
Improved craft labor productivity	16
Improved project schedule	16
Reduced management personnel	15
Reduced risk	5

Section 2: Implementation Assessment

Best Practice: **3.01 Materials Management**
Knowledge Area: **3.0 Procurement and Materials Management**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Project execution plan addresses materials management plan.	IR 7-3, IR 257-2, IR 257-3		
2.0 Project team has written materials management plan.	IR 7-3, IR 257-2, IR 257-3		
3.0 All project stakeholders (i.e., QC, engineering, owner, and construction) have identified their needs and are part of plan development.	IR 7-3, IR 257-2, IR 257-3		
4.0 The project has a computer-based materials management system.	IR 7-3, IR 257-2, IR 257-3		
5.0 Materials management system is integrated with CAD, scheduling, accounting systems.	IR 7-3, IR 257-2, IR 257-3		
6.0 Materials management plan identifies and outlines responsibility for functions as follows: material takeoff, procurement, supplier evaluation, warehousing, field control, surplus, expediting, and QA/QC.	IR 7-3, IR 257-2, IR 257-3		
7.0 Materials management system has the following capabilities: generates purchase orders from material requisitions; interacts with expediting status information; tracks supplier performance; links to schedule to show availability of materials; reports back order material status; reports field-issued material by craft; provides a surplus report; tracks bulk material, engineered material, and tagged items; uses bar coding for tool control, materials control, and estimating.	IR 7-3, IR 257-2, IR 257-3		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (7 x 3 = 21)		**21**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Section 3: CII Publication References

Best Practice: 3.01 Materials Management
Knowledge Area: 3.0 Procurement and Materials Management

Implementation Resources

IR 257-3	*Materials Management Planning Guide*
IR 257-2	*Global Procurement and Materials Management: An eGuide to Effective Project Execution*
IR 7-3	*Procurement and Materials Management: A Guide to Effective Project Execution*

Education Modules

EM 7-21	*Tools for Effective Materials Management*, Instructor's Guide
EM 7-21A	*Tools for Effective Materials Management*, Participant Handbook

Research Summaries

RS 257-1	*Global Procurement and Materials Management*
RS 7-2	*Project Materials Management Primer*
RS 7-1	*Costs and Benefits of Materials Management Systems*

Research Reports

RR 257-11	*Global Procurement and Materials Management*

5.01 Planning for Start-up

Section 1: CII Best Practice Summary Sheet

Best Practice: **5.01 Planning for Start-up**
Knowledge Area: **5.0 Facility Start-up and Operations**

Definition

Start-up is the transitional phase between plant construction completion and commercial operations, including all of the activities that bridge these two phases. Critical steps within the start-up phase include systems turnover, check-out of systems, commissioning of systems, introduction of raw materials, and performance testing.

Elements

Mechanical completion is not the project objective; rather, successful commercial operation defines a successful project. Successful commercial operation requires a successful start-up. The message is as follows:

- Research indicates a reasonably strong correlation between start-up success and the extent of planning conducted prior to start-up.
- Effective start-up planning requires that the right issues be addressed by the right people at the right times.
- CII developed its Start-up Planning Model to help its members plan a more thorough, effective, and efficient start-up.
    1. This model is a sequence of planning activities organized according to typical project phases.
    2. The planning activities are complemented by tools that facilitate the implementation of the particular start-up planning activity. (See Table 5.01-1.)

Table 5.01-1. Start-up Planning Model Phases, Activities, and Tools

Project Phase	Number of Start-up Planning Activities	Number of Tools Available
1. Requirements Definition and Technology Transfer	1	2
2. Conceptual Development and Feasibility	3	3
3. Front End Engineering	10	12
4. Detailed Design	15	8
5. Procurement	3	0
6. Construction	7	0
7. Checkout & Commissioning	3	1
8. Initial Operations	3	0

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3. Each planning activity has a detailed, one-page activity profile with the following information:
   A. Project Phase
   B. Key Concepts
   C. Deliverables
   D. Motive/Rationale
   E. Responsibility/Accountability/Consult/Inform Assignments
   F. Quality Gate/Sequencing Constraints
   G. Basic Steps
   H. Tools Needed/Provided
   I. Challenges to Successful Implementation

4. Of the planning activities, eight activities are designated as "quality gates." (See Table 5.01-2.)

Table 5.01-2. Start-up Planning Quality Gates
(Ref.: RS 121-1, *Planning for Start-up: Overview of Research*, p. 10)

Project Phase	Quality Gate
Definition and Technology Transfer	Recognize the impact of start-up on project economics
Conceptual Development and Feasibility	Update the Start-up Execution Plan
Front End Engineering Detailed Design Procurement	Finalize the Operations & Maintenance organization and management systems
Construction	Check-out systems
Check-out and Commissioning	Commission systems
Initial Operations	Finalize documentation

5. Two tools enable substantial improvement in the quality of start-up planning and are included in the best practice (Ref.: IR 121-2, *Planning for Start-up*):
   – SuPER tool (Tool 1-A-2) for evaluating the degree of start-up planning.
   – Start-up Execution Plan (Tool 3-B-2), a mechanism for integrating all start-up planning developments.

Benefits

- Provides a model for developing a detailed start-up plan for all aspects of start-up including system turnover, checkout of systems, commissioning of systems, introduction of raw materials, and performance testing.
  a. Presents an opportunity for business unit, plant operations, and owner project management to agree and commit to start-up objectives, plan, and duration.
  b. Identifies and involves start-up manager, plant operations, and maintenance personnel in front end engineering and detailed design phases, allowing for their input before design is fixed.

c. Increased focus on cost elements of start-up, estimate accuracy, and meeting commercial operations date.

d. Improved communications and information exchange between stakeholders.

e. Timely and thorough identification of problems and issues during the planning phase rather than during the start-up activities.

- The *CII Value of Best Practices* study shows that an average high use of planning for start-up shows better cost and schedule performance for owners, and better cost performance for contractors.

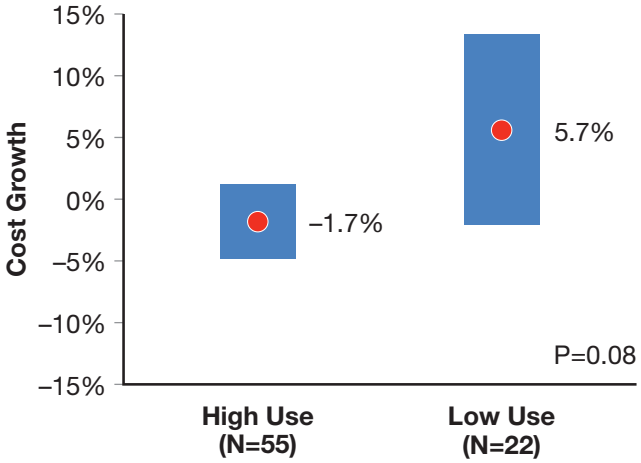

Figure 5.01-1. Impact of Planning for Start-up on Cost Growth–Owners
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 31)

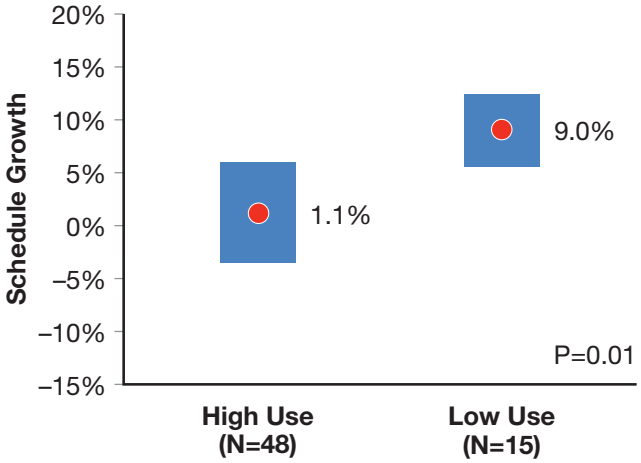

Figure 5.01-2. Impact of Planning for Start-up on Schedule Growth–Owners
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 33)

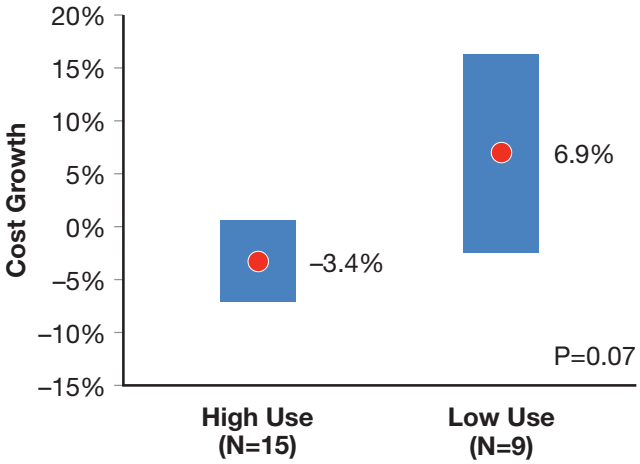

Figure 5.01-3. Impact of Planning for Start-up on Cost Growth–Contractors
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 35)

Planning for Start-up Model

The Planning for Start-up Model is a sequence of planning activities organized according to eight typical project phases, as shown in Section 2: Implementation Assessment.

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Section 2: Implementation Assessment

Best Practice: **5.01 Planning for Start-up**
Knowledge Area: **5.0 Facility Start-up and Operations**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Conceptual Development and Feasibility elements addressed. • Realistic forecast of start-up duration developed. • Start-up costs estimated. • Impact of start-up on project economics recognized.	IR 121-2		
2.0 Front End Engineering plan incorporates start-up criteria. • Start-up objectives established. • Start-up execution plan developed. • Start-up team assignments made. • Start-up systems identified. • Operations and maintenance (O&M) input obtained. • Start-up risks assessed. • Start-up incentives analyzed. • Start-up procurement requirements identified. • Start-up budget and schedules refined. • Start-up execution plan updated.	IR 121-2		
3.0 Detailed Design phase includes start-up criteria. • Address start-up issues in team-building sessions. • Assess and communicate start-up effects from changes. • Plan for supplier field support of start-up. • Include start-up in the project CPM schedule. • Plan for start-up QA/QC. • Refine the start-up team organization plan and responsibility assignments. • Acquire additional O&M input. • Indicate start-up system numbers on engineering deliverables. • Refine start-up risk assessment. • Plan O&M training. • Develop start-up spare parts plan. • Develop system turnover plan. • Develop and communicate start-up procedures and process safety management. • Refine start-up budget and schedule. • Update the start-up execution plan.	IR 121-2		

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
4.0 Procurement includes start-up requirements in contracting and purchasing program. • Engage quality suppliers for start-up services. • Refine the start-up spare parts plan and expedite. • Implement the procurement QA/QC plan.	IR 121-2		
5.0 Construction includes and interfaces with start-up team. • Update the start-up execution plan and release for construction. • Conduct construction/start-up team building. • Refine the start-up integrated CPM schedule. • Conduct operator/maintenance training. • Implement the field QA/QC plan. • Finalize the start-up risk assessment. • Transition to start-up systems-based execution.	IR 121-2		
6.0 Checkout and commissioning plan developed and implemented. • Finalize the O&M organization and management systems. • Checkout systems. • Commission systems.	IR 121-2		
7.0 Start-up team participates in performance testing, initial operations, and project completion. • Introduce feedstocks. • Conduct performance testing. • Finalize documentation.	IR 121-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (7 x 3 = 21)		**21**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 5.01 Planning for Start-up
Knowledge Area: 5.0 Facility Start-up and Operations

Implementation Resource

IR 121-2 *Planning for Start-up*

Education Modules

EM 121-21 *Planning for Start-up*, Instructor's Guide
EM 121-21A *Planning for Start-up*, Participant Handbook

Online Education Courses

TAL 121-31 *Introduction to Planning for Start-up: Early Phases*
TAL 121-32 *Planning for Start-up: Final Project Phases*

Research Summary

RS 121-1 *Planning for Start-up: Overview of Research*

Research Report

RR 121-11 *Planning for Start-up: Analysis of the Planning Model and Other Success Drivers*

Web Seminar

WS 121-01 *Planning for Start-up*

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7.01 Team Building

Section 1: CII Best Practice Summary Sheet

Best Practice: **7.01 Team Building**
Knowledge Area: **7.0 Project Organization and Management**

Definition

Team building is a project-focused process that builds and develops shared goals, interdependence, trust and commitment, and accountability among team members. It also seeks to improve team members' problem-solving skills.

Elements

Alignment, teamwork, and team building appear to be variations of the same concept but are, in fact, three distinct concepts with different but complementary definitions. All three are critical to the success of a project. To effectively utilize the team building concept, implementers must have a clear understanding of the three concepts and how they complement each other.

Alignment addresses the concern of whether all team members are working toward the same, correct goal. Teamwork involves team members' effective interaction, cooperation, and mutual support while working together. Team building is the process used to develop and enhance teamwork.

Elements of the team building process include the following:

- trust
- a set of shared goals for the project
- an interdependent relationship among team members.

Team members must possess and demonstrate the following:

- a shared commitment to work together
- a shared sense of team's accountability
- a clearly defined individual accountability
- pride in being a member of the team
- open communication and feedback
- effective conflict management
- increased sense of work satisfaction.

For a project team to operate effectively, it must first be aligned in the areas of culture, execution, information, and tools. The alignment process is addressed in the CII Best Practice 1.02 Alignment, and must be carried out during the front end planning (FEP) and development phases of the project. (See Figure 7.01-1.) If this process is conducted properly, the project team will have laid the groundwork to implement the team building process.

