CII Best Practices Guide: Improving Project Performance

Prepared by the

Construction Industry Institute

Implementation Strategy Committee

Implementation Resource 166-3

Version 4.0

February 2012
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface to the Fourth Version</td>
<td>v</td>
<td>4.0</td>
</tr>
<tr>
<td>Foreword</td>
<td>vii</td>
<td>4.0</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>Use of the Self-Assessment Guide</td>
<td>7</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>CII Best Practices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.01  Front End Planning</td>
<td>1.01-1</td>
<td>4.0</td>
</tr>
<tr>
<td>1.02  Alignment</td>
<td>1.02-1</td>
<td>4.0</td>
</tr>
<tr>
<td>2.01  Constructability</td>
<td>2.01-1</td>
<td>4.0</td>
</tr>
<tr>
<td>3.01  Materials Management</td>
<td>3.01-1</td>
<td>4.0</td>
</tr>
<tr>
<td>5.01  Planning for Startup</td>
<td>5.01-1</td>
<td>4.0</td>
</tr>
<tr>
<td>7.01  Team Building</td>
<td>7.01-1</td>
<td>4.0</td>
</tr>
<tr>
<td>7.02  Partnering</td>
<td>7.02-1</td>
<td>4.0</td>
</tr>
<tr>
<td>8.01  Quality Management</td>
<td>8.01-1</td>
<td>4.0</td>
</tr>
<tr>
<td>8.02  Implementation of CII Research</td>
<td>8.02-1</td>
<td>4.0</td>
</tr>
<tr>
<td>8.03  Lessons Learned</td>
<td>8.03-1</td>
<td>4.0</td>
</tr>
<tr>
<td>8.05  Benchmarking and Metrics</td>
<td>8.05-1</td>
<td>4.0</td>
</tr>
<tr>
<td>8.09  Change Management</td>
<td>8.09-1</td>
<td>4.0</td>
</tr>
<tr>
<td>10.01 Disputes Prevention &amp; Resolution</td>
<td>10.01-1</td>
<td>4.0</td>
</tr>
<tr>
<td>10.06 Project Risk Assessment</td>
<td>10.06-1</td>
<td>4.0</td>
</tr>
<tr>
<td>11.01 Zero Accidents Techniques</td>
<td>11.01-1</td>
<td>4.0</td>
</tr>
</tbody>
</table>
Preface to the Fourth Version

This fourth version 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 insure alignment with the CII Value of Best Practices Project assessment criteria that resulted in the corresponding performance charts included for each Best Practice.

Other key changes incorporated through this version include an updated Comprehensive Scoring Register; complete incorporation of the Implementation Model descriptions previously included in the CII IR166-2 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; and 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 CIIProductFeedback@cii.utexas.edu.

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Austin, Texas
February 2012
Foreword

This publication is designed primarily to assist CII Implementation Champions and others in leading 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 a means of evaluating the completeness of implementation for each Best Practice.

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:

- 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 employed. 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://construction-institute.org/bp.cfm.

Evaluations and comparisons related to CII Best Practices can be made among several projects, either as a one-time evaluation of implementation or for periodic evaluations over time. Users may wish to reproduce selected portions for distribution to others (subject to the CII copyright provisions). Users may 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 suppliers who have a singular mission: to improve the cost effectiveness of the capital facility project life cycle, from front end planning through completion and commissioning. 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 40 leading universities involved, is unique in the engineering and construction industry. The research results lead to best practices for the entire industry to share and implement to improve the likelihood of capital project success.

One of the major sources of value of CII research is found in its implementation. CII has addressed implementation as being one of six distinctive core competencies of its Strategic Plan, which is quoted below:

*CII is implementation driven. Based on sound research, CII develops and disseminates to members and the entire industry state-of-the-art concepts, best practices, and metrics for improving the business effectiveness and sustainability of capital projects. CII products and services support a complete continuum of learning, practice development, implementation, leadership development, and benchmarking and metrics.*

Benefits

The CII publication BMM2010-4, *CII Value of Best Practices Report*, provides complete information on the benefits of implementing CII Best Practices. Summary results are shown in Figures 1-1 through 1-4.
Introduction

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 the Institute, 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 implement CII products, including best practices, effectively, the CII Implementation Strategy Committee (ISC) has developed an Implementation Model that specifies the steps of implementing a CII product as illustrated in Figure 1-5.

Use the CII Implementation Model to craft your organization's implementation effort.

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 and Metrics Data. CII products include implementation resources, research summaries and educational materials that can be used to assist individuals in process improvements. CII also provides other resources such as staff assistance, the Implementation Champions program, and other resources listed in its implementation webpage <http://construction-institute.org/impl.cfm> to facilitate implementation within and across CII companies. The CII Benchmarking and Metrics program provides project performance and process use metrics to assist organizations in understanding improvement opportunities.

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

- A statement that clearly informs employees what the organization expects relative to implementation of CII products
Introduction

- 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:

  - 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
  - Objective measurement of the results of using CII Best Practices.

**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 and target goals set by which to measure success. (See “The Ten Stages to Implementation Success,” in the following section.) The plan and goals should:

  - Be based on 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 review of CII and other 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.

*Among the duties of the Review Board:*

  - Determine which CII Best Practices (or other practices) are applicable to their organizations.
  - 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):

- Facilitate the understanding of a specific CII Best Practice.
- Frequently serves 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:

- Provide knowledge necessary for successful implementation, including company specific processes and practices.
- Include all key stakeholders of the project team impacted 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. It is recommended that this occur on a pilot application basis with a good mechanism for measurement. Recommendations include:

- Select CII Best Practices for implementation based on 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, results must be measured to make sure that the effort is worthwhile. Suggestions include:

- Use the same techniques that were used during the self audit.
- Measure both utilization of Best Practices and impact of use.
- Participate in surveys conducted by the CII Benchmarking and Metrics Committee or other benchmarking services — the results will give comparison 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:

- 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 organization 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 success in implementing a new practice is to have a clear perspective on the overall stages required for the entire implementation process. To assist in this overall perspective and as an outline of the critical stages required in the implementation process, the following is an overall guide to the Ten Stages to Successful Implementation (Figure 1-6). This guidance has been extracted from CII Implementation Resource 246-2, The Implementation Planning Model, Version 1.2.

![Diagram of the Ten Stages to Implementation Success]

**Figure 1-6. A 10-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. This case will need to be presented to both management and critical staff, so 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. The
Stage 3: Establish Steps – The Implementation Planning Model establishes a series of four critical steps that will be followed during the implementation process. The third stage in the overall process is to understand these steps and develop an approximate schedule for the implementation process that is based on these four steps. 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. In this stage, the implementation team must take the specifics within the Implementation Matrix presented in this document and adapt the generic elements with organization specifics that address the unique requirements of the 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 is 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 – The failure to prepare adequately for a new practice, in the majority of cases, 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 will identify areas where 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 an iterative process through the implementation process. In Stage 8, the implementation team will follow the tasks laid out in the implementation plan for each step of the implementation process. Each step in the process has a set of three to five tasks that have been identified as critical for success in that step. Concurrently, potential barriers and strategies are presented to enhance the preparation of the implementation team.

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 will determine if 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 where 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 benchmark process is to determine if 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 if 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 is guided to IR246-2, *The Implementation Planning Model*, Version 1.2. A web-based companion tool is the Implementation Assistant, available at the CII website under the Implementation section <http://construction-institute.org/impl.cfm>.

### Assessment Process

The assessment process involves comparing organizational needs, processes, procedures, and practices against the requirements of a CII Best Practice utilizing the checklists available in this publication. The checklists provide a starting point for assessing the level of implementation that exists within an organization for a given process and determining what areas require additional effort.

After the areas of improvement have been identified, the Implementation Champion and management team must evaluate 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 in order to achieve the greatest benefit considering the probability of success and the associated costs and benefits. Based on the results of this evaluation, an implementation plan can be developed that will provide a “blueprint” for reaching the organization’s goals in implementing CII Best Practices.

A quick assessment process specific to CII implementation issues is available through use of the CII Implementation Thermometer. This tool can be utilized to obtain an overall status of the organization related to the CII implementation process (see Figure 1-7). From the results of this assessment, the areas needing more attention can be identified through additional detailed analysis.

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

One approach to starting your implementation journey:

1. Examine your work flow and take a process oriented perspective. Assess your operations using the Section 2 “Best Practice Assessment” portion of each Best Practice chapter in this Guide. Low scores reveal areas with improvement opportunities. A suggested assessment order:

2. Above all work safely, refer to 11.01 Zero Accident Techniques and insure that you have an embedded safety culture within your projects.

3. 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.

4. Start of 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.

5. Ensure that your team is working in an environment of interdependence and trust. Refer to 7.01 Team Building for key criteria.

6. Plan your project thoroughly and carefully—from business planning to execution. Refer to 1.01 Front End Planning to start things out right.
### Implementation Issues

<table>
<thead>
<tr>
<th>Step</th>
<th>Level of Agreement</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td>1. My organization has established a “Corporate Commitment” to the implementation of CII Best Practices.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>2. My organization has established a CII “Corporate Implementation Champion.”</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>4. My organization has an “Implementation Plan &amp; Goals” for CII Implementation.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>5. My organization has an active board or process to review CII products and determine their application in our work processes.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>6. My organization provides for either internal or external training on CII products.</td>
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<td>0 3 5 8 10</td>
</tr>
<tr>
<td>7. My organization has implemented and makes extensive use of at least five CII products.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>8. My organization measures both the utilization and results of project Best Practices including CLI’s.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>9. My organization recognizes individuals and teams that utilize project Best Practices including CLI’s.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>10. My organization contributes to and uses the results of CII’s Benchmarking and Metrics Program.</td>
<td></td>
<td>0 3 5 8 10</td>
</tr>
</tbody>
</table>

### Total Score:

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

### Step 3.
Compare your Total Score to the Implementation Thermometer.

### Step 4.
Regardless of score — commit yourself to improving your project performance by implementing CII Concepts.

![CII Implementation Thermometer](image)

Figure 1-7. CII Implementation Thermometer
Introduction

7. Identify and proactively manage project risks throughout the lifecycle of capital projects. Refer to 10.06 Project Risk Assessment for international and domestic projects.