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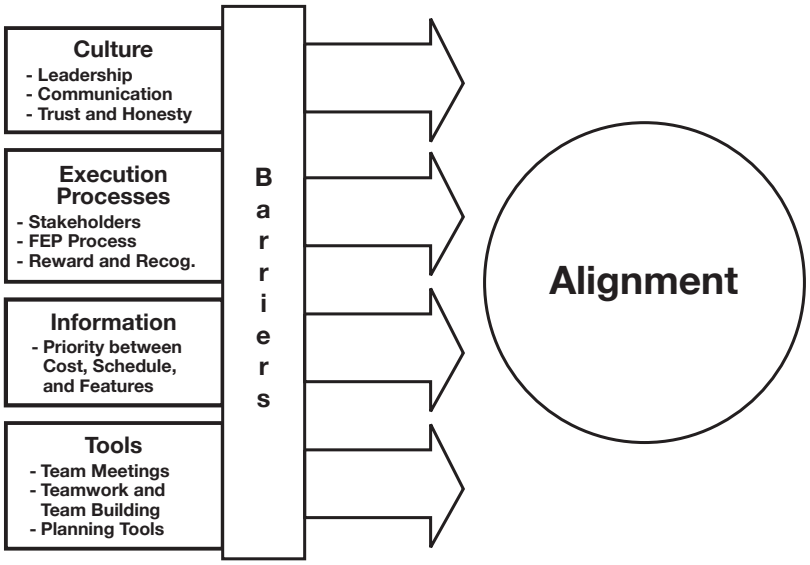

Figure 7.01-1. Alignment Key Issues Diagram
(Ref.: 113-3, *Alignment During Pre-Project Planning — A Key to Project Success*, p. 35)

In addition to the alignment process, assessing the effectiveness of communications on the project can also be beneficial. The communication assessment process consists of five steps: 1) developing a communication assessment questionnaire; 2) comparing the results to a reference database; 3) developing an improvement strategy; 4) implementing the improvement strategy; and 5) reassessing the results at regular interval. (See Figure 7.01-2.)

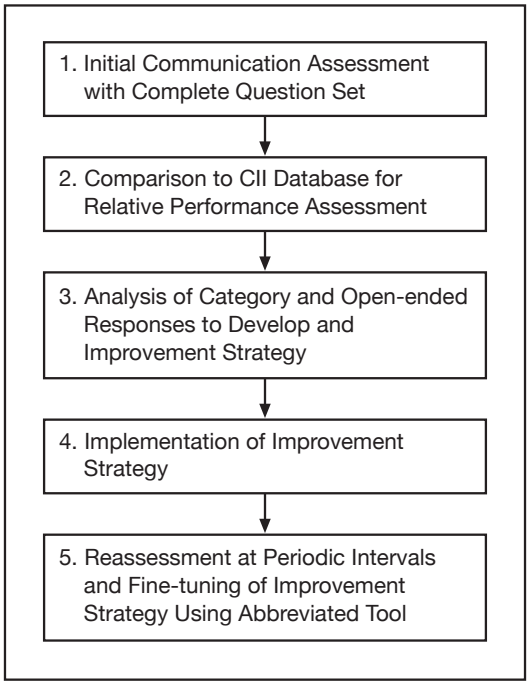

Figure 7.01-2. Communications Improvement Process
(Source: RS 105-1, *Compass: An Assessment Tool for Improving Project Team Communications*, Version 2.1)

Benefits

- Since the team building process is directed at specific projects, it is usually viewed as having a short-term focus. But the skills learned remain with the participants long after the completion of the project.
- Team building can be used to overcome the most common causes of poor relations between the owner, designer, and contractor, which include the following:
  - lack of a common project mission
  - adversarial conditions fostered by a lack of trust
  - perceived ethical violations
  - contingency positioning for litigation
  - absence of a team spirit.
- Team building fosters teamwork and enhances project performance.
- Utilizing team building will *improve an organization's processes* by enabling the following:
  - early identification of problems
  - development of internal and external relationships
  - reduction of adversarial relationships
  - development of trust and team spirit
  - the practice of open communication
  - improvement of cooperation, cohesiveness, and problem-solving skills
  - improvement of the quality of all phases of the project.
- Utilizing team building will *improve project performance* by enabling the following:
  - alignment of goals and expectations
  - reduction of project duration
  - lowered costs
  - improvement of safety performance
  - reduction and management of changes.

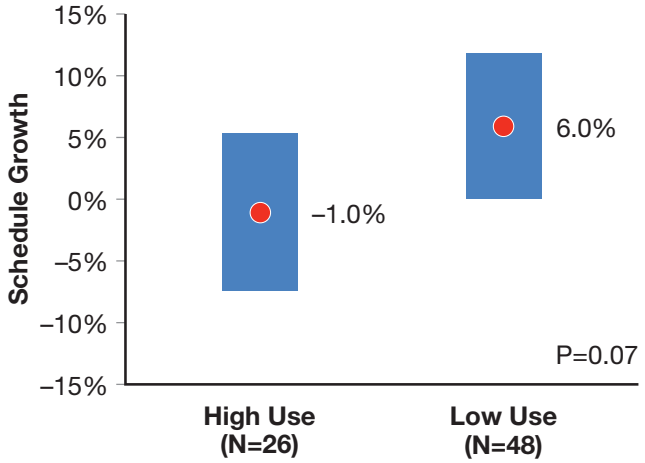

Figure 7.01-3. Impact of Team Building on Schedule Growth–Owner
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 32)

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Section 2: Implementation Assessment

Best Practice: 7.01 Team Building
Knowledge Area: 7.0 Project Organization and Management

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Team Building Principles			
1.1 Project management determined that team building techniques should be used on projects.	SD-87		
1.2 Team building "champion" assigned to or contracted for project.	SD-87		
1.3 Project management scheduled an initial communications assessment early in the project schedule.	IR 105-2		
1.4 Questionnaires selected/developed, and survey groups determined.	IR 105-2		
1.5 Communications improvement strategy developed.	IR 105-2		
2.0 Overcoming Potential Obstacles to Team Building			
2.1 Organization's top management demonstrated support for team building process.	SD-87		
2.2 Project management members familiarized with "team building process."	SD-87		
2.3 Written plan for training became a part of the team building process.	SD-87		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (8 x 3 = 24)		**24**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 7.01 Team Building
Knowledge Area: 7.0 Project Organization and Management

Implementation Resources

IR 113-3 *Alignment During Pre-Project Planning — A Key to Project Success*
IR 105-2 *Compass: Communications Project Assessment Tool*, Version 2.1

Education Modules

EM37-21 *Building the Project Team*, Instructor's Guide
EM37-21A *Building the Project Team*, Participant Handbook

Research Summaries

RS 105-1 *Compass: An Assessment Tool for Improving Project Team Communications*
RS 37-1 *Team Building: Improving Project Performance*

Research Reports

RR 105-11 *An Assessment Tool for Improving Team Communications*
SD-87 *Team Building: Implications for the Design/Construction Process*

Video

VC-605 *Maya Project — Success through Team Building*

7.02 Partnering

Section 1: CII Best Practice Summary Sheet

Best Practice: **7.02 Partnering**
Knowledge Area: **7.0 Project Organization and Management**

Definition

Partnering may involve a long-term commitment between two or more organizations, as in an alliance, or it may apply to a shorter period of time, such as the duration of a project. The purpose of partnering is to achieve specific business objectives by maximizing the effectiveness of each participant's resources. This requires changing traditional relationships to ones that exist within a shared culture without regard to organizational boundaries. These relationships are based on trust, dedication to common goals, and mutual understanding of individual expectations and values.

Elements

CII research states that nearly all successful partnering relationships have three key attributes in common:

1. Leadership that, through faith in the process, continues to support partnering ideals in the midst of doubt and questioning.
2. A situation where those involved adapt and accept each other's manner of business, with rewards that are tied to team accomplishments.
3. A belief in the potential for win/win outcomes to grow from collaboration, and a willingness to pursue such joint gains.

These attributes provide a framework for fostering a change in attitude from adversarial to cooperative, self-centered to team-focused, and from win/lose to win/win.

Implementation and management of the partnering process is a five-phase process that incorporates executive, management, and craft-level participants. (See Figure 7.02-1.)

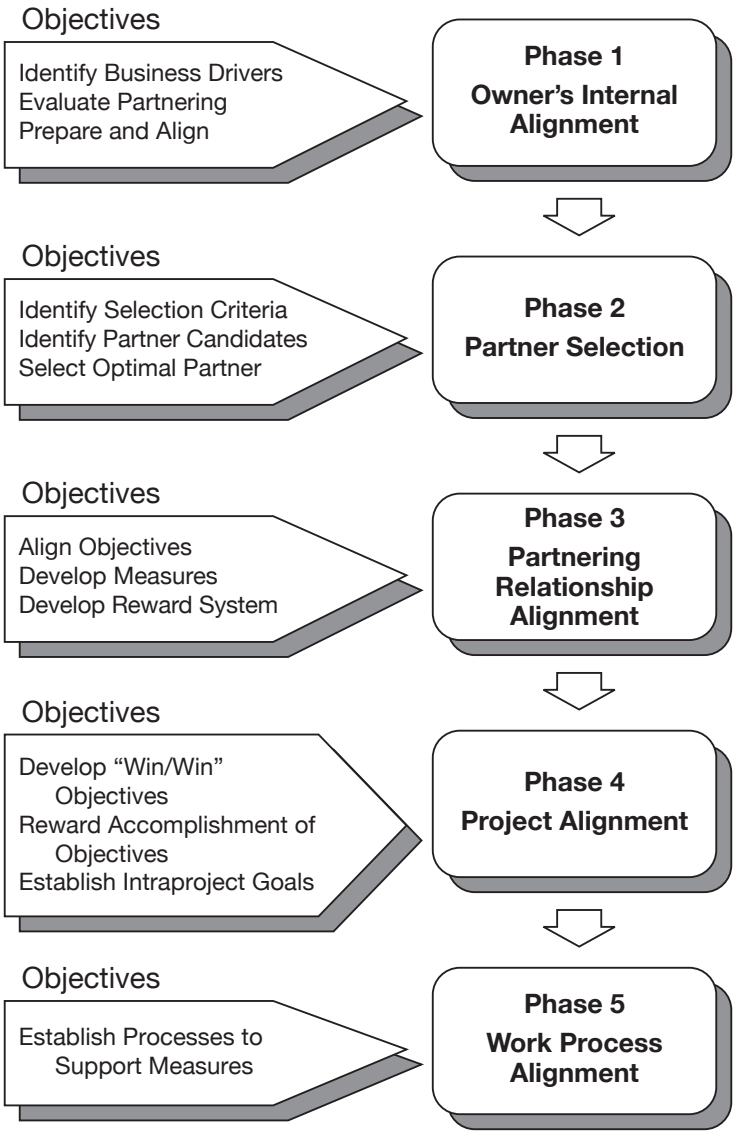

Figure 7.02-1. Phases of Partnering Process Model

After the partnering relationship is in place, the following guidelines will contribute to successful completion of the project:

- The relationship must be firmly established and not be in a state of constant reassessment.
- Partners must have a real commitment to the partnership and to each other's business objectives, since the project's success applies to all parties.
- Continuous, routine feedback is needed in all directions, along with a clear focus on continuous improvement.
- All parties must accept appropriate levels of risk, commensurate with their rewards and with the unique elements of their partnering relationship.

- There must be advantages and opportunities to the partnering process; all parties must realize more potential for success than is available in other relationships.
- The partnering relationship must be systemic in nature and cannot depend solely on individuals.
- All parties must seek new ways to lower costs and differentiate themselves to gain competitive advantage for the partnership.

Benefits

- Efficiency improvements will be realized from working together.
- Cost effectiveness for each organization may result from more effective utilization of resources.
- Increased opportunity for innovation exists in a partnering relationship.
- Partnering promotes continuous improvement of quality products and services.
- Improved profits (value) for all parties may be realized. (See Table 7.02-1.)

Table 7.02-1. Best in Class Results: Partnering vs. Traditional Construction
(Ref.: RS 102-1, *Model for Partnering Excellence*, Table 1, p. 4)

Category	Result Area	Results
Cost	Total project cost (TPC) Construction administration Marketing Engineering Value engineering Claims (% of TPC) Profitability	10% reduction 24% reduction 50% reduction $10/hour reduction 337% increase 87% reduction 25% increase
Schedule	Overall project Schedule changes Schedule compliance	20% reduction 48% reduction Increased from 85% to 100%
Safety	Hours without lost time accidents Lost work days Number of doctor cases Safety rating	3 million vs. 48,000 industry standard 4 vs. 6.8 industry standard 74% reduction 5% of national average
Quality	Rework Change orders Direct work rate	50% reduction 80% reduction 42% increase
Claims	Number of claims Projects with claims	83% reduction 68% reduction
Other	Job satisfaction	30% improvement

Partnering significantly improves project performance.

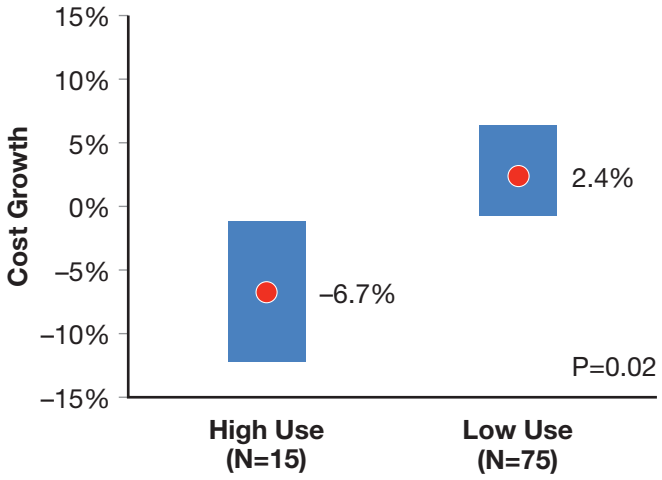

Figure 7.02-2. Impact of Partnering on Cost Growth–Owner
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 30)

Section 2: Implementation Assessment

Best Practice: 7.02 Partnering
Knowledge Area: 7.0 Project Organization and Management

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Owner's Internal Alignment			
1.1 We use partnering on most projects as a matter of routine.	IR 102-2		
1.2 Our organization uses partnering champions.	IR 102-2		
1.3 Our organization conducts initial partnering workshops.	IR 102-2		
1.4 Identified key business drivers and developed strategic plan.	IR 102-2		
1.5 Evaluated partnering process both within and external to organization.	IR 102-2		
1.6 Conducted internal assessment and alignment.	IR 102-2		
1.7 Utilized alliance tools.	IR 102-2		
1.8 Utilized common tools.	IR 102-2		
2.0 Partner Selection			
2.1 Developed a selection team.	IR 102-2		
2.2 Defined roles and responsibilities.	IR 102-2		
2.3 Developed selection criteria.	IR 102-2		
2.4 Completed a checklist of key elements.	IR 102-2		
2.5 Completed applicable partner selection tools.	IR 102-2		
3.0 Partnership Alignment			
3.1 Taken steps to develop trusting relationship.	IR 102-2		
3.2 Developed aligned relationship objectives that support each party's strategic objectives.	IR 102-2		
3.3 Developed aligned measures based on objectives, and incentives based on measures.	IR 102-2		
3.4 Created a separate, empowered organization.	IR 102-2		
3.5 Developed a conflict resolution process.	IR 102-2		
3.6 Completed a checklist of key elements for this phase.	IR 102-2		
3.7 Completed applicable partnership alignment tools.	IR 102-2		