8. Avoid repeating prior project development mistakes. 8.03 Lessons Learned provides a process to reinforce good practices and avoid past errors in execution.

9. In your planning begin with the end in mind. 5.01 Planning for Startup provides methodology to avoid problems that delay putting your investment to work and disrupt end of project construction activities.

10. 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.

11. Minimize the direct and indirect costs of contract disputes. Review 10.01 Disputes Prevention & Resolution to insure that you have mechanisms to prevent project disputes and means to facilitate dispute resolution.

12. Build in the means for safe projects that are constructible within cost and schedule goals. Use 2.01 Constructability to identify opportunities.

13. Look ahead to the supply chain, from long lead items to jobsite logistics. Assess your practices with 3.01 Materials Management.

14. 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.

15. Insure 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.

16. Stay on top of the latest capital project execution research. 8.02 Implementation of CII Research provides guidance on proven practice implementation techniques and continued introduction of innovation.

Benchmarking & Metrics

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 impact on project performance that may be attributed to using CII Best Practices as well as information about statistical measurements that can assist in improving capital project effectiveness.

For further guidance in the selection of implementation starting points, the reader is directed to CII publication BMM2010-4, CII Value of Best Practices Report, where the relative impact of implementing different CII Best Practices may be reviewed. Table 1-1 originates in BMM2010-4 and partly illustrates the relative impact of selected CII Best Practices.
**Table 1-1.** Summary of statistically significant relationship between CII Best Practices implementation and project performance

<table>
<thead>
<tr>
<th>Group</th>
<th>Best Practices</th>
<th>Owner</th>
<th>Contractor</th>
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<td>Cost</td>
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<td>Alignment During FEP</td>
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<tr>
<td>Planning for Start-up</td>
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<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Execution</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Constructability</td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Change Management</td>
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<tr>
<td>Organization and Behavior</td>
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<tr>
<td>Partnering</td>
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<td>√</td>
<td></td>
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<tr>
<td>Team Building</td>
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<td></td>
<td>√</td>
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</table>

Additional information about the CII Benchmarking & Metrics Program is available via the CII website under the Benchmarking section <http://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 can tailor the process to suit specific needs. The contents presented here will be modified in the future as new CII Best Practices are validated and the implementation process is further developed.
Use of the Self-Assessment Guide

The self-assessment guide presented here was developed to facilitate improved implementation of the CII Best Practices with a resulting improvement in project and construction safety, quality, schedule, and cost effectiveness.

Three key factors are essential to the successful implementation of CII Best Practices: knowledge of the CII Best Practices, a plan for implementation, and a process for implementation. This guide may be used as a reference for management and project individuals and as a training and education aid for all professionals in the implementation of CII Best Practices. Use of the guide will vary based on the experience level and objectives of the person or group charged with assessment and implementation. Three levels are described below:

**Level 1 Users**

New or inexperienced project or construction managers faced with 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 an implementation guide.
- 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 existing organization procedures with the CII Best Practices' checklist requirements for implementation.
- Consider revising organization 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 a guide.

**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.
Use of the Self-Assessment Guide

Limitations
The CII Best Practice summaries and checklists were created based on 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
An assessment form has been created for each CII Best Practice. The assessment scores, included as a part of each questionnaire, are structured subjective scoring methods that can be used to:

- Indicate a level of implementation that best matches 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.

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 multiple 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 NASes.

Projects may be evaluated at many points during the life of the project by use of the NAS. The first evaluation should occur early in the project. Additional evaluations may occur at selected points in the project life cycle, for example, as 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 may be accomplished by a consensus developed among several individuals knowledgeable of the project and Best Practice elements.

The following page may be copied for use in consolidating the NASes.
## Use of the Self-Assessment Guide

### Table 2-1. Comprehensive Scoring Register

#### Comprehensive Scoring Register

CII Best Practices

Project Name: ________________________________________

Date of Evaluation: ________________________________________

Name of Evaluator(s): ________________________________________

<table>
<thead>
<tr>
<th>BP#</th>
<th>BP Title</th>
<th>Normalized Assessment Score (NAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>Front End Planning</td>
<td></td>
</tr>
<tr>
<td>1.02</td>
<td>Alignment</td>
<td></td>
</tr>
<tr>
<td>2.01</td>
<td>Constructability</td>
<td></td>
</tr>
<tr>
<td>3.01</td>
<td>Materials Management</td>
<td></td>
</tr>
<tr>
<td>5.01</td>
<td>Planning for Startup</td>
<td></td>
</tr>
<tr>
<td>7.01</td>
<td>Team Building</td>
<td></td>
</tr>
<tr>
<td>7.02</td>
<td>Partnering</td>
<td></td>
</tr>
<tr>
<td>8.01</td>
<td>Quality Management</td>
<td></td>
</tr>
<tr>
<td>8.02</td>
<td>Implementation of CII Research</td>
<td></td>
</tr>
<tr>
<td>8.03</td>
<td>Lessons Learned</td>
<td></td>
</tr>
<tr>
<td>8.05</td>
<td>Benchmarking and Metrics</td>
<td></td>
</tr>
<tr>
<td>8.09</td>
<td>Change Management</td>
<td></td>
</tr>
<tr>
<td>10.01</td>
<td>Disputes Prevention &amp; Resolution</td>
<td></td>
</tr>
<tr>
<td>10.06</td>
<td>Project Risk Assessment</td>
<td></td>
</tr>
<tr>
<td>11.01</td>
<td>Zero Accident Techniques</td>
<td></td>
</tr>
</tbody>
</table>

Total: _______
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 defined as the process of developing sufficient strategic information with which owners can address risk and make decisions to commit resources in order to maximize the potential for a successful project. 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 early in the Front End Planning process.
• Front End Planning is divided into three main phases (see Figure 1.01-1):
  1. Feasibility
  2. Concept
  3. Detailed Scope.

Front End Planning Process

Figure 1.01-1. Front End Planning Process Map
1.01 Front End Planning

- The Front End Planning effort is typically identified with 2 to 5 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:
  - 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, 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 2009, owners with high Front End Planning usage on average spend 8% less than those with low usage. (See Figure 1.01-2.)

CII Front End Planning Benefit Data from Research Team 213

- Sample of 609 projects, $37 billion
- Results of good Front End Planning:
  - Cost: 10 percent less
  - Schedule: 7 percent shorter delivery
  - Changes: 5 percent fewer

Figure 1.01-2. Impact of Front End Planning on Cost Growth—Owners

(Ref.: BMM2010-4, CII Value of Best Practices Report)
## Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 My company has a formal gated approval process for capital projects.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Front End Planning in my organization is adequately funded.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 The roles and responsibilities of the Front End Planning Team were well defined.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 The Front End Planning Team members communicated effectively.</td>
<td>IR105-2, IR113-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 The Front End Planning documentation was complete and of a high quality.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 The owner's objectives, needs and expectations were clearly communicated to the Front End Planning Team.</td>
<td>IR213-3, IR113-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 Existing and emerging process and/or building technologies were analyzed thoroughly and in detail.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 Appropriate risk mitigation strategies were identified and clarified during Front End Planning.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 All necessary regulatory permits were addressed during Front End Planning.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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 so decision makers can evaluate the viability of a project prior to moving forward with design and construction.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.0 Project team members adequately represent the project stakeholders, including involvement from both owners and contractors.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0 The FEP process aligns key stakeholders with the project team.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.0 Project team members have the expertise and ability to contribute to the team and the project.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.01 Front End Planning

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.0 The FEP process identifies the risks of new project types, technologies, and locations.</td>
<td>IR213-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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**
- IR268-2  PDRI: Project Definition Rating Index – Infrastructure Projects
- IR242-2  Front End Planning of Renovation and Revamp Projects
- IR213-3  Front End Planning Process, Version 2.0
- IR213-2  Front End Planning Toolkit, Version 2.0
- IR155-2  PDRI: Project Definition Rating Index – Building Projects, Version 3.2
- IR113-3  Alignment During Pre-Project Planning: A Key to Project Success, Version 2.1
- IR113-2  PDRI: Project Definition Rating Index – Industrial Projects, Version 3.2
- IR105-2  Compass: Communications Project Assessment Tool, Version 2.1

**Education Modules**
- EM242-21  Front End Planning of Renovation and Revamp Projects, Instructor’s Guide
- EM242-21A Front End Planning of Renovation and Revamp Projects, Participant Handbook
- EM241-21  Construction Input Assessment in Front End Planning, Instructor’s Guide
- EM241-21A Construction Input Assessment in Front End Planning, Participant Handbook
- EM213-21  Front End Planning, Instructor’s Guide
- EM213-21A Front End Planning, Participant Handbook
- EM155-21  Project Definition Rating Index (PDRI) for Building Projects, Instructor’s Guide
- EM155-21A Project Definition Rating Index (PDRI) for Building Projects, Participant Handbook
- EM113-23  Project Definition Rating Index (PDRI) for Industrial Projects, Instructor’s Guide
- EM113-23A Project Definition Rating Index (PDRI) for Industrial Projects, Participant Handbook
- EM113-22  Scope Control and Change Management, Instructor’s Guide
- EM113-22A 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**
- RS268-1  Front End Planning Tool: PDRI for Infrastructure Projects
- RS242-1  Front End Planning for Renovation and Revamp Projects: An Overview
- RS213-1  Front End Planning: Break the Rules, Pay the Price
- RS155-1  Pre-Project Planning Tool: PDRI for Buildings
- RS113-1  Pre-Project Planning Tools: PDRI and Alignment
- RS39-1  Pre-Project Planning: Beginning a Project the Right Way

**Research Reports**
- RR268-11 Development of the Project Definition Rating Index (PDRI) for Infrastructure Projects
- RR242-11 Analysis Supporting Front End Planning for Renovation and Revamp Projects, Part 1
- RR242-12 Analysis Supporting Front End Planning for Renovation and Revamp Projects, Part 2
- RR221-11 Information Flow to Support Front End Planning
1.01 Front End Planning

Research Reports (continued)

RR213-12  Case Study Analysis in Support of Front End Planning Implementation
RR213-11  Data Analysis in Support of Front End Planning Implementation
RR155-11  Development of Project Definition Rating Index for Building Projects
RR113-11  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 where 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 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 (see 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 be well aligned.