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
4.0 Project Alignment			
4.1 Developed project objectives, incentives, and measures.	IR 102-2		
4.2 Developed consistency among key individuals.	IR 102-2		
4.3 Empowered team.	IR 102-2		
4.4 Supplied team with appropriate tools and resources.	IR 102-2		
4.5 Developed and implemented efficient and effective communication methods.	IR 102-2		
4.6 Instituted a dispute resolution process, starting at the lowest level.	IR 102-2		
4.7 Planned social activities to nurture trust and promote teamwork.	IR 102-2		
4.8 Completed checklist of key elements for this phase.	IR 102-2		
4.9 Utilized applicable project alignment tools.	IR 102-2		
5.0 Work Process Alignment			
5.1 Communicated project objectives to entire project team.	IR 102-2		
5.2 Analyzed work processes.	IR 102-2		
5.3 Effectively allocated resources.	IR 102-2		
5.4 Developed and implemented a program for implementing innovative ideas and processes.	IR 102-2		
5.5 Extended empowerment down to the discipline level.	IR 102-2		
5.6 Defined roles and responsibilities.	IR 102-2		
5.7 Completed checklist of key elements.	IR 102-2		
5.8 Completed alliance work process alignment tool.	IR 102-2		
5.9 Completed applicable project-specific work process alignment tools.	IR 102-2		
5.10 Partnering team members feel free to offer suggestions openly.	IR 102-2		

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
6.0 Partnering Measures			
6.1 Determined which results measures will be used on the project, and completed them.	IR 102-2		
6.2 Determined which process measures will be used on the project, and completed them.	IR 102-2		
6.3 Determined which relationship measures will be used on the project, and completed them.	IR 102-2		
6.4 The partnering relationships facilitate/promote innovation	IR 102-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (43 x 3 = 129)		**129**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 7.02 Partnering
Knowledge Area: 7.0 Project Organization and Management

Implementation Resources

IR 102-2 *Partnering ToolKit*

Education Modules

EM 102-21 *Developing, Implementing, and Managing A Partnering Relationship*, Instructor's Guide

EM 102-21A *Developing, Implementing, and Managing A Partnering Relationship*, Participant Handbook

Online Education Courses

TAL 102-31 *Partnering Course 1: Introduction to the Partnership Process*

TAL 102-32 *Partnering Course 2: Owner Internal Alignment and Partner Selection*

TAL 102-33 *Partnering Course 3: Relationship and Process Alignment*

TAL 102-34 *Partnering Course 4: Taking it to the Troops*

Research Summary

RS 102-1 *Model for Partnering Excellence*

Research Report

RR 102-11 *The Partnering Process—Its Benefits, Implementation, and Measurement*

8.01 Quality Management

Section 1: CII Best Practice Summary Sheet

Best Practice: **8.01 Quality Management**
Knowledge Area: **8.0 Business and Project Processes**

Definition

Within the capital facilities delivery industry, a quality management system (QMS) is a set of policies, processes, and procedures that govern the planning and execution of capital projects so that owners' business and project objectives are achieved.

Elements

- ISO 9001 is the starting point for most QM systems.
- Modern QM systems are based on a work processes approach that provides the following:
  - a common understanding across the organization of the activities involved in each step of the process
  - a sequence of activities and their interrelationships
  - responsibilities for their execution
  - recognition and management of process risks.
- QM systems are also closely linked to business excellence systems, such as the following:
  - Malcolm Baldrige
  - Lean Six Sigma
  - Phillip Crosby.
- Key QMS organizational characteristics include the following:
  - Upper management takes responsibility for implementing the QMS, providing consistent, visible leadership.
  - Work practices have specific aims and high levels of accountability across the organization
  - Top management uses the QMS to drive business process improvement and achieve goals and objectives.
  - Benefits of training are recognized in the organization and employees receive training related to their QMS.
  - Metrics, measurement, and analysis techniques are used consistently across the organization.
  - The organization obtains QMS certification, e.g. ISO 9001
  - Suppliers and contractors are required to implement a QMS.

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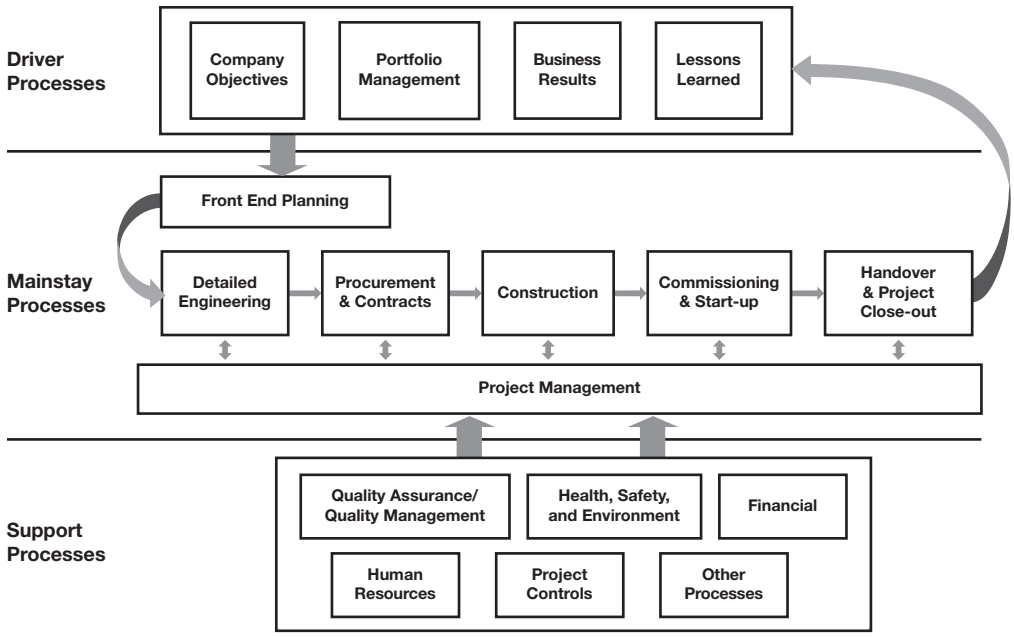

Figure 8.01-1. Capital Facilities Delivery Business Processes
(Ref.: RS 254-1, *Best Practices in Quality Management for the Capital Facilities Delivery Industry*, p. 2)

Benefits

Strategic implications related to pursuing quality management include the following:

- increased customer satisfaction
- ongoing organizational learning
- continuous improvement
- stable work processes the ensure the following:
  - minimal variation
  - productivity improvements
  - failure prevention
  - conformance to requirements.

Section 2: Implementation Assessment

Best Practice: **8.01 Quality Management**
Knowledge Area: **8.0 Business and Project Processes**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Understanding QMS Requirements			
1.1 Identified basis for your organization's QM system (e.g., ISO 9001).	IR 254-2		
1.2 QM system defined in a quality manual.	IR 254-2		
1.3 Quality policies clearly defined and documented.	IR 254-2		
1.4 Quality-related roles and responsibilities documented.	IR 254-2		
1.5 Upper management team understands the QMS basis and requirements.	IR 254-2		
1.6 QMS integrated with business process improvement methods (e.g., Lean Six Sigma, TQM, Malcolm Baldrige).	IR 254-2		
2.0 Processes Governed by the QMS			
2.1 The key processes governed by the QMS have been outlined in a diagram.	IR 254-2		
2.2 Each key process is understood across the organization.	IR 254-2		
2.3 The sequence and responsibility for the execution of the key processes are understood across the organization.	IR 254-2		
3.0 Management Commitment			
3.1 The written quality policy and performance objectives are endorsed by executive management.	IR 254-2		
3.2 The QMS policies and objectives are focused on understanding customer requirements and ensuring their fulfillment.	IR 254-2		
3.3 There is a quality manager/director responsible for assisting top management in implementation of the QMS.	IR 254-2		
4.0 Assessing QMS Compliance			
4.1 Implementation is periodically assessed for compliance with the QMS basis (e.g., ISO 9001).	IR 254-2		
4.2 An internal audit program is in place.	IR 254-2		
4.3 QMS certified by an independent third-party organization.	IR 254-2		

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
5.0 Measuring Effectiveness (Metrics)			
5.1 Performance metrics established that are aligned with the key business processes and performance objectives.	IR 254-2, IR 203-2		
5.2 Data are collected consistently and accurately to record measurement of these metrics.	IR 254-2, IR 203-2		
5.3 Metrics are assembled in reports for analysis against desired outcomes.	IR 254-2, IR 203-2		
5.4 Plan-Do-Check-Act assessment methodology being used as the framework for analyzing QMS processes.	IR 254-2		
6.0 QMS Maturity and Improvement			
6.1 Maturity of the QMS is periodically assessed using CII Best Practice.	IR 254-2		
6.2 CII Quality Management Best Practice is known and understood.	IR 254-2		
6.3 QMS improvement goals and objectives established and agreed upon by executive management.	IR 254-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (22 x 3 = 66)		**66**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 8.01 Quality Management
Knowledge Area: 8.0 Business and Project Processes

Implementation Resources

IR 254-2	*Implementing and Improving Quality Management Systems in the Capital Facilities Delivery Industry*
IR 203-2	*Zero Field Rework Self-Assessment Opportunity Checklist*

Research Summaries

RS 254-1	*Best Practices in Quality Management for the Capital Facilities Delivery Industry*
RS 203-1	*Making Zero Rework A Reality*
RS 153-1	*The Field Rework Index: Early Warning for Field Rework and Cost Growth*

Research Reports

RR 254-11	*Best Practices in Quality Management for the Capital Facilities Delivery Industry*
RR 203-11	*Making Zero Rework A Reality: A Comparison of Zero Accident Methodology to Zero Rework and Quality Management*
RR 153-11	*An Investigation of Field Rework in Industrial Construction*
SD-80	*Project Performance Modeling: A Methodology for Evaluating Project Execution Strategies*

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8.02 Implementation of CII Research

Section 1: CII Best Practice Summary Sheet

Best Practice: **8.02 Implementation of CII Research**
Knowledge Area: **8.0 Business and Project Processes**

Definition

As relates to CII Best Practices, implementation of CII research is the comprehensive and effective use of proven CII products by member organizations, as outlined in the CII Implementation Model. (See Figure 1-5 on page 3.)

Elements

The CII Implementation Model contains nine fundamental recommendations for organizations implementing best practices. The Implementation Model is included in this best practice summary, which details the following elements:

- **A Foundation of CII Products, Support, and Benchmarking & Metrics Data**
  - Use CII products, which include implementation resources, research summaries, and educational materials that you can use to implement process improvements. See the CII Knowledge Structure at http://www.construction-institute.org/know.cfm.
  - Take advantage of CII support, such as staff assistance, the Implementation Champions program, and other resources listed on its implementation web page <http://www.construction-institute.org/impl.cfm> to facilitate implementation within and across CII organizations.
  - Participate in the CII Benchmarking & Metrics Program's project performance and process use metrics to understand improvement opportunities.

- **Organizational Commitment**
  - Make a statement that clearly informs employees what the organization expects relative to implementation of CII products: "Walk the talk."
  - Incorporate implementation of CII products into performance reviews with specific targets: products to be implemented by a specified date.
  - Issue directives to implement specific CII products into existing processes, procedures, and practices within the company.
  - Use the CII Implementation Model as a guide.

- **Organizational Implementation Champion (IC)**

  The IC guides and directs participation in CII, and thus maximizes the organization's membership benefits.

  Essential competencies include the following:
  - Leadership — Identifies greatest organizational need and directs resources to achieve maximum benefits.
  - Communication — Communicates benefits, successes, and opportunities.
  - Knowledge — Enhances awareness of CII Best Practices. Enhances availability of information for application within the organization.
  - Measurement — Makes objective comparison of results with CII Best Practices.

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- **Self-audit**
  - The CII Knowledge Structure organizes CII publications by topic and type at http://www.construction-institute.org/know.cfm.
  - CII Implementation Resource 166-3 (this publication) describes the CII Best Practices and provides a process and set of selected questions for each one. These enable users to determine how applicable the central elements are within the organization.
  - Compare the organization's baseline performance of each practice with performance attained after more complete use of the practice, and the needs or desires of the organization.
- **Implementation Plan and Goals**
  - Based on organizational vision, identifies specific goals for the use of CII Best Practices.
  - Selects strategies and formulates implementation plans.
  - Develops systems to integrate CII Best Practices into the organization.
  - CII Implementation Resource 246-2 outlines the Implementation Planning Model, which guides users in the development of a roadmap for implementing new best practices. The Implementation Assistant, a web-based tool, is available at https://www.construction-institute.org/implement/icstartpage.cfm. This resource supports the user in the development and implementation of new best practices.
- **Product Champions/Review Boards**

  The Product Champion
  - Frequently selected early in the review process to facilitate the understanding of a best practice.
  - Frequently serves as the overall manager of the implementation process for the selected best practice.

  The Review Board
  - Determines which CII Best Practices are applicable to the organization.
  - Recommends specific application of the best practices within the organization's business process for capital development projects.
- **Product(s) Training**
  - Provides knowledge necessary for successful implementation.
  - To be effective, must involve all elements of project team affected by the best practice's being implemented.
  - Many CII resources are available to support training.
  - Goal is to improve project performance. Needs adequate resources to achieve goal.
- **Product(s) Implementation**
  - Select best practices for implementation on the basis of potential for improvement in your organization or project.
  - Identify possible barriers and plan enablers to counter barriers.
  - Provide leadership, communication, resources, and support.

- **Measure Results**
  - Use the same techniques that were used during the self-audit.
  - Measure both utilization of CII Best Practices and impact of use.
  - Participate in surveys conducted by the CII Benchmarking & Metrics Program, and the results will give you a comparison of your efforts with those of other member organizations.
- **Celebrate Success**
  - Communicate implementation benefits, successes, and opportunities.