- The second, horizontal, involves the cross-organizational alignment between functional groups within organizations. 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
1.02 Alignment

• 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-memos 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 that:

• 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., checklist, 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 through out the project life cycle).

The alignment thermometer is a tool that will determine the alignment of a project at anytime during the project life cycle. This is most effectively utilized during the front end planning phase (see Figure 1.02-3).

Project successes and team successes are relative to objective setting.

Table 1.02-1. Alignment Index vs. Performance Analysis (from Research Team 213 data)

<table>
<thead>
<tr>
<th>Alignment Index Score</th>
<th>Performance</th>
<th>Less than Median</th>
<th>Greater than Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>N=30</td>
<td>3.3% over budget</td>
<td>6.5% below budget</td>
</tr>
<tr>
<td>Schedule</td>
<td>N=33</td>
<td>24.5% behind schedule</td>
<td>8.4% behind schedule</td>
</tr>
<tr>
<td>Change orders</td>
<td>N=26</td>
<td>8.2% of budget</td>
<td>7.6% of budget</td>
</tr>
</tbody>
</table>

(Ref.: BMM2010-4, CII Value of Best Practices Report)

Figure 1.02-2. Impact of Alignment during Front End Planning on Cost Growth—Owners
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:

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

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
Step 3. Plot your team's answers in the appropriate column and calculate the Average, Range (high score – low score) and Range ÷ Average.

<table>
<thead>
<tr>
<th>TEAM SCORE</th>
<th>Respondent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
</tr>
</tbody>
</table>

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 ÷ Average likely indicates an issue for special concern.

Helpful Hints:
- Poll all appropriate stakeholders (including business and operations).
- Poll periodically and keep track of score (team meetings, monthly, quarterly).
- 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
## Section 2: Implementation Assessment

### Best Practice: 1.02 Alignment

**Knowledge Area:** 1.0 Project Planning

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Project team established and all team members clearly understand project objectives and have committed to work toward these goals.</td>
<td>IR113-3, IR213-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 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. | IR113-3 |                |                                           |
| 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. | IR113-3 |                |                                           |
| 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. | IR113-2, IR113-3 |                |                                           |
| 5.0 Team members understand three key issues related to planning, such as tools, software programs, checklists, and aide-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). | IR113-3 |                |                                           |

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

<table>
<thead>
<tr>
<th>Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>Team members know and utilize the alignment thermometer, which helps project team evaluate and improve its performance on critical alignment issues.</td>
<td>IR113-3</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>The project operations and maintenance philosophy was clearly communicated.</td>
<td>IR113-3, IR213-3</td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>Team alignment was promoted through a rewards/recognition program during Front End Planning.</td>
<td>IR113-3</td>
<td></td>
</tr>
<tr>
<td>9.0</td>
<td>The rewards/recognition system was tied into the overall project objectives and priorities.</td>
<td>IR113-3</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>All members of the Front End Planning Team and relevant internal groups and contractors were included in the reward/recognition system.</td>
<td>IR113-3</td>
<td></td>
</tr>
<tr>
<td>11.0</td>
<td>The planning tools used for promoting alignment (such as checklists, simulations, software programs, work flow diagrams for planning, developing, controlling and managing projects, etc.) were effective.</td>
<td>IR113-3</td>
<td></td>
</tr>
</tbody>
</table>

**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
IR113-3 Alignment During Pre-Project Planning: A Key to Project Success

Education Modules
EM113-21 Development and Alignment of Project Objectives, Instructor’s Guide
EM113-21A Development and Alignment of Project Objectives, Participant Handbook

Online Education Course
TAL113-31 Development and Alignment of Project Objectives

Research Summaries
RS113-1 Pre-Project Planning Tools: PDRI and Alignment
RS12-1 Project Objective Setting

Research Report
RR113-12 Team Alignment During Pre-Project Planning of Capital Facilities
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 optimum 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 as shown in Figure 2.01-1. The Roadmap highlights six milestones to 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:

- Owner and manager commitment to the concepts of constructability.
- Performing self-assessment and identify 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 constructability program.
- Identifying constructability sponsor/champion.
- Establishing functional support organization and procedures.
- Developing main database and lessons-learned system.
- Updating the organizational program using the lessons-learned tool.
**2.01 Constructability**

**Figure 2.01-1. Constructability Implementation Roadmap**

- **Corporate Program**
- **Project Program**
- **Corporate Program**

**Key Steps:***

1. **Assess and recognize constructability benefits**
2. **Develop implementation policy**
3. **Develop constructability team**
4. **Establish corporate constructability program**
5. **Secure contractors, vendors, and consultants**
6. **Consult applications matrix and lessons-learned file**
7. **Identify constructability sponsor/champion**
8. **Define constructability objectives and measures**
9. **Select project contracting strategy**
10. **Develop constructability procedures and integrate into project activities**
11. **Document lessons learned**
12. **Modify organization and procedures; update lessons-learned databases**
13. **Apply constructability concepts and procedures**
14. **Evaluate corporate program effectiveness**
15. **Update corporate program**
16. **Develop constructability procedures and integrate into project activities**
17. **Assemble key owner team members**
18. **Identify constructability objectives, methods, concepts, and barriers**
19. **Perform self-assessment and identify barriers**
20. **Understand constructability objectives, methods, concepts, and barriers**

---

*Note: The diagram illustrates the steps involved in the constructability implementation roadmap.*
Establishing a Project Program involves:

Understanding and communicating constructability objectives, methods, concepts, and barriers to all levels of the project team.

Obtaining constructability capabilities by:

- Selecting and assembling key owner team members with:
  - Expertise and experience.
  - Communication and team working skills.
  - Openness to new ideas.

- Establishing project objectives considering constructability.
- Selecting organization responsible for constructability.
- Determining the desired level of formality of the constructability program.
- Selecting project contracting strategy, which impacts project constructability.
- Identifying owner’s available in-house constructability resources.
- Developing the constructability team.
- Identifying and addressing project barriers.
- Consulting applications matrix and lessons-learned file.
- Developing constructability procedures and integrating 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 organizational program using the lessons-learned tool.
- Considering issues of plant and personnel security that could affect construction execution.
2.01 Constructability

Benefits

• Reduces overall project costs 4.3 percent on average.
  – Impacts 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.
  – Operability, functionality, and reliability

• Improves project team relationships.

• Minimizes rework and rescheduling on the project.

• Enhances the progress of the work.
  – Planning, design, construction, and startup schedules

• Results in repeat business.

(Ref.: BMM2010-4, CII Value of Best Practices Report)

Figure 2.01-2. Impact of Constructability on Cost Growth—Contractors
### Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Constructability defined and owner/management committed to it early in project development.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>2.0 Constructability benefits assessed and recognized, and implementation procedure developed.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>3.0 Scope of constructability program established and constructability concepts selected, understood, and agreed by all parties. Program geared to construction contract type, project size, and project complexity.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>4.0 Environment is conducive to constructability participation on project, well funded with dedicated staff with the right expertise.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>5.0 Constructability program implementation an integral part of project execution.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>6.0 A constructability coordinator is assigned to each project with well defined responsibilities, adequate time to exercise them and an opportunity to play a major role on the projects.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>7.0 The constructability team incorporates relevant information from the lessons learned data base into the project execution plan.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>8.0 Matrices with detailed documentation utilized for evaluation.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>9.0 Self-assessment and barrier identification performed.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>10.0 Constructability barrier assessment checklist used as tool in self-assessment/barrier identification.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>11.0 The engineering deliverables reflect the recommendations for constructability from the construction personnel.</td>
<td>SP34-1</td>
<td></td>
</tr>
<tr>
<td>12.0 Established method to track and record lessons learned.</td>
<td>SP34-1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preliminary Assessment Score</th>
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<tr>
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<tr>
<td>Normalized Score (Preliminary Assessment Score / Maximum Attainable Score) x 100</td>
<td>0</td>
</tr>
</tbody>
</table>

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

Section 3: CII Publication References

Best Practice: 2.01 Constructability
Knowledge Area: 2.0 Design Optimization

Implementation Resource
SP34-1 Constructability Implementation Guide

Education Modules
EM-11 Implementing Project Constructability, Instructor’s Guide
EM-11A Implementing Project Constructability, Participant Handbook

Online Education Courses
TAL34-31 Constructability 1: Implementing Constructability
TAL34-32 Constructability 2: Implementing a Constructability Program
TAL34-33 Constructability 3: Conceptual Planning Phase
TAL34-34 Constructability 4: Design, Procurement, and Field Operation Phases

Research Summaries
RS3-1 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 lifecycle 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 in the project environment; they must be involved in the requirements and planning portion of the process and take the initiative to influence those 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 in areas of control and responsibility among other project functions.