Benefits

The CII Governance Plan mandates that the CII research program ensures that CII research attains the validity and credibility necessary for acceptance by the engineering and construction industry at large. Implementation of CII Research findings yields the following benefits:

- Improved work processes. CII products establish or augment existing work processes on the basis of research existing and/or validated construction industry methods and criteria.
- Enhanced professional development. CII products expand member employees' personal knowledge and increase their contributions to their respective business organizations.
- Opportunity to improve the business organization's return on investment. Organizations that implement CII products operate with increased efficiency.
- Improved competitive position through increased knowledge base and exposure to industry norms and developing trends. CII research is comprehensive and addresses evolving industry challenges.
- Enhanced communications between owners and contractors through common references and criteria found in CII products.
- Improved project performance in the following areas:
  - cost and schedule performance.
  - safety performance.
  - relative cost and schedule benefits. CII document BMM 2010-4, *CII Value of Best Practices Report*, provides statistical evidence of improvements.

Check http://www.construction-institute.org/scriptcontent/bmm-pubs.cfm for the latest *Benchmarking & Metrics Value of Best Practices* publication.

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Section 2: Implementation Assessment

Best Practice: **8.02 Implementation of CII Research**
Knowledge Area: **8.0 Business and Project Processes**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Implementation efforts based on CII research findings, CII support, and CII Benchmarking data.	IR 166-2, IR 246-2		
2.0 Organizational commitment from senior management secured, and statement to organization issued detailing commitment.	IR 166-2, IR 246-2		
3.0 Internal funding for implementation of CII research findings is at appropriate levels in my organization.	IR 166-2, IR 246-2		
4.0 Implementation champion(s) and publication review boards have been strategically selected and empowered in sufficient numbers on the basis of subject matter experts and/or geographically significant corporate offices.	IR 166-2, IR 246-2		
5.0 There is a formal system or process in place for assessing CII research for potential incorporation into internal processes. For example, the CII Implementation Thermometer has been reviewed, discussed, and completely scored, and/or the IR 166-3 questionnaires for self-audit have been employed.	IR 166-2, IR 246-2		
6.0 The most applicable CII research findings have been selected on the basis of the highest return value for the organization's range of services.	IR 166-2, IR 246-2		
7.0 Plans and goals for implementation of CII research findings have been developed to address internal culture, business model, processes, and organizational structure (e.g., CII IR 246-2, *Implementation Planning Model*, is being used for effective implementation).	IR 166-2, IR 246-2		
8.0 Educational resources have been allocated to support implementation efforts.	IR 166-2, IR 246-2		
9.0 A formal process is in place to measure the results of the CII research findings that are being implemented (e.g., participation in a CII Benchmarking & Metrics process or measurement against established goals).	IR 166-2, IR 246-2		
10.0 Implementation efforts and successes are recognized and rewarded.	IR 166-2, IR 246-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (10 x 3 = 30)		**30**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Section 3: CII Publication References

Best Practice: 8.02 Implementation of CII Research
Knowledge Area: 8.0 Business and Project Processes

Implementation Resources

BMM 2010-4	*CII Value of Best Practices Report* Check <http://www.construction-institute.org/scriptcontent/bmm-pubs.cfm> for the latest version.
IR 246-2	*The Implementation Planning Model: Steps to Success*, Version 1.2
IR 166-3	*CII Best Practices Guide: Improving Project Performance*, Version 3.0
IR 166-2	*Implementation Model + Knowledge Structure Guide*

Research Summaries

RS 246-1a	*The Role of Executive Support in Implementation Champion Success*
RS 246-1	*The Implementation Planning Model: An Overview*
RS 166-1	*Measuring Organizational Implementation Status: Development of the CII Knowledge Implementation Index (CKII)*

Research Reports

RR 246-11	*Implementing CII Practices—The Implementation Planning Model: Steps to Success*
RR 166-11	*Assessment of CII Knowledge Implementation at the Organizational Level*

Web Seminar

WS 246-01	*CII Implementation Assistant*

8.03 Lessons Learned

Section 1: CII Best Practice Summary Sheet

Best Practice: **8.03 Lessons Learned**
Knowledge Area: **8.0 Business and Project Processes**

Definition

A lesson learned is knowledge gained from experience, successful or otherwise, for the purpose of improving future performance. Examples include the following:

- a lesson that is incorporated into a work process
- a tip to enhance future performance
- a solution to a problem or a corrective action
- a lesson that is incorporated into a policy or a guideline
- an adverse situation to avoid.

A lessons learned (LL) program comprises the people, processes, and tools that support an organization's collection, analysis, and implementation of validated lessons learned. The ultimate goal of this program is to add value to the organization by promoting the communication of information.

Elements

- An LL program should be considered part of an overall knowledge management system.
- An effective LL program allows organizations to document project experiences so that the entire organization can learn from one person's experience.
- LL programs can be formal or informal.
  - A formal program is part of a funded, standardized, documented work process that is consistent across an organization and includes written reporting.
  - Informal programs are generally manual or rely on word-of-mouth, anecdotes, and individual efforts to gather data.
- Organizations recognize the inherent value of an LL program; however, no organization has successfully quantified the direct value of its LL program.
- The quality of lessons learned is more important than the quantity of lessons.
- Legal experts agree that LL programs benefit organizations, provided that potential legal liabilities are considered and proper documentation methods are used.

- The LL process includes three key steps: collection, analysis, and implementation (illustrated in Figure 8.03-1):
  - Collection entails gathering data and generating information on the experiences of individuals and teams.
  - Analysis can be performed by a team or by one nominated individual regarded as a subject matter expert.
  - Implementation can take many forms, ranging from publication in a database to changes in practices and procedures.

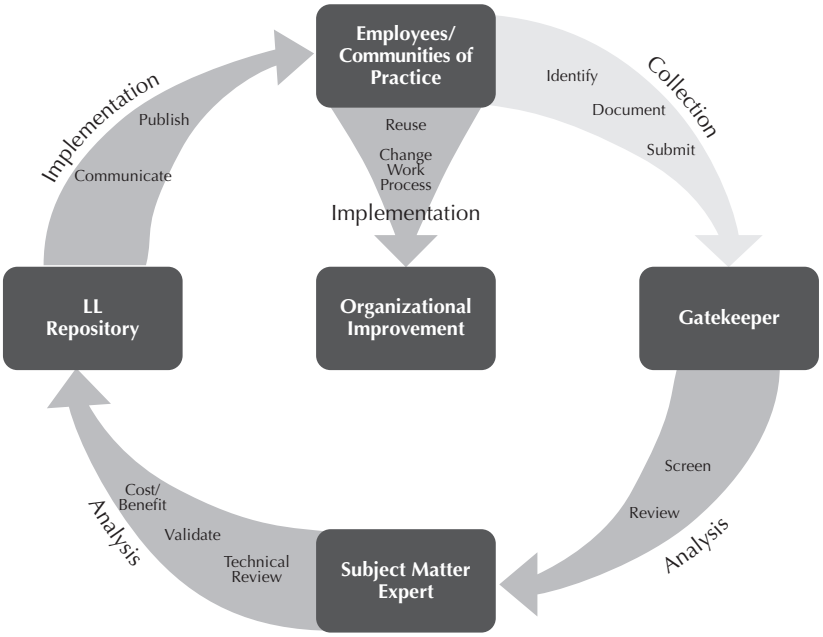

Figure 8.03-1. Lessons Learned Flow Diagram
(Ref.: RS 230-1, *Effective Management Practices and Technologies for Lessons Learned Programs*, p. 7)

Benefits

Organizations in the capital facilities delivery industry cannot afford to make repetitive mistakes on major projects. Conversely, great benefits come from repeating positive project experiences. The need for institutional memory is amplified by the reality that, in the course of normal turnover and retirement, people with years of experience leave their organizations.

An effective LL program is a critical element in the management of institutional knowledge; it will facilitate the continuous improvement of processes and procedures and provide a direct advantage in an increasingly competitive industry.

In 2008, the CII Knowledge Management Committee designated lessons learned a CII Best Practice based on the following benefits:

1. A study of >100 surveys of involving >70 organizations:
   - sixty-two percent of companies reported having somewhat effective lessons learned programs (LLPs)
   - eight percent reported very effective LLPs.
   - twenty percent were neutral.
   - ten percent reported having LLPs that were not effective.

     (Ref.: IR 230-2, *Implementation of Lessons Learned Programs*, Table 20)

2. Quantifiable measures of improvement:
   - Fifteen percent base cost improvements for State Department Embassy Prototypes due to LLP
   - Safety improvements from 50 percent to 300 percent
   - Key performance indicator trends improving due to enhanced LLP.

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Section 2: Implementation Assessment

Best Practice: **8.03 Lessons Learned**
Knowledge Area: **8.0 Business and Project Processes**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Leadership			
1.1 Upper management promotes and supports the lessons learned program (LLP) by providing encouragement and rewards.	IR 230-2		
1.2 Project teams consistently participate in an LLP.	IR 230-2		
1.3 Managers communicate LLP to staff and employees.	IR 230-2		
1.4 Individuals understand their role in the LLP.	IR 230-2		
1.5 Upper management has a shared vision of the LLP that involves the entire organization.	IR 230-2		
2.0 LL Process: Submission/Collection			
2.1 A designated group or individual in the organization administers LL submission/collection.	IR 230-2		
2.2 The organization has a well-defined work process for submitting or collecting LLs.	IR 230-2		
2.3 The work process for submitting/collecting LLs is consistently followed within the organization.	IR 230-2		
2.4 The LL submission/collection process is effective.	IR 230-2		
3.0 LL Process: Analysis			
3.1 Submitted LLs undergo an initial screening before they are analyzed and entered into the system.	IR 230-2		
3.2 Submitted LLs are analyzed before they are shared within the organization.	IR 230-2		
3.3 Qualified personnel analyze LLs.	IR 230-2		
3.4 There is a defined work process for analyzing LLs in the organization.	IR 230-2		
3.5 Members of the organization are aware of the analysis procedure for LLs.	IR 230-2		
3.6 Individuals submitting LLs are given feedback.	IR 230-2		
3.7 The LL analysis process is effective.	IR 230-2		

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
4.0 LL Process: Implementation			
4.1 There is a defined work process for making LLs available within the organization.	IR 230-2		
4.2 There is continuous (24/7) access to LLs in the organization.	IR 230-2		
4.3 Some LLs in the system may be removed/retired after a certain amount of time.	IR 230-2		
4.4 Individuals understand how to retrieve and apply LLs.	IR 230-2		
4.5 There is a defined work process that requires the retrieval and application of LLs.	IR 230-2		
4.6 The LL implementation process is effective.	IR 230-2		
5.0 Resources			
5.1 The IT resources used in the organization enhance the ability of the LLP.	IR 230-2		
5.2 The LLP IT system is integrated with other IT systems.	IR 230-2		
5.3 The LLP has adequate human resources to manage/ administer the process.	IR 230-2		
5.4 Individuals are trained to use the LLP effectively.	IR 230-2		
5.5 Individuals are given the time and resources needed to use and contribute to the LLP.	IR 230-2		
6.0 Maintenance and Improvement			
6.1 Maintenance of the LLP is constant and ongoing.	IR 230-2		
6.2 Feedback from individuals is solicited to improve the LLP.	IR 230-2		
6.3 Metrics are used to evaluate the performance of the LLP.	IR 230-2		
7.0 Culture			
7.1 Individuals participate in the LLP because they understand the value of the system.	IR 230-2		
7.2 Communities of practice encourage their members to use the LLP to avoid/solve project problems or enhance performance.	IR 230-2		
7.3 The lessons learned process is an ingrained part of day-to-day activities for all individuals.	IR 230-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (33 x 3 = 99)		**99**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Section 3: CII Publication References

Best Practice: 8.03 Lessons Learned
Knowledge Area: 8.0 Business and Project Processes

Implementation Resource

IR 230-2 *Implementation of Lessons Learned Programs*

Research Summary

RS 230-1 *Effective Management Practices and Technologies for Lessons Learned Programs*

Research Report

RR 230-11 *An Analysis of Lessons Learned Programs in the Construction Industry*, Second Edition

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8.05 Benchmarking and Metrics

Section 1: CII Best Practice Summary Sheet

Best Practice: **8.05 Benchmarking and Metrics**
Knowledge Area: **8.0 Business and Project Processes**

Definition

Benchmarking is the systematic process of measuring an organization's performance against that of recognized leaders for the purpose of determining best practices that, when adapted and utilized, lead to superior performance.

Elements

The CII Benchmarking & Metrics Program measures project performance and CII Best Practices use for small and large capital projects, and for small maintenance projects. Once entered into the CII online benchmarking system, a project can be immediately compared against industry performance. The essential elements of the Benchmarking & Metrics Program are as follows:

- process-based (structured/systematic)
- CII Best Practice-oriented
- part of a continuous improvement process
- aware of what is important to your organization (critical success factors)
- able to measure, compare, and perform gap analysis against leaders
- able to adapt practices to your organization.

As shown in Figure 8.05-1, benchmarking and metrics is a defined process and method with defined steps and activities:

1. Obtain organizational commitment to benchmarking as a basis for improvement.
2. Identify person responsible for benchmarking coordination – i.e., the Benchmarking Associate.
3. Attend CII Benchmarking Associates Training.
    - Learn the basics of the CII Benchmarking & Metrics Program:
        1. online data entry
        2. metrics and terminology
        3. organization and industry reports.
4. Identify project managers responsible for project benchmarking and improvement.
5. Determine levels of use: How much and what do you want to benchmark?