IT Systems

Effective materials management IT systems are essential elements in 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 that area in the last decade.

Materials Requirements Planning (MRP)

MRP encompasses identifying, quantifying, and scheduling the acquisition of project materials and equipment. Determining which of these are required is a key element to project success since planning for their acquisition influences all project activities and has particular impact on the resultant project schedule. MRP spans the organizational groups of owners, engineers, constructors, fabricators, and suppliers.
3.01 Materials Management

Project Acquisition Strategy (PAS)
The PAS articulates the project’s approach for sourcing the necessary materials, equipment and subcontracts. It should identify how the right suppliers for the project will be selected and the types of commercial arrangements to be undertaken with these suppliers. A successful PAS requires that sourcing managers know the project objectives and business drivers, their own organization’s procedures, limitations, and strategies; the commodities they are sourcing; and the suppliers’ market.

Purchasing
The Purchasing function holds the responsibility for procuring goods (i.e., the materials and equipment) for the project in alignment with the specifications and in compliance with the project schedule and budget. It typically includes 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 hold two roles: strategic, whereby they perform comprehensive market surveillance; manage supplier utilization; and develop relationships with key supplier organizations, all of which are necessary to compete in the marketplace today; and tactical, whereby they hold responsibility to procure the project materials and equipment.

Subcontracting
Subcontracting holds the responsibility for procuring services (i.e., contracts and subcontracts) for the project in alignment with the specifications and in compliance with the project 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 holds the responsibility for on-time delivery from suppliers, consistent with the terms of the purchase order or contract. It typically includes delivery of engineering and data deliverables; materials and equipment; and spares and consumables. Expediting must be a planned, orderly, and systematic process wherein 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 need to be checked to ensure completeness of dispatch and to detect potential damages occurring during shipment.

Supplier Quality Management (SQM)
SQM is the system of processes and procedures used by the project organization that 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 portfolio. 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.
3.01 Materials Management

Transportation and Logistics

Transportation and Logistics is planning, controlling, and executing the delivery of materials to the project jobsite. These activities must be coordinated with engineering, procurement, and construction schedule requirements, and 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 construction forces on the project within a cost-effective manner. With proper planning and true system integration, material shortages can be identified well in advance so 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 startup to ensure the equipment is available and is being serviced per the original equipment manufacturer guidelines. O&M materials management requirements typically include the materials (spares); labor and warehousing necessary for project commissioning; startup; the early operation of the equipment; and provisions for integrated facilities management transitions.

Other Materials Management Observations

- Early project planning should include global market studies that should include not only identifying the least expensive sources of equipment and materials of verifiable quality, but also considering 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 improvements in the use of materials management IT systems occur continuously.

- Managers should address quality issues proactively in global sourcing by planning to import from qualified suppliers or developing the local supply base to achieve desired quality standards before the start of the project.
### Benefits

**Table 3.01-1. Benefits of Materials Management**

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Average % Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced bulk supplies</td>
<td>40</td>
</tr>
<tr>
<td>Improved supplier performance</td>
<td>24</td>
</tr>
<tr>
<td>Cash flow savings</td>
<td>23</td>
</tr>
<tr>
<td>Reduced site storage and handling</td>
<td>21</td>
</tr>
<tr>
<td>Improved craft labor productivity</td>
<td>16</td>
</tr>
<tr>
<td>Improved project schedule</td>
<td>16</td>
</tr>
<tr>
<td>Reduced management personnel</td>
<td>15</td>
</tr>
<tr>
<td>Reduced risk</td>
<td>5</td>
</tr>
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</table>

## Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Project execution plan addresses materials management plan.</td>
<td>IR7-3, IR257-2, IR257-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Have written materials management plan.</td>
<td>IR7-3, IR257-2, IR257-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 All stakeholders in project (QC, Engineering, Owner, and Construction) identified their needs and are part of plan development.</td>
<td>IR7-3, IR257-2, IR257-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 Computer-based materials management system.</td>
<td>IR7-3, IR257-2, IR257-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Materials management system integrated with CAD, scheduling, accounting systems.</td>
<td>IR7-3, IR257-2, IR257-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 Materials management plan identifies and outlines responsibility for functions as follow: material takeoff, procurement, supplier evaluation, warehousing, field control, surplus, expediting, QA/QC.</td>
<td>IR7-3, IR257-2, IR257-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 Materials management system has the following capabilities: generate purchase orders from material requisitions; interact with expediting status information; track supplier performance; link to schedule to show availability of materials; report back order material status; report field issued material by craft; provide a surplus report; track bulk material, engineered material, and tagged items; use bar coding for tool control, materials control, and estimating.</td>
<td>IR7-3, IR257-2, IR257-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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</tbody>
</table>

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X
Section 3: CII Publication References

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

Implementation Resources
IR257-3  Materials Management Planning Guide
IR257-2  Global Procurement and Materials Management: An eGuide to Effective Project Execution
IR7-3  Procurement and Materials Management: A Guide to Effective Project Execution

Education Modules
EM7-21  Tools for Effective Materials Management, Instructor's Guide
EM7-21A  Tools for Effective Materials Management, Participant Handbook

Research Summaries
RS257-1  Global Procurement and Materials Management
RS7-2  Project Materials Management Primer
RS7-1  Costs and Benefits of Materials Management Systems

Research Reports
RR257-11  Global Procurement and Materials Management
5.01 Planning for Startup

Section 1: CII Best Practice Summary Sheet

Best Practice: 5.01 Planning for Startup
Knowledge Area: 5.0 Facility Startup and Operations

Definition

Startup is defined as the transitional phase between plant construction completion and commercial operations, including all of the activities that bridge these two phases. Critical steps within the startup 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; it is successful commercial operation that defines a successful project. Successful commercial operation requires a successful startup. The message is:

- Research indicates a reasonably strong correlation between startup success and the extent of planning conducted prior to startup.
- Effective startup planning requires that the right issues be addressed by the right people at the right times.
- CII developed a Startup Planning Model to help its members plan a more thorough, effective, and efficient startup.

1. This model is a sequence of planning activities organized according to typical project phases.
2. The planning activities are complemented with tools that facilitate the implementation of the particular startup planning activity (see Table 5.01-1).

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Number of Startup Planning Activities</th>
<th>Number of Tools Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Requirements Definition and Technology Transfer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. Conceptual Development and Feasibility</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3. Front End Engineering</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>4. Detailed Design</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>5. Procurement</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6. Construction</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>7. Checkout &amp; Commissioning</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>8. Initial Operations</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5.01-1. Startup Planning Model Phases, Activities, and Tools
5.01 Planning for Startup

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>
<thead>
<tr>
<th>Project Phase</th>
<th>Quality Gate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition and Technology Transfer</td>
<td>Recognize the impact of startup on project economics</td>
</tr>
<tr>
<td>Conceptual Development and Feasibility</td>
<td>Update the Startup Execution Plan</td>
</tr>
<tr>
<td>Front End Engineering Detailed Design</td>
<td>Finalize the Operations &amp; Maintenance organization and management systems</td>
</tr>
<tr>
<td>Construction</td>
<td>Check-out systems</td>
</tr>
<tr>
<td>Check-out and Commissioning</td>
<td>Commission systems</td>
</tr>
<tr>
<td>Initial Operations</td>
<td>Finalize documentation</td>
</tr>
</tbody>
</table>

5. Two tools offer substantial improvement in the quality of startup planning and are included in the Best Practice (Ref.: IR121-2, Planning for Startup):
   - SuPER tool (Tool 1-A-2) for evaluating the degree of startup planning.
   - Startup Execution Plan (Tool 3-B-2), a mechanism for integrating all startup planning developments.

Benefits

- Provides a model for developing a detailed startup plan for all aspects of startup 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 startup objectives, plan, and duration.
  b. Identifies and involves Startup Manager, plant operations, and maintenance personnel in front end engineering and detailed design phases, allowing for their input before design is fixed.
5.01 Planning for Startup

c. Increased focus on cost elements of startup, 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 startup activities.

Planning for Startup Model

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

**Best Practice:** 5.01 Planning for Startup  
**Knowledge Area:** 5.0 Facility Startup and Operations

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Conceptual Development and Feasibility elements addressed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Realistic forecast of startup duration developed</td>
<td>IR121-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup costs estimated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Impact of startup on project economics recognized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Front End Engineering plan incorporates startup criteria.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup objectives established</td>
<td>IR121-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup execution plan developed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup team assignments made</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup systems identified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Operations and maintenance (O&amp;M) input obtained</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup risks assessed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup incentives analyzed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup procurement requirements identified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup budget and schedules refined</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Startup execution plan updated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 Detailed Design phase includes startup criteria.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Address startup issues in team-building sessions</td>
<td>IR121-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Assess and communicate startup effects from changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Plan for supplier field support of startup</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Include startup in the project CPM schedule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Plan for startup QA/QC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Refine the startup team organization plan and responsibility assignments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Acquire additional O&amp;M input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Indicate startup system numbers on engineering deliverables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Refine startup risk assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Plan O&amp;M training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Develop startup spare parts plan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Develop system turnover plan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Develop and communicate startup procedures and process safety management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Refine startup budget and schedule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Update the startup execution plan</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X
### 5.01 Planning for Startup

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
</table>
| 4.0 Procurement includes startup requirements in contracting and purchasing program.  
- Quality suppliers for startup services  
- Refine the startup spare parts plan and expedite  
- Implement the procurement QA/QC plan | IR121-2       |                |                                           |
| 5.0 Construction includes and interfaces with startup team.  
- Update the startup execution plan and release for construction  
- Conduct construction-startup team building  
- Refine the startup integrated CPM schedule  
- Conduct operator/maintenance training  
- Implement the field QA/QC plan  
- Finalize the startup risk assessment  
- Transition to startup systems-based execution | IR121-2       |                |                                           |
| 6.0 Checkout and commissioning plan developed and implemented.  
- Finalize the O&M organization and management systems  
- Checkout systems  
- Commission systems | IR121-2       |                |                                           |
| 7.0 Startup team participates in performance testing, initial operations, and project completion.  
- Introduce feedstocks  
- Conduct performance testing  
- Finalize documentation | IR121-2       |                |                                           |

**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 Startup
Knowledge Area: 5.0 Facility Startup and Operations

Implementation Resource
IR121-2 Planning for Startup

Education Modules
EM121-21 Planning for Startup, Instructor’s Guide
EM121-21A Planning for Startup, Participant Handbook

Online Education Courses
TAL121-31 Introduction to Planning for Startup: Early Phases
TAL121-32 Planning for Startup: Final Project Phases

Research Summary
RS121-1 Planning for Startup: Overview of Research

Research Report
RR121-11 Planning for Startup: Analysis of the Planning Model and Other Success Drivers

Web Seminar
WS121-01 Planning for Startup
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 and that 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 complementary and different definitions. All three are critical to the success of a project. To effectively utilize the team building concept, a clear understanding of the three concepts and how they complement each other is required.

Alignment concerns whether the team members are all working toward the same, correct goal. Teamwork involves how well the members interact, cooperate, and support one another 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:

- Shared commitment to work together.
- Shared sense of team's accountability.
- 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 phase of the project (see Figure 7.01-1). If this process is conducted properly, the project team will have the groundwork to implement the team building process.
In addition to the alignment process, assessing the effectiveness of communications on the project can also be beneficial. The communication assessment process consists of: developing a communication assessment questionnaire, comparing the results to a reference database, developing an improvement strategy, implementing the improvement strategy, and reassessing the results at regular intervals (see Figure 7.01-2).

![Alignment Key Issues Diagram](image_url)

**Figure 7.01-2.** Communications Improvement Process
(Ref.: RS105-1, *Compass: An Assessment Tool for Improving Project Team Communications, Version 2.1*)
Benefits

- The team building process is usually viewed as having a short-term focus as it is directed at a specific project, 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 owner-designer-contractor, which include:
  a. Lack of a common project mission.
  b. Adversarial conditions fostered by a lack of trust.
  c. Perceived ethical violations.
  d. Contingency positioning for litigation.
  e. Absence of a team spirit.

- Team building fosters teamwork and enhances project performance.

- Utilizing team building will improve an organization’s processes by:
  - Identifying problems early.
  - Building internal and external relationships.
  - Reducing adversarial relationships.
  - Developing trust and team spirit.
  - Practicing open communication.
  - Improving cooperation, cohesiveness, and problem-solving skills.
  - Improving quality of all phases of the project.

- Utilizing team building will improve project performance by:
  - Providing alignment of goals and expectations.
  - Shortening schedule.
  - Lowering cost.
  - Improving safety record.
  - Reducing and managing changes.

Figure 7.01-3. Impact of Team Building on Schedule Growth–Owner

(Ref.: BMM2010-4, CII Value of Best Practices Report)
## Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0 Team Building Principles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Project management determined that team building techniques should be used on projects.</td>
<td>SD-87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Team building “champion” assigned to or contracted for project.</td>
<td>SD-87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Project management scheduled an initial communications assessment early in the project schedule.</td>
<td>IR105-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Questionnaires selected/developed and survey groups determined.</td>
<td>IR105-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Communications improvement strategy developed.</td>
<td>IR105-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.0 Overcoming Potential Obstacles to Team Building</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Organization’s top management demonstrated support for team building process.</td>
<td>SD-87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Project management members familiar with “team building process.”</td>
<td>SD-87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Written plan for training a part of team building process.</td>
<td>SD-87</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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
- IR113-3  Alignment During Pre-Project Planning — A Key to Project Success
- IR105-2  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
- RS105-1  Compass: An Assessment Tool for Improving Project Team Communications
- RS37-1  Team Building: Improving Project Performance

Research Reports
- RR105-11 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 be a long-term commitment between two or more organizations as in an alliance or it may be applied 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 a shared culture without regard to organizational boundaries. The relationship is based on trust, dedication to common goals, and the understanding of each other's 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 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 win/lose to win/win.

Implementation and management of the partnering process is a five-phase process (see Figure 7.02-1) that incorporates executive, management, and craft-level participants.
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 in a state of constant reassessment.
- Real commitment must exist between the partners and to each other’s business objectives since the project’s success applies to all parties.
- Continuous, routine feedback is needed in all directions as well as a clear focus on continuous improvement.
- All parties must accept appropriate levels of risk commensurate with their rewards and the unique elements of their partnering relationship.
7.02 Partnering

- 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 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. Benchmarking Results: Partnering vs. Traditional Construction**

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

(Ref.: RS102-1, *Model for Partnering Excellence*, Table 1)
**7.02 Partnering**

Figure 7.02-2. Impact of Partnering on Cost Growth–Owner

(Ref.: BMM2010-4, CII Value of Best Practices Report)
## Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Owner's Internal Alignment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 We use partnering on most projects as a matter of routine.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Our organization uses partnering champions.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Our organization conducts initial partnering workshops.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Identified key business drivers and developed strategic plan.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Evaluated partnering process both within and external to organization.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Conducted internal assessment and alignment.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.7 Utilized alliance tools.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8 Utilized common tools.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Partner Selection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Developed a selection team.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Defined roles and responsibilities.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Developed selection criteria.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Completed a checklist of key elements.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 Completed applicable partner selection tools.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 Partnership Alignment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Taken steps to develop trusting relationship.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Developed aligned relationship objectives that support each party’s strategic objectives.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Developed aligned measures based on objectives, and incentives based on measures.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.4 Created a separate, empowered organization.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 Developed a conflict resolution process.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.6 Completed a checklist of key elements for this phase.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.7 Completed applicable partnership alignment tools.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X
<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.0 Project Alignment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Developed project objectives, incentives, and measures.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Developed consistency among key individuals.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3 Empowered team.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4 Supplied team with appropriate tools and resources.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 Developed and implemented efficient and effective communication methods.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6 Instituted a dispute resolution process, starting at lowest level.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.7 Planned social activities to nurture trust and promote teamwork.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.8 Completed checklist of key elements for this phase.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.9 Utilized applicable project alignment tools.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5.0 Work Process Alignment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 Communicated project objectives to entire project team.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 Analyzed work processes.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 Effectively allocated resources.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.4 Developed and implemented a program for implementing innovative ideas, processes.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5 Extended empowerment down to discipline level.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.6 Defined roles and responsibilities.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.7 Completed checklist of key elements.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.8 Completed alliance work process alignment tool.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.9 Completed applicable project-specific work process alignment tools.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.10 Partnering team members feel free to offer suggestions openly.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 6.0 Partnering Measures

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Determined which results measures will be used on project and completed them.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2 Determined which process measures will be used on project and completed them.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.3 Determined which relationship measures will be used on a project and completed them.</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.4 The partnering relationships facilitate/promote innovation</td>
<td>IR102-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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
IR102-2 Partnering ToolKit

Education Modules
EM102-21 Developing, Implementing, and Managing A Partnering Relationship, Instructor’s Guide
EM102-21A Developing, Implementing, and Managing A Partnering Relationship, Participant Handbook

Online Education Courses
TAL102-31 Partnering Course 1: Introduction to the Partnership Process
TAL102-32 Partnering Course 2: Owner Internal Alignment and Partner Selection
TAL102-33 Partnering Course 3: Relationship and Process Alignment
TAL102-34 Partnering Course 4: Taking it to the Troops

Research Summary
RS102-1 Model for Partnering Excellence

Research Report
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) can be defined as a set of policies, processes, and procedures that govern the planning and execution of capital facilities delivery 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:
  – A common understanding across the organization of the activities involved with each step in the process
  – Sequence of activities and their interrelationships
  – Responsibilities for their execution
  – How process risks are recognized and managed.

• QM systems are also closely linked with business excellence systems e.g.
  – Malcolm Baldrige
  – Lean Six Sigma
  – Phillip Crosby

• Key QMS organizational characteristics
  – 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.
  – Consistent use of metrics, measurement, and analysis techniques across the organization.
  – QMS certification is obtained, e.g. ISO 9001
  – Suppliers and contractors are required to implement a QMS.
**Figure 8.01-1.** Capital Facilities Delivery Business Processes

**Benefits**

Strategic implications related to pursuing quality management:

- Increased customer satisfaction,
- Ongoing organizational learning,
- Continuous improvement,
- Stable work processes with
- Minimal variation,
- Productivity improvements,
- Failure prevention, and
- Conformance to requirements.
## Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0 Understanding QMS Requirements</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Basis for your organizations QM system (e.g., ISO 9001) identified.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 QM system defined in a quality manual.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Quality policies clearly defined and documented.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Quality-related roles and responsibilities documented.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Upper management team understands the QMS basis and requirements.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 QMS integrated with business process improvement methods (e.g., Lean Six Sigma, TQM, Malcolm Baldrige).</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.0 Processes Governed by the QMS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 There is a diagram of the key processes governed by the QMS.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Each key process is understood across the organization.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 The sequence and responsibility for the execution of the key processes are understood across the organization.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.0 Management Commitment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 The written quality policy and performance objectives are endorsed by executive management.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 The QMS policies and objectives are focused on understanding customer requirements and ensuring they are fulfilled.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 There is a Quality Manager/Director responsible for assisting top management in implementation of the QMS.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.0 Assessing QMS Compliance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Implementation periodically assessed for compliance with the QMS basis (e.g., ISO 9001).</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Internal audit program in place.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3 QMS certified by an independent third-party organization.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Strongly Disagree = 0; Somewhat Disagree = 1; Agree = 2; Strongly Agree = 3; Unable to address or score = X
### 5.0 Measuring Effectiveness (Metrics)