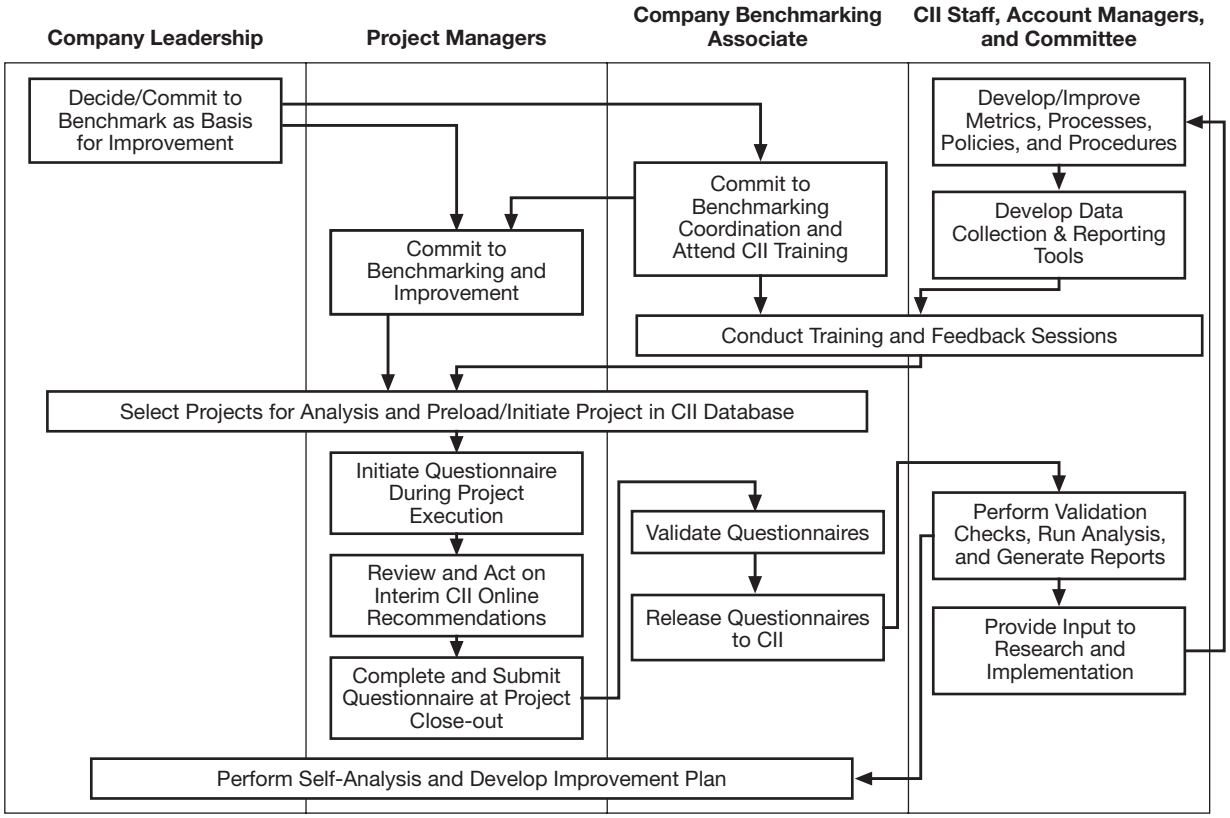

Figure 8.05-1. CII Benchmarking Roadmap (Process)

6. Use the Benchmarking & Metrics Implementation Toolkit to train internally at https://www.construction-institute.org/scriptcontent/toolkit/tool_home.cfm. (See Figure 8.05-2.)
7. Select projects to benchmark.
8. Input project data during project execution:
   - large project questionnaire
   - small project questionnaire.
9. Review and act on interim online CII recommendations.
10. Finalize and submit project questionnaire at close-out.
11. Carry out data validation internally and with CII.
12. Perform self-analysis of performance and practice use, and compare with industry.
13. Develop and implement improvement plan, using CII publications.
14. Repeat steps 5–13 for continuous improvement.

Figure 8.05-2. Benchmarking & Metrics Implementation Toolkit

Check <https://www.construction-institute.org/scriptcontent/toolkit/tool_home.cfm> for latest version.

Benefits

- The benchmarking process promotes a collaborative attitude among competitors—and among owners and contractors—for the greater good of all.
- Benchmarking provides individual project teams with the opportunity to gain 20/20 hindsight without paying the high price of first-hand experience.
- Implementation of benchmarking at the organizational level leads to positive effects on the bottom line.
- The benchmarking process brings to light areas of strength and weakness, allowing project management to focus on improvement where needed without wasting scarce resources.
- Leveraging the analytical results of benchmarking, an organization can come to understand what practices are most effective for greater bottom-line impacts and it can focus on those practices.
- CII Benchmarking & Metrics delivers the following tangible benefits:
  - builds a performance culture
  - highlights strengths and weakness
  - allows focus on improvement where needed without wasting scarce resources
  - prevents mistakes in project implementation
  - organizational level benchmarking yields a positive bottom line
  - provides understanding and focus on the most effective practices for greater bottom-line impacts.

- CII Benchmarking is compelling in the following ways:
  - provides information not available elsewhere
  - provides multiple performance perspectives
  - quantifies value
  - ensures confidential reporting
  - provides source of analysis to drive improvement:
    - integration with other data sources
    - industry-level analysis
    - measurement of best practices.

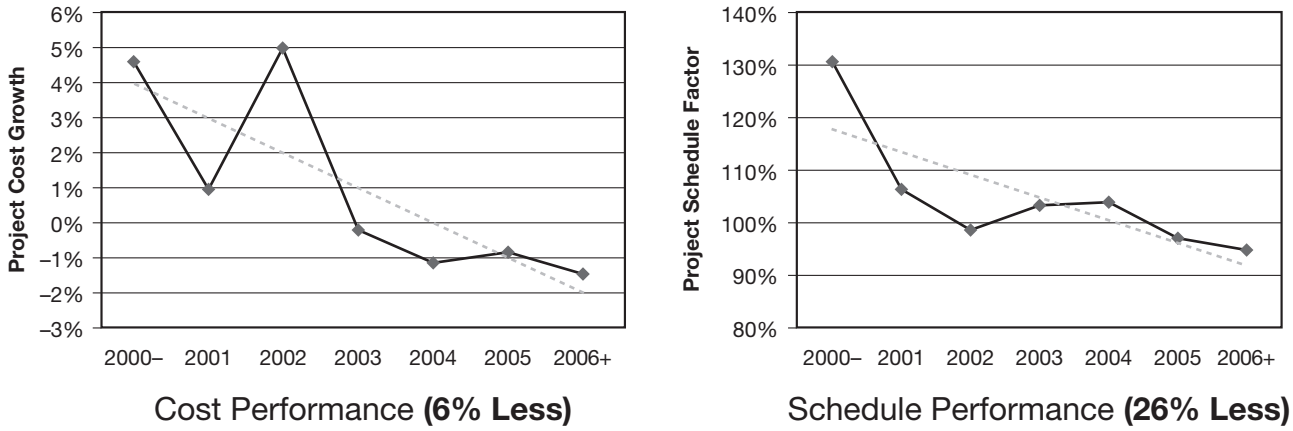

Figure 8.05-3. Proven Results from Benchmarking Efforts – Pharmaceutical and Biotechnology Owners Benchmarking Program (Ref.: BMM 2009-10, *Pharmaceutical and Biotechnology Facility Benchmarking Summary Report, 2005–2009*, Figure 15, p. 23, and Figure 16, p. 25)

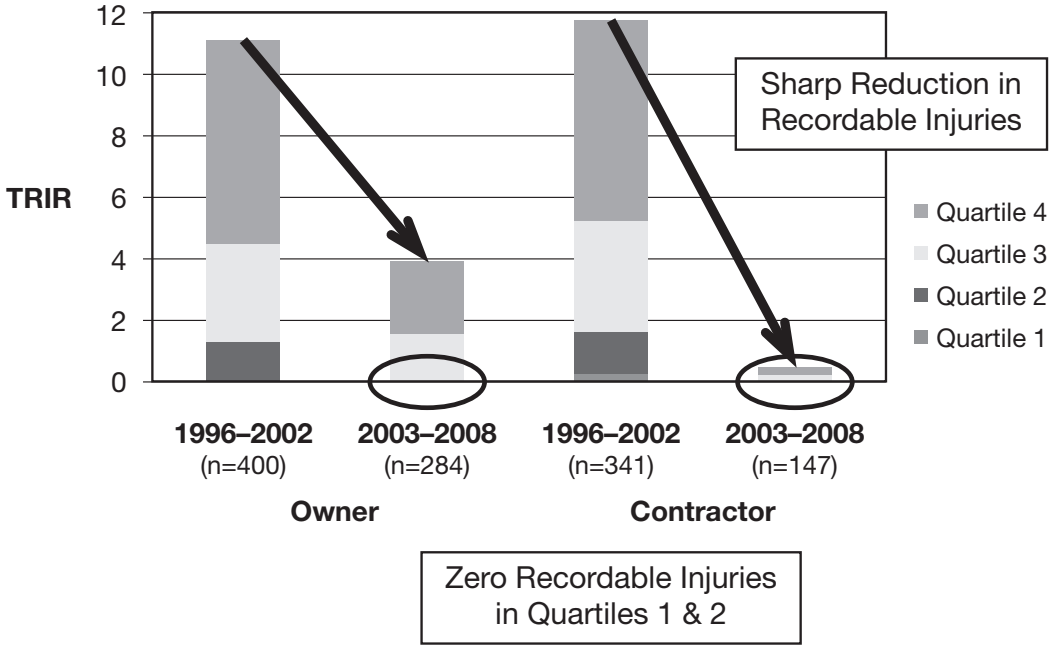

Figure 8.05-4. CII Benchmarking Safety Results (Source: CII Benchmarking & Metrics)

Section 2: Implementation Assessment

Best Practice: **8.05 Benchmarking and Metrics**
Knowledge Area: **8.0 Business and Project Processes**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Senior management of thet organization has committed to benchmarking as a basis for improvement.	IR BMM-2		
2.0 Person selected to be Benchmarking Associate for the organization and to be responsible for benchmarking coordination.	IR BMM-2		
3.0 Attendance at Benchmarking Associates' training, focusing on metrics and terminology, online data entry, and organization- and industry-level reports.	IR BMM-2		
4.0 Project managers identified for benchmarking and improvement.	IR BMM-2		
5.0 Level of use determined on the basis of performance measurements to be utilized.	IR BMM-2		
6.0 Benchmarking Associate utilizes Benchmarking Toolkit for training of project managers.	IR BMM-2		
7.0 Specific projects selected for benchmarking that provide a realistic benchmark of the organization.	IR BMM-2		
8.0 Project benchmarking data input during project execution phases.	IR BMM-2		
9.0 Interim online CII recommendations acted upon to close gap between level of performance and best-in-class performance.	IR BMM-2		
10.0 Project closeout questionnaires finalized and submitted for validation and review by CII.	IR BMM-2		
11.0 Assistance provided to CII Account Manager for validation of projects for placement into the benchmarking database.	IR BMM-2		
12.0 Self-analysis performed to compare performance and CII Best Practice use compared to those of others in the same industry group and cost category.	IR BMM-2		
13.0 Improvement plan developed and implemented using CII publications as basis for improvement.	IR BMM-2		
14.0 Steps 5–13 repeated for continuous improvement to obtain best-in-class performance.	IR BMM-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (14 x 3 = 42)		**42**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Section 3: CII Publication References

Best Practice: 8.05 Benchmarking and Metrics
Knowledge Area: 8.0 Business and Project Processes

Implementation Resources

BMM 2010-4	*CII Value of Best Practices Report*
IR BMM-2	*Benchmarking & Metrics Implementation Toolkit Pocket Guide*
IR BMM-2A	*Benchmarking & Metrics Implementation Toolkit: https://www.construction-institute.org/scriptcontent/toolkit/tool_home.cfm*

Research Summary

BMM 2002-3	*Benchmarking and Metrics Summary Report for 2001*

8.09 Change Management

Section 1: CII Best Practice Summary Sheet

Best Practice: **8.09 Change Management**
Knowledge Area: **8.0 Business and Project Processes**

Definition

Change management is an organization's process of incorporating a balanced change culture of recognizing, planning, and evaluating project changes to effectively manage them. These changes include scope, error, design development, estimate adjustments, schedule adjustment, and changed condition, either elective or required.

Elements

- Establishing a good up-front baseline agreement that allows all team members to recognize and measure change is essential to achieving effective change management. Figure 8.09-1 illustrates effective change management principles.

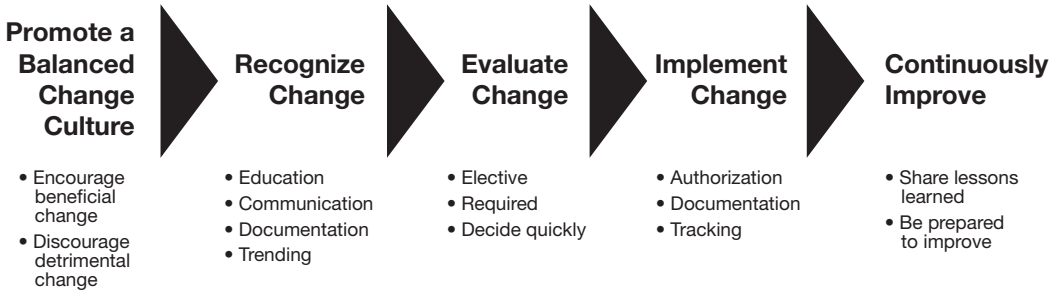

Figure 8.09-1. The Principles of Effective Change Management

- Use a classification process to determine if the change is a required or an elective change.
- For a required change, focus immediately on effective implementation.
- For an elective change, implementation may or may not occur (require financial justification for all changes).
- Generate a measurable outcome that indicates successful achievement of some quality objective; use this metric to enable the appropriate management level to implement or reject the changes in a timely manner.
- Clearly define who is responsible for taking the necessary action, based on the metrics supplied. (See Table 8.09-1 for a list of commonly used change management metrics.)
- Throughout the life of the project, collect, store, and make accessible data that are relevant to making management decisions and measuring changes.
- Use the data collection system to facilitate the timely presentation of analyzed data to the appropriate decision makers.

- Use established benchmarks to monitor project performance.
- Ensure that all team members consistently use the recording or reporting system to document all changes.
- Establish a recognition/reward system for those who initiate beneficial change.
- Establish agreements between the project participants at the different levels of the project.

Table 8.09-1. Common Change Management Metrics Evaluated Against Metric Criteria

	Measurable	Significant	Influenceable	Repeatable	Timely
Amount	x	x		x	
Time Available for Decision	x	x	x	x	x
Type	x	x	x	x	x
Time	x	x		x	x
Nature	x			x	x
Work Packages Affected	x	x	x	x	x
Source	x		x	x	x
Completion Status		x	x	x	
Function/ Craft		x	x		x

SAMPLE

Benefits

Change management offers the following benefits:

- provides archived, periodic, and end-of-project data that aid in the measurement of change impact and in the planning of future projects
- minimizes the number of changes on future projects
- enables anticipation of project changes and corrective actions that have proven to be effective
- increases project safety
- reduces cost and schedule
- improves job quality.
- Enhances team inter-phase relationships.

Change management is one of the most widely used best practices. Implementation of change management can have a significant impact on owner cost performance. Figure 8.09-2 presents a calculation of this impact from the *CII Value of Best Practices* study.