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Performance metrics established that are aligned with the key business processes and performance objectives.</td>
<td>IR254-2, IR203-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 Data collected consistently and accurately to record measurement of these metrics.</td>
<td>IR254-2, IR203-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 Metrics assembled in reports for analysis against desired outcomes.</td>
<td>IR254-2, IR203-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.4 Plan-Do-Check-Act assessment methodology being used as the framework for analyzing QMS processes.</td>
<td>IR254-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6.0 QMS Maturity and Improvement

| 6.1 Maturity of the QMS periodically assessed using CII Best Practice. | IR254-2 | |
| 6.2 CII Quality Management Best Practice known and understood. | IR254-2 | |
| 6.3 QMS improvement goals and objectives established and agreed with executive management. | IR254-2 | |

**Preliminary Assessment Score**

- 0

**Maximum Attainable Score**

- \((22 \times 3 = 66)\)

**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

IR254-2 Implementing and Improving Quality Management Systems in the Capital Facilities Delivery Industry
IR203-2 Zero Field Rework Self-Assessment Opportunity Checklist

Research Summaries

RS254-1 Best Practices in Quality Management for the Capital Facilities Delivery Industry
RS203-1 Making Zero Rework A Reality
RS153-1 The Field Rework Index: Early Warning for Field Rework and Cost Growth

Research Reports

RR254-11 Best Practices in Quality Management for the Capital Facilities Delivery Industry
RR153-11 An Investigation of Field Rework in Industrial Construction
SD-80 Project Performance Modeling: A Methodology for Evaluating Project Execution Strategies
# 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 products is the comprehensive and effective use of proven CII products by member organizations as outlined in the CII Implementation Model (see Figure 1-1).

## Elements

The CII Implementation Model contains a foundation of nine recommendations for an organization to pursue in implementing best practices. The Implementation Model is included in this Best Practice Summary and details the following elements:

### A Foundation of CII Products, Support, and Benchmarking and Metrics Data

- CII products include implementation resources, research summaries, and educational materials that can be used to assist individuals in process improvements. See the CII Knowledge Structure [http://construction-institute.org/know.cfm].
- CII also provides programs such as staff assistance, Implementation Champions program, and other resources listed in its implementation web page [http://construction-institute.org/impl.cfm] to facilitate implementation within and across CII organizations.
- The CII Benchmarking and Metrics Program provides project performance and process use metrics to assist organizations in understanding 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 Implementation Model as a guide.

### Organizational Implementation Champion (IC)

The IC guides and directs participation in CII — maximizes organizational benefits.

Essential competencies include:

- Leadership — Identifies greatest organizational need and directs resources to achieve maximum benefits.
- Communication — Communicates benefits, successes, opportunities.
- Knowledge — Enhances awareness of CII Best Practices. Enhances availability of information for application within the organization.
- Measurement — Objective comparison of results with CII Best Practices.
8.02 Implementation of CII Research

Self Audit
• The CII Knowledge Structure organizes the CII publications <http://construction-institute.org/know.cfm>.
• This publication, CII Implementation Resource 166-3, describes each CII Best Practice and provides a process and set of selected questions for each Best Practice that enable users to determine the extent of applicability of central elements for that practice within the organization.
• Compare performance of the organization within the practice context with performance attained through 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 organization.
• CII Implementation Resource 246-2 outlines the Implementation Planning Model that will guide users in the development of a roadmap and the specific steps for implementing new Best Practices. The Implementation Assistant, a web-based tool, is available at https://www.construction-institute.org/implement/icstartpage.cfm to support 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 impacted 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 based on potential for improvement in your organization or project.
• Identify possible barriers and plan enablers to counter barriers.
• Provide leadership, communication, resources, and support.
8.02 Implementation of CII Research

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 and Metrics Program and the results will give you comparison of your efforts with those of other member organizations.

Celebrate Success
- Communicate implementation benefits, successes, and opportunities.

Benefits
The CII Governance Plan charters the CII Research program to ensure research execution of the highest quality that 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 by using CII products to establish or augment existing work processes based on existing and/or validated construction industry methods and criteria.
- Enhanced professional development by expanding personal knowledge and contribution to business organization.
- Opportunity to improve business organization’s return on investment by operating with increased efficiency.
- Improved competitive position through increased knowledge base, exposure to industry norms and developing trends.
- Enhanced communications between owners and contractors through common references and criteria found in CII products.
  - cost and schedule performance.
  - safety performance.
  - relative cost and schedule benefits.

## Section 2: Implementation Assessment

### Best Practice: 8.02 Implementation of CII Research

**Knowledge Area:** 8.0 Business and Project Processes

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Implementation efforts based on CII research findings, CII support, and CII Benchmarking data.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Organizational commitment from Senior Management secured and statement to organization issued detailing commitment.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 Internal funding for implementation of CII research findings is at appropriate levels in my organization.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 Implementation champion(s) and publication review boards have been strategically selected and empowered in sufficient number on the basis of subject matter experts and/or geographically significant corporate offices.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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 IR166-3 questionnaires for self audit has been employed.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 The most applicable CII research findings have been selected based on highest return value for organization's range of services.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 Plans and goals for implementation of CII research findings developed to address internal culture, business model, processes, and organizational structure. For example, CII IR246-2, <em>The Implementation Planning Model</em>, is being used for effective implementation.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 Educational resources have been allocated to support implementation efforts.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 There is a formal process in place to measure results of CII research findings that are being implemented. For example, participation in CII Benchmarking &amp; Metrics process or measurement against established goals.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0 Implementation efforts and successes are recognized and rewarded.</td>
<td>IR166-2, IR246-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Preliminary Assessment Score

- **0**

### Maximum Attainable Score

- **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*
Section 3: CII Publication References

**Best Practice: 8.02 Implementation of CII Research**

**Knowledge Area: 8.0 Business and Project Processes**

**Implementation Resources**
- BMM2010-4 *CII Value of Best Practices Report*
- IR246-2 *The Implementation Planning Model: Steps to Success, Version 1.2*
- IR166-3 *CII Best Practices Guide: Improving Project Performance, Version 3.0*
- IR166-2 *Implementation Model + Knowledge Structure Guide*

**Research Summaries**
- RS246-1a *The Role of Executive Support in Implementation Champion Success*
- RS246-1 *The Implementation Planning Model: An Overview*
- RS166-1 *Measuring Organizational Implementation Status: Development of the CII Knowledge Implementation Index (CIKI)*

**Research Reports**
- RR246-11 *Implementing CII Practices—The Implementation Planning Model: Steps to Success*
- RR166-11 *Assessment of CII Knowledge Implementation at the Organizational Level*

**Web Seminar**
- WS246-01 *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:

- 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 is comprised of 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 as formal or informal.
  - A formal program is part of a funded, standardized, documented work process which 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 a LL program; however, no organization has successfully quantified the direct value of their 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.

Version 4.0 / 23Feb12
8.03 Lessons Learned

- The LL process includes three key steps: collection, analysis, and implementation (illustrated in Figure 8.03-1):
  - Collection entails gathering data and generation 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](image)

**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 and increasingly competitive industry.
In 2008, the CII Knowledge Management Committee designated Lessons Learned a CII Best Practice based on the following benefits:

1. Study of >100 surveys of involving >70 organizations:
   - 62% of companies reported somewhat effective Lessons Learned Programs (LLP)
   - 8% reported very effective
   - 20% neutral
   - 10% not effective
   (Ref.: IR230-2, Implementation of Lessons Learned Programs, Table 20)

2. Quantifiable measures:
   - 15% base cost improvements for State Department Embassy Prototypes due to LLP
   - Varies safety improvements from 50% to 300%
   - Key Performance Indicator trends improving due to enhanced LLP
# Section 2: Implementation Assessment

## Best Practice: 8.03 Lessons Learned

**Knowledge Area:** 8.0 Business and Project Processes

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0 Leadership</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Upper management promotes and supports the Lessons Learned (LL) program by providing encouragement and rewards.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Project teams consistently participate in a LL program.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Managers communicate LL program to staff and employees.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Individuals understand their role in the LL program.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Upper management has a shared vision of the LL program that involves the entire organization.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.0 LL Process: Submission/Collection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 A designated group or individual in the organization administers LL submission/collection.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 A well-defined work process for submitting or collecting LL exists within the organization.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 The work process for submitting/collecting LL is consistently followed within the organization.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 LL submission/collection process is effective.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.0 LL Process: Analysis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Submitted LL undergoes an initial screening before they are analyzed and inputted into the system.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Submitted LL is analyzed before they are shared within the organization.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Qualified personnel analyze LL.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.4 There is a defined work process for analyzing LL in the organization.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 Members of the organization are aware of the analysis procedure for LL.</td>
<td>IR230-2</td>
<td></td>
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</tr>
<tr>
<td>3.6 Individuals submitting LL are given feedback.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.7 LL analysis process is effective.</td>
<td>IR230-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>Element Score*</th>
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</tr>
</thead>
</table>

#### 4.0 LL Process: Implementation

4.1 There is a defined work process for making LL available within the organization. IR230-2

4.2 There is continuous (24/7) access to LL in the organization. IR230-2

4.3 Some LL in the system may be removed/retired after a certain amount of time or after. IR230-2

4.4 Individuals understand how to retrieve and apply LL. IR230-2

4.5 There is a defined work process which requires the retrieval and application of LL. IR230-2

4.6 LL implementation process is effective. IR230-2

#### 5.0 Resources

5.1 The IT resources used in the organization enhance the ability of the LL program. IR230-2

5.2 LL program IT system is integrated with other IT systems. IR230-2

5.3 LL program has adequate human resources to manage/administer the process. IR230-2

5.4 Individuals are trained to use the LL program effectively. IR230-2

5.5 Individuals are given the time and resources needed to use and contribute to the LL program. IR230-2

#### 6.0 Maintenance and Improvement

6.1 Maintenance of LL program is constant and ongoing. IR230-2

6.2 Feedback from individuals is solicited to improve the LL program. IR230-2

6.3 Metrics are used to evaluate the performance of the LL program. IR230-2

#### 7.0 Culture

7.1 Individuals participate in the LL program because they understand the value of the system. IR230-2

7.2 Communities of practice encourage their members to use the LL program to avoid/solve project problems or enhance performance. IR230-2

7.3 The Lessons Learned process is an ingrained part of day-to-day activities for all individuals. IR230-2

**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*
Section 3: CII Publication References

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

**Implementation Resource**
- IR230-2 Implementation of Lessons Learned Programs

**Research Summary**
- RS230-1 Effective Management Practices and Technologies for Lessons Learned Programs

**Research Report**
- RR230-11 An Analysis of Lessons Learned Programs in the Construction Industry, Second Edition
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 recognized leaders for the purpose of determining best practices that lead to superior performance when adapted and utilized.

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

- Process (structured/systematic)
- CII Best Practice oriented
- Part of a continuous improvement process
- Understanding what is important to your organization (critical success factors)
- Measurement, comparison, gap analysis against leaders
- Adapting practices to your organization

Benchmarking and Metrics is a defined process and method with defined steps and activities (see Figure 8.05-1):

1. Obtain organization commitment to benchmark as a basis for improvement.
2. Identify person responsible for Benchmarking coordination – Benchmarking Associate.
   - Learn about the CII Benchmarking and 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?
6. Use the Benchmarking & Metrics Implementation Toolkit to train internally (see Figure 8.05-2) – https://www.construction-institute.org/scriptcontent/toolkit/tool_home.cfm

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.


13. Develop and implement improvement plan using CII publications.

14. Repeat steps 5–13 for continuous improvement.
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 wisdom without paying the high price of first-hand experience.

- Implementation of benchmarking at the organization 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 can focus on those practices.

- CII Benchmarking & Metrics delivers tangible benefits:
  - Builds a performance culture.
  - Highlights strengths and weakness.
  - Allows focus on improvement where needed without wasting scarce resources.
  - Avoids making mistakes in project implementation.
  - Organizational level benchmarking yields positive bottom line.
  - Provides understanding and focus on most effective practices for greater bottom-line impacts.
8.05 Benchmarking and Metrics

- CII Benchmarking is compelling.
  - Provides information not available elsewhere.
  - Provides source of analysis to drive improvement:
    - Integrates with other data sources
    - Industry-level analysis
    - Measurement of best practices

- Provides multiple perspectives of performance
  - Quantifies Value
  - Confidential

Figure 8.05-3. Proven Results from Benchmarking Efforts – Pharmaceutical and Biotechnology Owners Benchmarking Program

Figure 8.05-4. CII Benchmarking Safety Results

Version 4.0 / 23Feb12
Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Senior management of organization has committed to benchmarking as a basis for improvement.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Person selected to be Benchmarking Associate for the organization and responsible for benchmarking coordination.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 Attended Benchmarking Associate’s Training focusing on metrics and terminology, online data entry, organization and industry reports.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 Project Managers identified for benchmarking and improvement.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Level of use determined based upon performance measurements to be utilized.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 Benchmarking Associate utilizes Benchmarking Toolkit for training of Project Managers.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 Specific projects selected for benchmarking which provide a realistic benchmark of the organization.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 Project benchmarking data input during project execution phases.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 Interim online CII recommendations acted upon to close gap between level of performance and best in class performance.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0 Project closeout questionnaires finalized and submitted for validation and review by CII.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.0 Assistance provided to CII Account Manager for validation of projects for placement into the benchmarking database.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0 Self-analysis performed to compare performance and CII Best Practice use compared to same industry group and cost category.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.0 Improvement plan developed and implemented using CII publications as basis for improvement.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.0 Steps 5–13 repeated for continuous improvement to obtain best in class performance.</td>
<td>IR BMM-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Implementation Resources

- BMM2010-4  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

- BMM2002-3  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 the process of incorporating a balanced change culture of recognition, planning, and evaluation of project changes in an organization to effectively manage project changes. These changes include: scope, error, design development, estimate adjustments, schedule adjustment, changed condition, elective, or required.

Elements

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

Figure 8.09-1. The Principles of Effective Change Management

- A classification process is used to determine if the change is a required or an elective change.
- For a required change, immediate focus should be 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 degree of success in achieving some quality objective (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.
- Collections, storage, and accessibility of relevant data throughout the life of the project can be used to make management decisions and measure changes.
- Data collection system must facilitate the timely presentation of analyzed data to the appropriate decision makers.
8.09 Change Management

- Use established benchmarks to monitor project performance.
- Recording or reporting system must be consistently used by all team members to document all changes.
- Recognition/reward system for those who initiate beneficial change.
- Agreements must exist between the project participants at the different levels of the project.

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

<table>
<thead>
<tr>
<th></th>
<th>Measurable</th>
<th>Significant</th>
<th>Influenceable</th>
<th>Repeatable</th>
<th>Timely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Available for Decision</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Type</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Time</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Nature</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Work Packages Affected</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Source</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Completion Status</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function/ Craft</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 in 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.
Figure 8.09-2. Impact of Change Management on Cost Growth—Owner

(Ref.: BMM2010-4, CII Value of Best Practices Report)
## Section 2: Implementation Assessment

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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 The change management process is specified in project contracts.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Principal project participants familiar with documented change management process and used it to actively manage project changes.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 Baseline project scope established early in project and frozen with changes managed against this base.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 Areas susceptible to change identified, evaluated for risk during project design.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Project changes evaluated against business drivers and success criteria for project.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 All changes require formal justification.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 All parties agreed to process for approving change before implementing it.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 System in place to ensure timely communication of change information to proper disciplines and project participants.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 Project personnel taking proactive measures to promptly settle, authorize, and execute change orders on project.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0 Project contract addresses criteria for classifying change and basis for adjusting contract.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.0 Tolerance level for changes established, communicated to all project participants.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0 All changes processed through identified owner representative.</td>
<td>SP43-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **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
Section 3: CII Publication References

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

Implementation Resource
SP43-1 Project Change Management

Education Modules
EM113-22 Scope Control and Change Management, Instructor’s Guide
EM113-22A Scope Control and Change Management, Participant Handbook

Online Education Course
TAL113-32 Scope Control and Change Management

Research Summaries
RS158-1 Quantifying the Cumulative Impact of Change Orders for Electrical and Mechanical Contractors
RS153-1 The Field Rework Index: Early Warning for Field Rework and Cost Growth
RS43-2 Quantitative Effects of Project Change
RS6-10 Impact of Changes on Construction Cost and Schedule

Research Reports
RR158-11 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
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 alternate dispute resolution process to eliminate the necessity to take disputes 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.
10.01 Disputes Prevention & Resolution

Contractor objects to any decision, action, or order of owner.

Owner considers objection and gives decision.

- OR - Either owner or contractor may give written notice and submit any disagreement, claim, or controversy to board.

Accept decision

Matter resolved

Decision is final unless either party submits dispute to board.

Accept decision

Matter resolved

Decision is submitted to board and hearing is scheduled.

Hearings are held. Board makes written recommendation to parties.

Accept recommendation

Matter resolved

Parties receive board recommendation and respond in writing.

Reject recommendation

Parties resort to other methods of settlement.

Figure 10.01-1. Dispute Review Board Process Flow Diagram from IR23-2
Table 10.01-1. Dispute Review Board Methodology from IR23-2

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 in writing and are made directly to the project participants who are responsible for accepting, appealing, or rejecting recommendations.
### Table 10.01-1. Dispute Review Board Methodology from IR23-2 (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

- 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

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Disputes Review Board (DRB) consistently stipulated in contract and subcontract documents.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Partnering principles consistently used on project.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 DRB team consistently included in partnering.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 DRB team established in early stages of all projects.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Neutral team members on DRB.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 DRB team members experienced on this type of project.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 DRB team operating procedures established.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 Limits to authority of DRB team established.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 DRB team compensation established.</td>
<td>IR23-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| | 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
IR23-2  Prevention and Resolution of Disputes Using Disputes Review Boards

Research Summaries
RS23-1  Disputes Prevention and Resolution Techniques in the Construction Industry
RS24-1  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 assist owners and/or contractors a way to assess the diverse set of political, geographic, economic, environmental, regulatory, security, and cultural risks a project faces.

**Elements**

Project Risk Assessment:

- 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 of risk during the project’s life cycle.
- will indicate 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.
- is flexible to meet the needs of almost any individual project.

This process is principally supported by CII IR181-2, *International Project Risk Assessment (IPRA)*, which consists of four main Sections, each divided into a series of Categories, in turn further divided into Elements (specific risk factors), as illustrated in Figure 10.06-1. A complete list of the IPRA’s four sections, 14 categories, and 82 elements can be found in IR181-2. **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.
Benefits

Effective utilization of Project Risk Assessment improves project performance in terms of cost, schedule, and scope as can be seen from the following charts.

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

- Project Risk Assessment can provide numerous benefits to the project team. These include:
  - A checklist for determining the risk potential of a project.
  - Standardized risk terminology.
  - A process for identifying and assessing risk to facilitate prediction of disruptions, potential for disputes, etc.
  - A means to monitor progress in addressing risk control at various stages during 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) identified PRA to be a CII Best Practice based on CII Benchmarking & Metrics data captured in Figures 10.06-2 through 10.06-6.