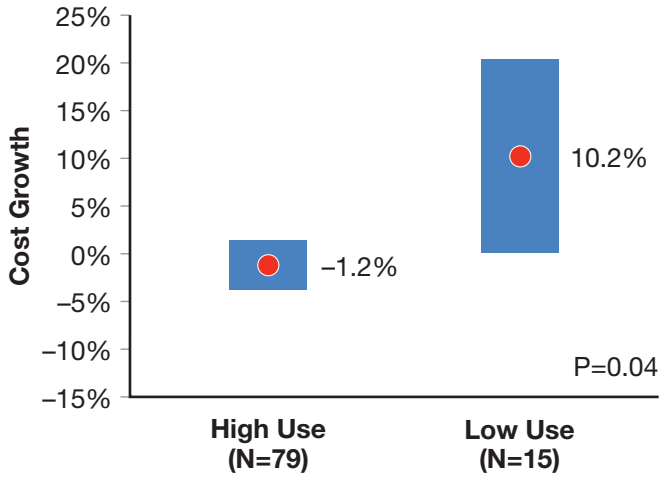

Figure 8.09-2. Impact of Change Management on Cost Growth—Owner
(Ref.: BMM 2010-4, *CII Value of Best Practices Report,* Figure 22, p. 30)

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Section 2: Implementation Assessment

Best Practice: **8.09 Change Management**
Knowledge Area: **8.0 Business and Project Processes**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 The change management process is specified in project contracts.	SP 43-1		
2.0 Principal project participants are familiar with documented change management process and have used it to actively manage project changes.	SP 43-1		
3.0 Baseline project scope established early in project and frozen, with changes managed against this base.	SP 43-1		
4.0 Areas susceptible to change are identified, and evaluated for risk during project design.	SP 43-1		
5.0 Project changes are evaluated against business drivers and success criteria for project.	SP 43-1		
6.0 All changes require formal justification.	SP 43-1		
7.0 All parties agreed to a process for approving change before implementing it.	SP 43-1		
8.0 System is in place to ensure timely communication of change information to proper disciplines and project participants.	SP 43-1		
9.0 Project personnel take proactive measures to promptly settle, authorize, and execute change orders on project.	SP 43-1		
10.0 Project contract addresses criteria for classifying change and the basis for adjusting contract.	SP 43-1		
11.0 Tolerance level for changes is established and communicated to all project participants.	SP 43-1		
12.0 All changes processed through identified owner representative.	SP 43-1		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (12 x 3 = 36)		**36**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Section 3: CII Publication References

Best Practice: 8.09 Change Management
Knowledge Area: 8.0 Business and Project Processes

Implementation Resource

SP 43-1 *Project Change Management*

Education Modules

EM 113-22 *Scope Control and Change Management*, Instructor's Guide
EM 113-22A *Scope Control and Change Management*, Participant Handbook

Online Education Course

TAL 113-32 *Scope Control and Change Management*

Research Summaries

RS 158-1 *Quantifying the Cumulative Impact of Change Orders for Electrical and Mechanical Contractors*
RS 153-1 *The Field Rework Index: Early Warning for Field Rework and Cost Growth*
RS 43-2 *Quantitative Effects of Project Change*
RS 6-10 *Impact of Changes on Construction Cost and Schedule*

Research Reports

RR 158-11 *Quantifying the Cumulative Impact of Change Orders for Electrical and Mechanical Contractors*
SD-108 *Quantitative Impacts of Project Change*
SD-66 *Construction Changes and Change Orders: Their Magnitude and Impact*

10.01 Disputes Prevention & Resolution

Section 1: CII Best Practice Summary Sheet

Best Practice: **10.01 Disputes Prevention & Resolution**
Knowledge Area: **10.0 Risk Management**

Definition

Dispute resolution techniques include the use of a disputes review board as an alternative to litigation. The Dispute Review Board technique provides a process for addressing disputes in their early stages before the dispute affects the progress of the work, creates adversarial positions, and leads to litigation.

Elements

- Provisions for a Dispute Review Board must be in the contract documents. (See Figure 10.01-1 and Table 10.01-1.)
- Provisions for a Dispute Review Board must be in the subcontract contract documents.
- Operation of the Dispute Review Board should be included in the partnering process.
- The Dispute Review Board members need to be selected in the early stages of the project.
- The Dispute Review Board members must be neutral.
- The Dispute Review Board members need to be experienced in the project type.
  - The owner selects one member.
  - The contractor selects one member.
  - The first two members select the team chairman.
  - The Dispute Review Board, the owner, and the contractor will establish operation procedures.
- The owner and the contractor will establish Dispute Review Board limits of authority.
- The owner and the contractor will establish the method of compensation for the Dispute Review Board members.

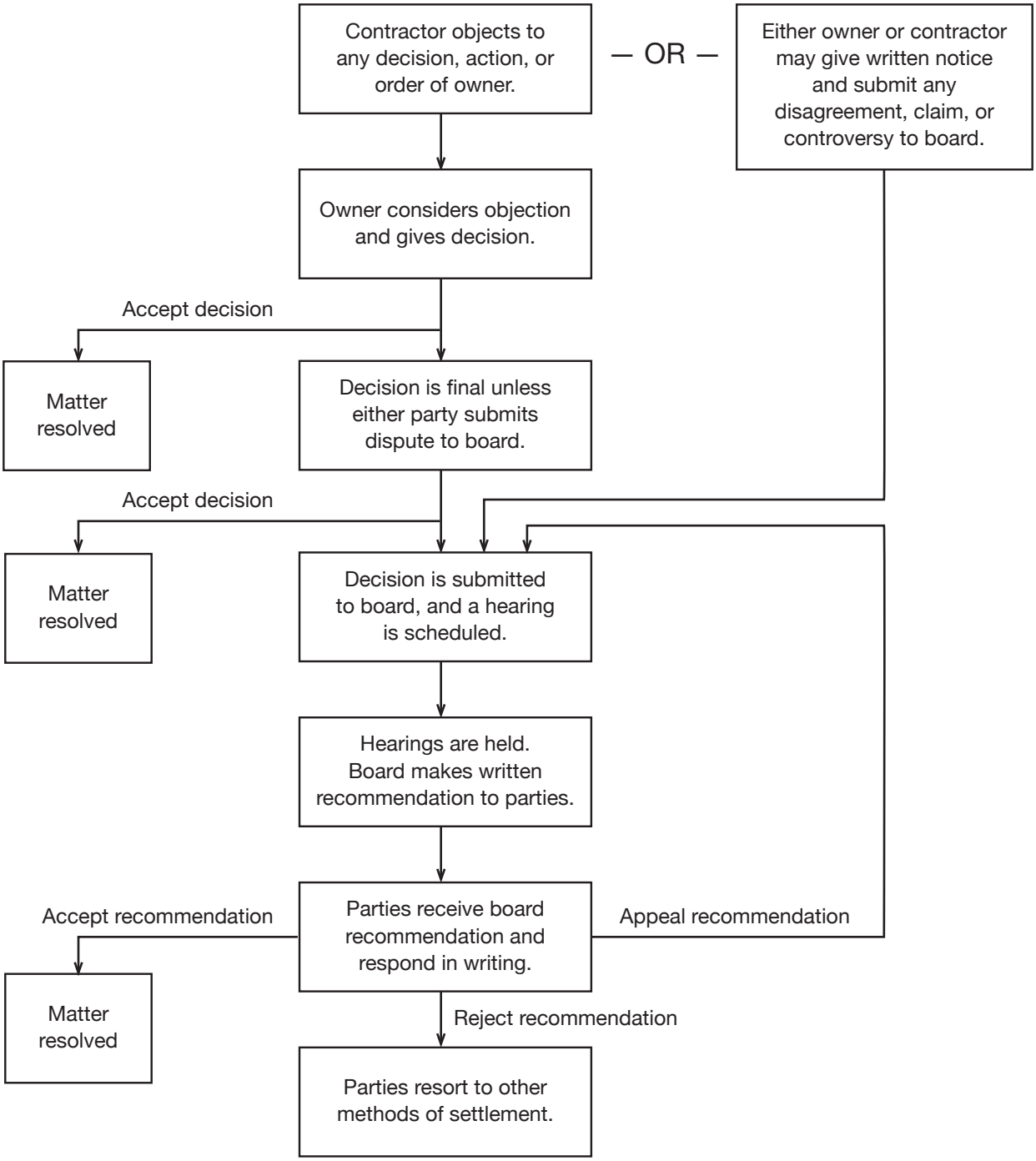


Figure 10.01-1. Dispute Review Board Process Flow Diagram
(Ref.: IR 23-2, *Prevention and Resolution of Disputes Using Disputes Review Boards,* p. 9)

Table 10.01-1. Dispute Review Board Methodology from IR 23-2

Dispute Review Board Methodology

Contract Requirements

1. The intention to establish a board is noted in the instructions to bidders.
2. The provisions for establishing the board are set out in the contract.
3. The provisions for establishing the board do not preclude either owner or contractor from resorting to other methods for the final settlement of disputes.

Member Qualifications

4. Board members are neutral, able to serve owner and contractor equally, and have no conflict of interest.
5. Board members have acknowledged technical expertise in the type of work being undertaken.
6. Board members are respected by the owner and contractor for their impartiality and technical expertise.

Member Selection

7. Owner and contractor each nominate one board member. These two members select the third member to chair the board.
8. All parties agree on the selection and appointment of all board members.

Operating Procedures

9. Board members receive regular, written progress reports and remain informed on the status of the work.
10. Board meetings are held on the job site at regular intervals, not exceeding four months.
11. Presentations to the board are made by field project managers who are completely involved in the process.

Conduct of Hearings

12. Either owner or contractor is able to submit any decision, action, order, claim, or controversy to the board at any time.
13. Both owner and contractor are adequately represented at all hearings; rebuttals and requests for clarification are permitted.
14. Board recommendations are made in writing and are addressed directly to the project participants who are responsible for accepting, appealing, or rejecting recommendations.

Table 10.01-1. Dispute Review Board Methodology from IR 23-2 (continued)

Timing and Sequence of Events

15. Board selection and appointment are made within eight weeks of notice to proceed with contract work.
16. Disputes are submitted to the board as soon as possible, and the board handles issues current at the time of submittal.
17. Written recommendations of the board and the reasoning supporting the recommendations are made available to the project participants within two weeks of a submittal.

Limitations of Authority

18. Board members do not act as consultants and do not give advice on the conduct of the work.
19. The board does not usurp either the owners' or the contractors' authority to direct the work as provided in the contract.

Subsequent Proceedings

20. The recommendations of the board are not binding and may be rejected by either owner or contractor.
21. The written recommendations of the board and the reasoning supporting the recommendations are admissible as evidence in any subsequent dispute resolution procedure.

Cost

22. The cost of the board is borne equally by the owner and the contractor.

Benefits

The benefits of disputes prevention & resolution are the following:

- eliminates adversarial positions
- promotes trust between participants
- helps eliminate disputes
- resolves disputes on the project
- enhances the progress of the work
- may result in repeat business.

Section 2: Implementation Assessment

Best Practice: **10.01 Disputes Prevention & Resolution**
Knowledge Area: **10.0 Risk Management**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Disputes Review Board (DRB) consistently stipulated in contract and subcontract documents.	IR 23-2		
2.0 Partnering principles consistently used on project.	IR 23-2		
3.0 DRB team consistently included in partnering.	IR 23-2		
4.0 DRB team established in early stages of all projects.	IR 23-2		
5.0 Neutral team members on DRB.	IR 23-2		
6.0 DRB team members experienced on this type of project.	IR 23-2		
7.0 DRB team operating procedures established.	IR 23-2		
8.0 Limits to authority of DRB team established.	IR 23-2		
9.0 DRB team compensation established.	IR 23-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (9 x 3 = 27)		**27**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 10.01 Disputes Prevention & Resolution
Knowledge Area: 10.0 Risk Management

Implementation Resources

IR 23-2 *Prevention and Resolution of Disputes Using Disputes Review Boards*

Research Summaries

RS 23-1 *Disputes Prevention and Resolution Techniques in the Construction Industry*
RS 24-1 *Cost Trust Relationships*

Research Reports

SD-100 *The Cost-Trust Relationship in the Construction Industry*
SD-95 *Dispute Prevention and Resolution*

10.06 Project Risk Assessment

Section 1: CII Best Practice Summary Sheet

Best Practice: **10.06 Project Risk Assessment**
Knowledge Area: **10.0 Risk Management**

Definition

Project Risk Assessment (PRA) is the process used to identify, assess, and manage risks on a project. Assessing and managing project risk is a complex task, yet few tools and guidelines exist to help owners and/or contractors assess the diverse set of political, geographic, economic, environmental, regulatory, security, and cultural risks a project faces.

Elements

Project Risk Assessment has the following characteristics and purposes:

- is an effective method for determining the degree of project risk.
- identifies and describes critical issues related to a project and allows the project team to focus on risk factors of potential concern.
- is intended to evaluate the project risk exposure and provide an indication of its potential impact during the project's life cycle.
- indicates which components of the project should be considered for risk mitigation as part of an overall risk management strategy.
- analysis focuses on issues unique to each project.
- has the flexibility to meet the needs of almost any individual project.

This process is principally supported by CII IR 181-2, *International Project Risk Assessment (IPRA)*, which consists of four main sections, each divided into a series of categories, which, in turn, are further divided into elements (specific risk factors). (See Figure 10.06-1.) A complete list of the IPRA's four sections, 14 categories, and 82 elements can be found in IR 181-2. ***It is important to note that the publication is suited for implementation in domestic as well as international projects.*** Elements not applicable to a specific project can be ignored and eliminated from further actions.

SECTION I– COMMERCIAL

SECTION II – COUNTRY
- II.A. Tax/tariff
- II.B. Political
- II.C. Culture
  - II.C1. Traditions and business practices
  - II.C2. Public opinion
  - II.C3. Religious differences
- II.D. Legal

SECTION III – FACILITIES

SECTION IV – PRODUCTION/OPERATIONS

Figure 10.06-1. IR 181-2 Section, Categories, and Elements (sample)

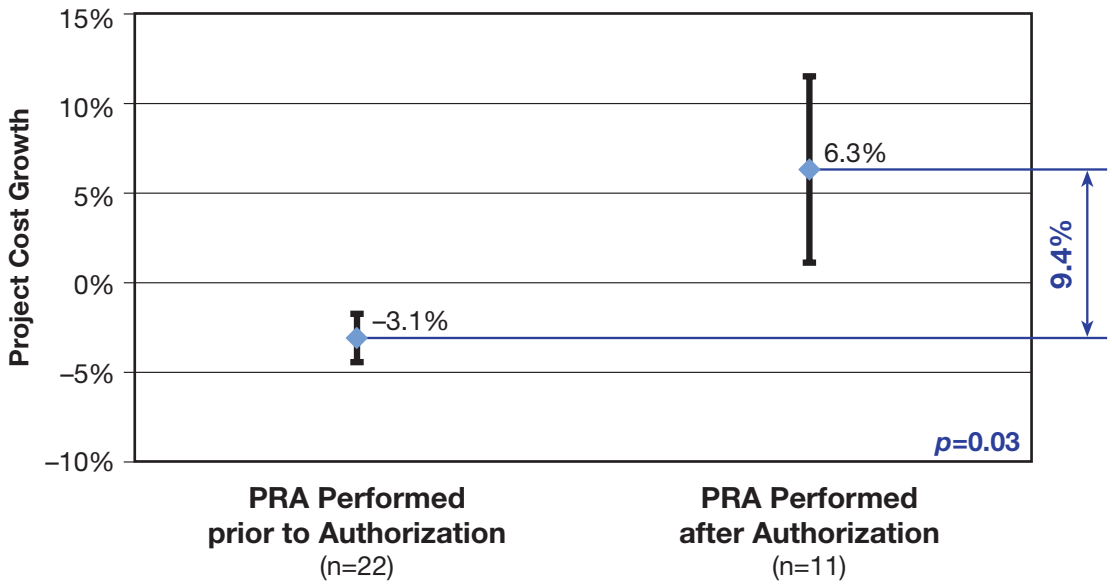
Benefits

Effective utilization of project risk assessment improves project performance in terms of cost, schedule, and scope.

Many industry participants recognize the importance of risk assessment, and the resultant risk mitigation process must be an immediate outflow of such evaluation. Undertaking this process during the early stages of any project, domestic or international, has the potential to significantly and positively affect project success.

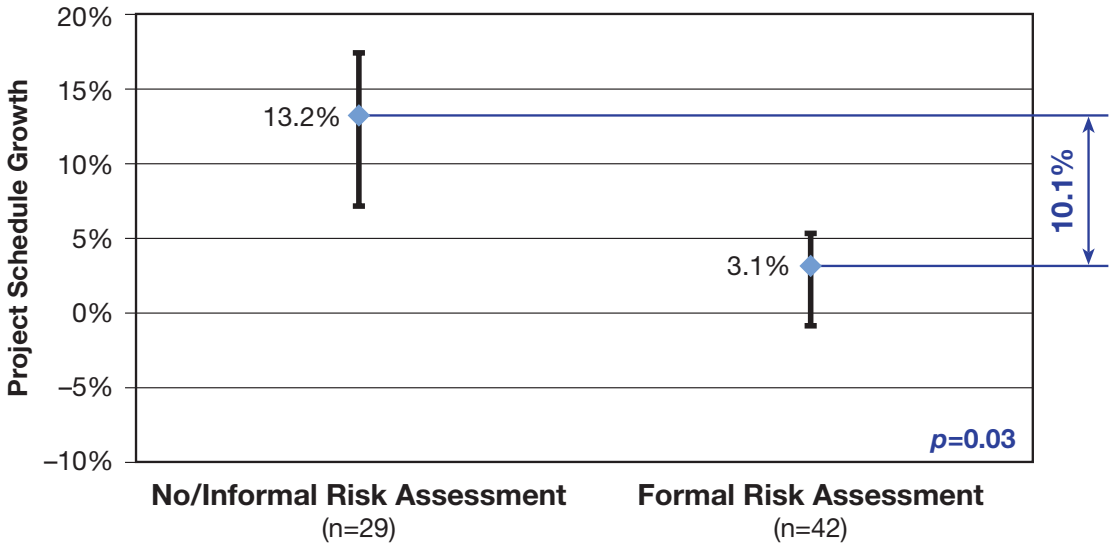
- Project risk assessment can provide numerous benefits to the project team. These include the following:
  - a **checklist** for determining the risk potential of a project
  - standardized risk **terminology**
  - a **process** for identifying and assessing risk to facilitate the prediction of disruptions, the potential for disputes, and other project impediments
  - a means to **monitor the progress** of risk control at various stages of the project's life cycle
  - a method to aid in **highlighting** poorly defined risk areas for investors, owners, and design or construction contractors and decision makers
  - a means **to reconcile differences**, using a common evaluation basis
  - a risk management **training process** for organizations and individuals
  - a **means of benchmarking** a company's risk management process, both within its organization and externally.

On August 12, 2011, the CII Knowledge Management Committee (KMC) designated PRA as a CII Best Practice, based on CII Benchmarking & Metrics data captured in Figures 10.06-2 through 10.06-6.



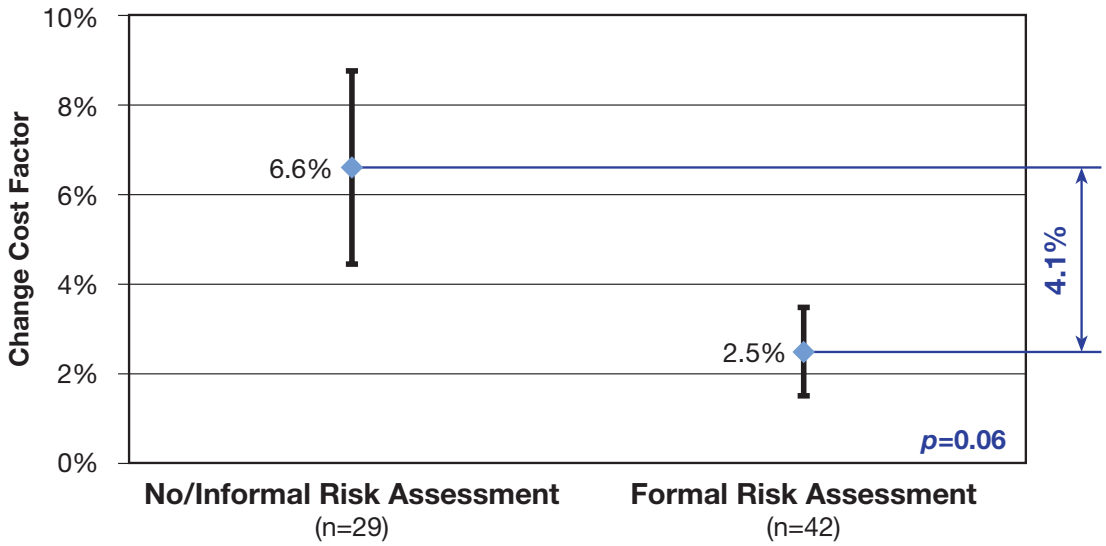
$$\text{Project Cost Growth} = \frac{\text{Actual Project Cost} - \text{Budget Project Cost}}{\text{Budget Project Cost}}$$

Figure 10.06-2. Contractor Benefits (Source: CII Benchmarking & Metrics)



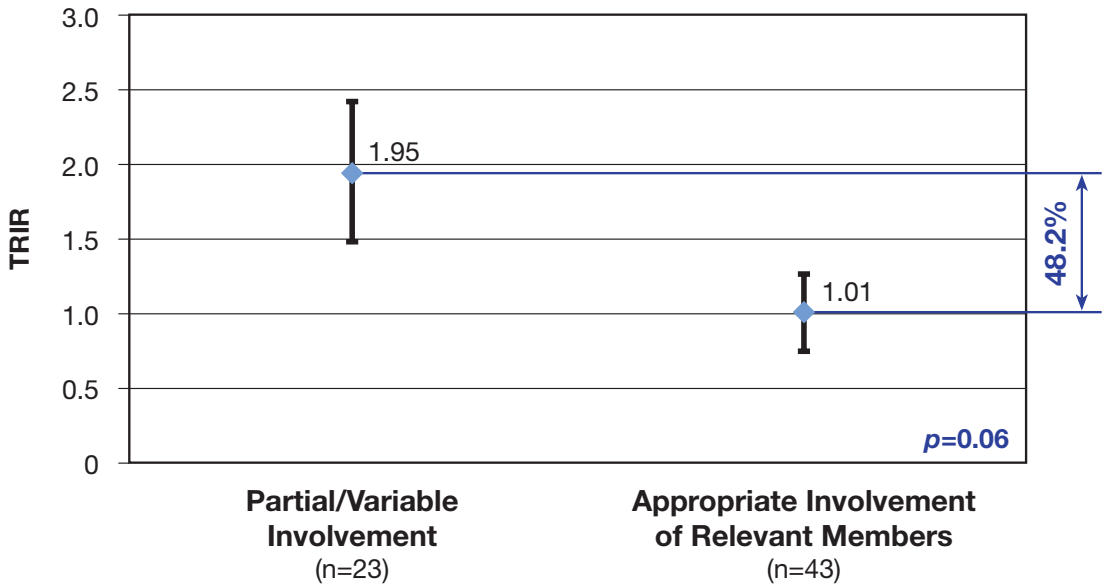
$$\text{Project Schedule Growth} = \frac{\text{Actual Project Duration} - \text{Planned Project Duration}}{\text{Planned Project Duration}}$$

Figure 10.06-3. Owner Benefits (Source: CII Benchmarking & Metrics)



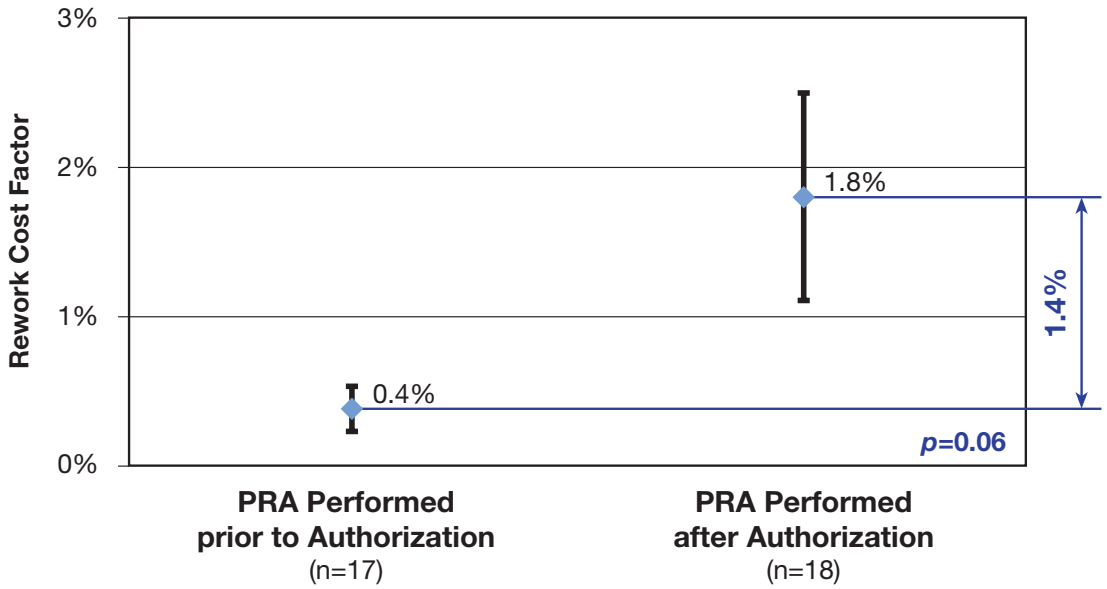
$$\text{Change Cost Factor} = \frac{\text{Approved Change Cost}}{\text{Actual Change Cost}}$$

Figure 10.06-4. PRA Owner Benefits (Source: CII Benchmarking & Metrics)



$$\text{TRIR} = \frac{\text{\# Total Recordable Cases X 200,000 wh}}{\text{Total work hours}}$$

Figure 10.06-5. Safety Improvement (Source: CII Benchmarking & Metrics)



$$\text{Rework Cost Factor} = \frac{\text{Direct Rework Cost}}{\text{Actual Construction Phase Cost}}$$

Figure 10.06-6. Rework Cost Reduction (Source: CII Benchmarking & Metrics)

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Section 2: Implementation Assessment

Best Practice: **10.06 Project Risk Assessment**
Knowledge Area: **10.0 Risk Management**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 Project managers are adequately trained in the project risk assessment (PRA) process.	IR 181-2		
2.0 Project risk assessment was frequently conducted.	IR 181-2		
3.0 An outside facilitator was used to conduct risk assessment.	IR 181-2		
4.0 The project team uses FEP tools, such as the PDRI and PRA, to provide sufficient scope definition to thoroughly define existing and future conditions and risks so decision makers can evaluate a project's viability prior to design and construction.	IR 181-2 IR 213-3		
5.0 Senior management of the organization sees the benefits of following the FEP and conducting a PRA.	IR 181-2 IR 213-3		
6.0 Project team members adequately represent the project stakeholders, including the involvement of both owners and contractors in the development and definition of a risk mitigation plan.	IR 181-2		
7.0 The IPRA process aligns key stakeholders with the project's risks, and the defined risk mitigation plan is executed.	IR 181-2		
8.0 Risk mitigation costs and contingency are added to the authorized budget as a result of the risk assessment process.	IR 181-2		
9.0 The project mitigation plan's schedule impact(s) are properly reflected in the project schedule as a result of using the IPRA.	IR 181-2		
10.0 The risk assessment process is well documented on each project.	IR 181-2		
11.0 The risk mitigation plan is frequently updated on each project	IR 181-2		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (11 x 3 = 33)		**33**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Section 3: CII Publication References

Best Practice: 10.06 Project Risk Assessment
Knowledge Area: 10.0 Risk Management

Implementation Resource

IR 181-2 *International Project Risk Assessment (IPRA)*

Education Modules

EM 181-21 *International Project Risk Assessment*, Instructor's Guide
EM 181-21A *International Project Risk Assessment,* Participant Handbook
EM 181-21K *International Project Risk Assessment,* Classroom Kit

Research Summary

RS 181-1 *Risk Assessment on International Projects: A Management Approach*

Research Report

RR 181-11 *Development of the IPRA Tool*

11.01 Zero Accidents Techniques

Section 1: CII Best Practice Summary Sheet

Best Practice: **11.01 Zero Accidents Techniques**
Knowledge Area: **11.0 Safety, Health, and Environment**

Definition

Zero accident techniques include the site-specific safety programs and the implementation, auditing, and incentive efforts undertaken to create a project environment and a level of training that embraces the mindset that all accidents are preventable and that zero accidents is an obtainable goal.

Elements

- Zero accidents/safety will be a major topic at all pre-construction and construction meetings.
- A written, site-specific zero accidents/safety program will be developed for each project.
- A site safety professional will be assigned full-time for safety on each project.
- A zero accidents/safety orientation will be conducted for all new personnel, including subcontractor personnel.
- A zero accidents/safety incentive and award program will be developed for each project.
- For each project, weekly zero accidents/safety toolbox meetings will be conducted, which all personnel—including subcontractors' personnel—are required to attend.
- Project zero accidents/safety inspections will be conducted by site supervisory personnel daily.
- A substance abuse program will be developed that includes random testing and testing for cause.
- Mandatory documentation that is required for each project
- Elements of Targeted Safety Programs (RS 216-1)
  - focus on specific hazards and not general safety issues
  - initiation/motivation for proactive awareness
  - benchmark/goals established
  - assignment of a champion
  - development of a program
  - communication of goals
  - monitoring and inspecting for compliance
  - corrective action or intervention
  - measurement and recognition of success

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- Elements for Shutdowns, Turnarounds, and Outages (RS 160a-1)
  - demonstrated management commitment
  - safety training
  - planning: pre-project and pre-task
  - safety education: orientation and specialized training
  - worker involvement
  - evaluation and recognition/reward
  - subcontract management
  - accident/incident investigations
  - drug and alcohol testing
- Elements for Owner's Role in Construction Safety (RS 190-1)
  - careful selection of safe contractors
  - contractual safety requirements
  - proactive involvement in the safety practices of projects
  - establishment of and funding of a safety recognition program
  - active participation in safety training and orientation, and verification of the comprehension of the training
  - assignment of a full-time safety representative on site

Benefits

The benefits of zero accident techniques are as follows:

- protects employees' life and health
- reduces insurance costs
  - improves experience modification rate
  - improves incident rate
  - improves frequency rate (See Figures 11.01-1 and 11.01-2.)
  - improves severity rate
  - enables firms to compete for new projects
  - generates repeat business.

The *CII Value of Best Practices* study demonstrates that the high use of zero accident techniques substantially improves project safety as measured by the Total Recordable Incident Rate (TRIR). (See Figures 11.01-1 through 11.01-4.)

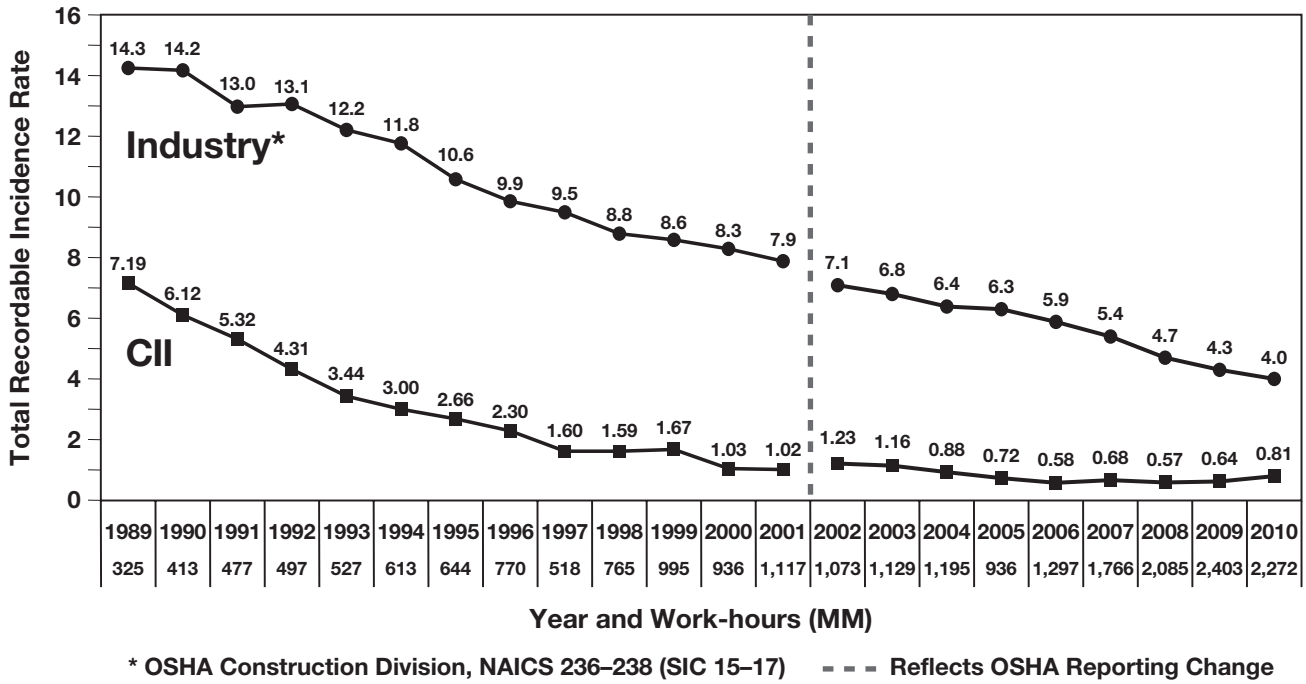

Figure 11.01-1. Total Recordable Incident Rate
(Ref.: BMM 2010-2, *2010 Safety Report*, p. 8; for the latest chart,
see the latest CII Safety Report in the CII Store)

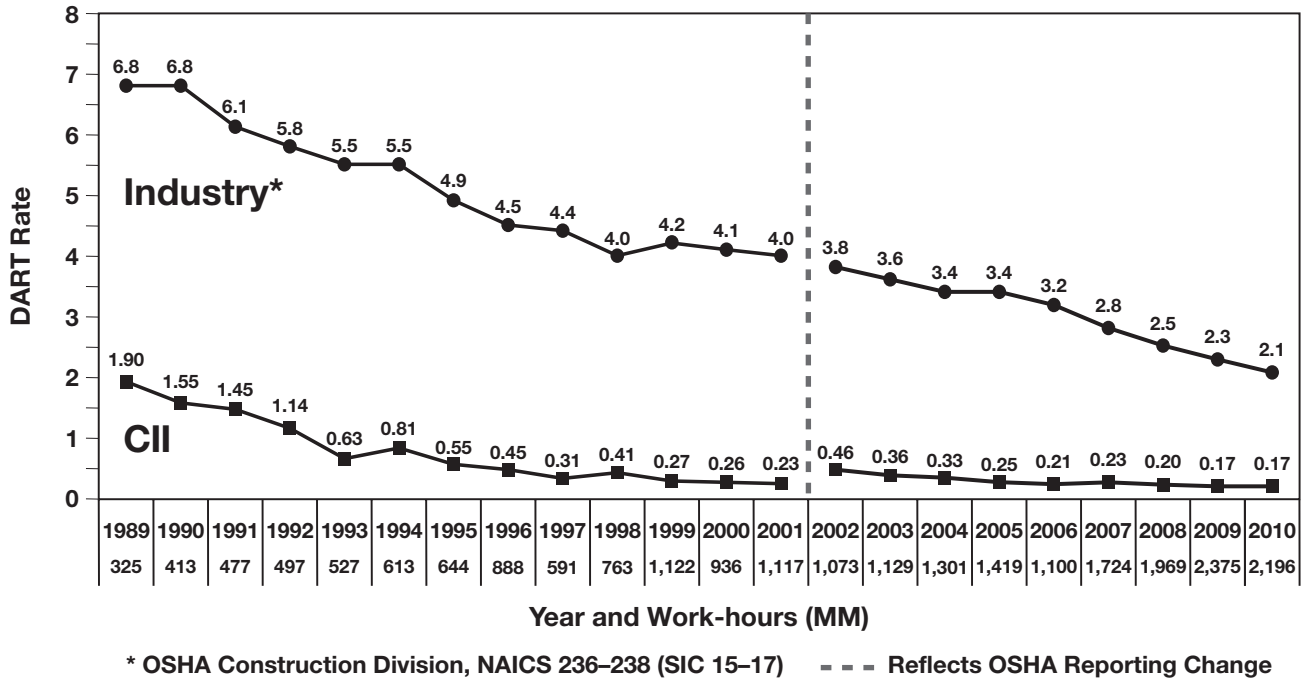

Figure 11.01-2. DART Rate
(Ref.: BMM 2010-2, *2010 Safety Report*, p. 9; for the latest chart,
see the latest CII Safety Report in the CII Store)

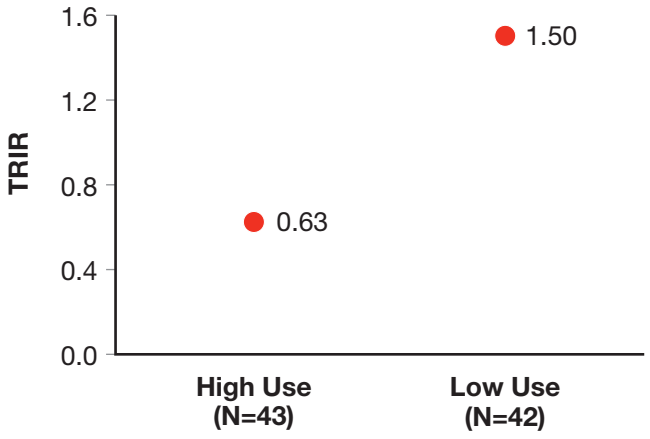

Figure 11.01-3. Impact of Zero Accident Techniques on TRIR—Owners
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 33)

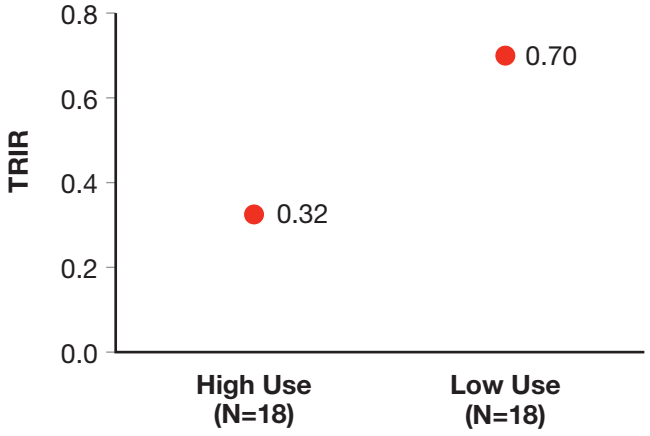

Figure 11.01-4. Impact of Zero Accident Techniques on TRIR—Contractors
(Ref.: BMM 2010-4, *CII Value of Best Practices Report*, p. 36)

Section 2: Implementation Assessment

Best Practice: **11.01 Zero Accidents Techniques**
Knowledge Area: **11.0 Safety, Health, and Environment**

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
1.0 A program is in place for the careful selection of safe contractors.	RS 190-1		
2.0 Written, site-specific zero accidents/safety plan has been developed for each project.	Pub. 32-1, Appx. D: A		
3.0 A zero accidents/safety professional has been assigned on each project site full-time.	Pub. 32-1, Appx. D: I		
4.0 Written zero accidents/safety incentive awards program for hourly craft employees, including subcontractor employees, is established on each project site.	Pub. 32-1, Appx. D: K		
5.0 Each project requires zero accidents/safety orientation for all new employees, including subcontractor employees.	Pub. 32-1, Appx. D: L, M		
6.0 Each project requires weekly zero accidents/safety toolbox meetings, including subcontractors.	Pub. 32-1, Appx. D: G		
7.0 Each project requires pre-hire substance abuse testing of all employees, including subcontractor employees.	Pub. 32-1, Appx. D: O		
8.0 Each project requires random substance abuse testing of all employees, including subcontractor employees.	Pub. 32-1, Appx. D: O		
9.0 Each site requires on-site OSHA safety training.	Pub. 32-1, Appx. D: E, M		
10.0 Corporate safety personnel conduct frequent safety audits.	RS 160-1		
11.0 Near-misses are frequently investigated.	RS 160-1		
12.0 Safety risks are systematically identified in the pre-construction phases of each project.	RS 160-1		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (12 x 3 = 36)		**36**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

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Owner-specific Items

Implementation Assessment Element	CII Document	Element Score*	Organization Documents Reviewed & Comments
13.0 There are established processes and funding for a safety recognition program.	RS 190-1		
14.0 A full-time onsite safety representative has been assigned.	RS 190-1		
Preliminary Assessment Score		**0**	
Maximum Attainable Score (14 x 3 = 42)		**42**	
Normalized Score (Preliminary Assessment Score/ Maximum Attainable Score) x 100		**0**	

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X

Section 3: CII Publication References

Best Practice: 11.01 Zero Accidents Techniques
Knowledge Area: 11.0 Safety, Health, and Environment

Implementation Resource

SP 32-2 *Zero Injury Economics*

Education Modules

EM 160-21 *Making Zero Accidents A Reality*, Instructor's Guide
EM 160-21A *Making Zero Accidents A Reality*, Participant Handbook
EM 160-21K *Making Zero Accidents A Reality*, Classroom Kit

Online Education Course

TAL 5-31 *Construction Safety: Zero Accident Techniques*

Research Summaries

RS 216-1 *Targeted Safety Programs*
RS 190-1 *The Owners' Role in Construction Safety*
RS 160A-1 *Making Zero Accidents A Reality: Focus on Shutdowns, Turnarounds, and Outages*
RS 160-1 *Safety Plus: Making Zero Accidents A Reality*
RS 32-1 *Zero Injury Techniques*

Research Reports

RR 216-11 *Targeted Safety Programs*
RR 190-11 *The Owner's Role in Construction Safety*
RR 160A-11 *Making Zero Accidents A Reality: Focus on Shutdowns, Turnarounds, and Outages*
RR 160-11 *Safety Plus: Making Zero Accidents A Reality*
RR 101-11 *Addressing Construction Worker Safety in the Project Design*
SD-88 *Construction Safety Self-Assessment Process*
SD-86 *Zero Accident Techniques*

Video

VA-006 *One Too Many*

Web Seminars

WS 11-02 *The Owner's Role in Construction Worker Safety*
WS 11-01 *Improving Safety Performance with Upstream Indicators*

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