**Figure 10.06-2. Contractor Benefits**

![Chart showing Project Cost Growth for PRA performed prior to authorization and after authorization.](chart)

- PRA Performed prior to Authorization (n=22)
  - Project Cost Growth = \( \frac{\text{Actual Project Cost} - \text{Budget Project Cost}}{\text{Budget Project Cost}} \)
  - Project Cost Growth: 6.3% ± 9.4% (p=0.03)

- PRA Performed after Authorization (n=11)
  - Project Cost Growth: -3.1% ± 15.3%

**Figure 10.06-3. Owner Benefits**

![Chart showing Project Schedule Growth for no/informal risk assessment and formal risk assessment.](chart)

- No/Informal Risk Assessment (n=29)
  - Project Schedule Growth = \( \frac{\text{Actual Project Duration} - \text{Planned Project Duration}}{\text{Planned Project Duration}} \)
  - Project Schedule Growth: 13.2% ± 21.2% (p=0.03)

- Formal Risk Assessment (n=42)
  - Project Schedule Growth: 3.1% ± 10.1%
11.06 Project Risk Assessment

**Change Cost Factor**

- No/Informal Risk Assessment (n=29)
- Formal Risk Assessment (n=42)

Change Cost Factor = \( \frac{\text{Approved Change Cost}}{\text{Actual Change Cost}} \)

**Figure 10.06-4.** PRA Owner Benefits

**TRIR**

- Partial/Variable Involvement (n=23)
- Appropriate Involvement of Relevant Members (n=43)

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

**Figure 10.06-5.** Safety Improvement
11.06 Project Risk Assessment

**Figure 10.06-6**: Rework Cost Reduction

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

<table>
<thead>
<tr>
<th>PRA Performed prior to Authorization (n=17)</th>
<th>PRA Performed after Authorization (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

\[ p = 0.06 \]

1.4%
### Section 2: Implementation Assessment

#### Best Practice: 10.06 Project Risk Assessment

**Knowledge Area: 10.0 Risk Management**

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Project managers are adequately trained on the Project Risk Assessment (PRA) process.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Project risk assessment was frequently conducted.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 An outside facilitator was used to conduct risk assessment.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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 the viability of a project prior to moving forward with design and construction.</td>
<td>IR181-2 IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Senior management of the organization sees the benefits of following the FEP and conducting a PRA.</td>
<td>IR181-2 IR213-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 Project team members adequately represent the project stakeholders, including involvement from both owners and contractors to develop and define a risk mitigation plan.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 The IPRA process aligns key stakeholders with the project's risks and the defined risk mitigation plan is executed.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 Risk mitigation costs and contingency are added to the authorized budget as a result of the risk assessment process.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 The project mitigation plan's schedule impact(s) are properly reflected in the project schedule as a result of using the IPRA.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0 The risk assessment process is well documented on each project.</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.0 The risk mitigation plan is frequently updated on each project</td>
<td>IR181-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Preliminary Assessment Score

| Preliminary Assessment Score | 0 |

#### Maximum Attainable Score (11 x 3 = 33)

| Maximum Attainable Score (11 x 3 = 33) | 33 |

#### Normalized Score (Preliminary Assessment Score / Maximum Attainable Score) x 100

| 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: 10.06 Project Risk Assessment
Knowledge Area: 10.0 Risk Management

Implementation Resource
IR181-2 *International Project Risk Assessment (IPRA)*

Education Modules
EM181-21 *International Project Risk Assessment*, Instructor’s Guide
EM181-21K *International Project Risk Assessment*, Classroom Kit

Research Summary
RS181-1 *Risk Assessment on International Projects: A Management Approach*

Research Report
RR181-11 *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 implementation, auditing, and incentive efforts 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 accident/safety program will be developed for each project.
• A site safety professional will be assigned full time for safety for each project.
• A zero accident/safety orientation will be conducted for all new personnel including subcontractor personnel.
• A zero accident/safety incentive and award program will be developed for each project.
• Weekly zero accident/safety toolbox meetings will be conducted for each project that all personnel, including subcontractors’ personnel, are required to attend.
• Project zero accident/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 (RS216-1)
  – Focus on specific hazards and not general safety issues
  – Initiation/motivation for proactive awareness
  – Benchmark/goals established
  – Assign a champion
  – Development of a program
  – Communication of goals
  – Monitoring and Inspecting for compliance
  – Corrective action or intervention
  – Measurement and recognition of success
11.01 Zero Accidents Techniques

- Elements for Shutdowns, Turnarounds, and Outages (RS160a-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 (RS190-1)
  - 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 verifying the comprehension of the training
  - Assigning a full-time safety representative on site

Benefits

- Protection of employee’s life and health
- Reduced insurance costs
  - Improved experience modification rate
  - Improved incident rate
  - Improved frequency rate (see Figures 11.01-1 and 11.01-2)
  - Improved severity rate
  - Ability to compete for new projects
  - Repeat business
Figure 11.01-1. Total Recordable Incident Rate
(For the latest chart see the latest CII Safety Report in the CII Store.)

* OSHA Construction Division, NAICS 236–238 (SIC 15–17) Reflects OSHA Reporting Change

Figure 11.01-2. DART Rate
(For the latest chart see the latest CII Safety Report in the CII Store.)
11.01 Zero Accidents Techniques

Figure 11.01-3. Impact of Zero Accident Techniques on TRIR—Owners

Figure 11.01-4. Impact of Zero Accident Techniques on TRIR—Contractors
## Section 2: Implementation Assessment

### Best Practice: 11.01 Zero Accidents Techniques

#### Knowledge Area: 11.0 Safety, Health, and Environment

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 A program is in place for the careful selection of safe contractors.</td>
<td>RS190-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 Written, site-specific zero accident/safety plan for each project.</td>
<td>Pub. 32-1, Appx. D: A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 Zero accident/safety professional on each project site full-time.</td>
<td>Pub. 32-1, Appx. D: I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 Written zero accident/safety incentive awards program for hourly craft employees, including subcontractor employees, on each project site.</td>
<td>Pub. 32-1, Appx. D: K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Each project requires zero accident/safety orientation for all new employees, including subcontractor employees.</td>
<td>Pub. 32-1, Appx. D: L, M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 Each project requires weekly zero accident/safety toolbox meetings, including subcontractors.</td>
<td>Pub. 32-1, Appx. D: G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 Each project requires pre-hire substance abuse testing of all employees, including subcontractor employees.</td>
<td>Pub. 32-1, Appx. D: O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 Each project requires random substance abuse testing of all employees, including subcontractor employees.</td>
<td>Pub. 32-1, Appx. D: O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 Each site requires on-site OSHA safety training.</td>
<td>Pub. 32-1, Appx. D: E, M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0 Corporate safety personnel conduct frequent safety audits.</td>
<td>RS160-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.0 Near-misses are frequently investigated.</td>
<td>RS160-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0 Safety risks are systematically identified in the pre-construction phases of each project.</td>
<td>RS160-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Preliminary Assessment Score

- **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*
11.01 Zero Accidents Techniques

Owner-specific Items

<table>
<thead>
<tr>
<th>Implementation Assessment Element</th>
<th>CII Document</th>
<th>Element Score*</th>
<th>Organization Documents Reviewed &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.0 There are established processes and funding for a safety recognition program.</td>
<td>RS190-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.0 A full-time onsite safety representative has been assigned.</td>
<td>RS190-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 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
- SP32-2 Zero Injury Economics

Education Modules
- EM160-21 Making Zero Accidents A Reality, Instructor’s Guide
- EM160-21K Making Zero Accidents A Reality, Classroom Kit

Online Education Course
- TAL5-31 Construction Safety: Zero Accident Techniques

Research Summaries
- RS216-1 Targeted Safety Programs
- RS190-1 The Owner’s Role in Construction Safety
- RS160A-1 Making Zero Accidents A Reality: Focus on Shutdowns, Turnarounds, and Outages
- RS160-1 Safety Plus: Making Zero Accidents A Reality
- RS32-1 Zero Injury Techniques

Research Reports
- RR216-11 Targeted Safety Programs
- RR190-11 The Owner’s Role in Construction Safety
- RR160A-11 Making Zero Accidents A Reality: Focus on Shutdowns, Turnarounds, and Outages
- RR101-11 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
- WS11-02 The Owner’s Role in Construction Worker Safety
- WS11-01 Improving Safety Performance with Upstream Indicators
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Aramco Services Company
ArcelorMittal
Archer Daniels Midland Company
Architect of the Capitol
BP America
Barrick Gold Corporation
Bristol-Myers Squibb Company
CITGO Petroleum Corporation
Cameco Corporation
Cargill
Chevron
ConocoPhillips
DTE Energy
The Dow Chemical Company
DuPont
Eastman Chemical Company
Ecopetrol
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General Electric Company
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Hovensa
International Paper
Irving Oil Limited
Kaiser Permanente
Kinross Gold Corporation
Koch Industries
Eli Lilly and Company
LyondellBasell
Marathon Oil Corporation
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NOVA Chemicals Corporation
Occidental Petroleum Corporation
Ontario Power Generation
Petroleo Brasileiro S/A - Petrobras
Petroleos Mexicanos
Praxair
The Procter & Gamble Company
SABIC - Saudi Basic Industries Corporation
Sasol Technology
Shell Global Solutions US
Smithsonian Institution
Southern Company
Statoil ASA
Teck Resources Limited
Tennessee Valley Authority
TransCanada Corporation
U.S. Army Corps of Engineers
U.S. Department of Commerce/NIST/Engineering Laboratory
U.S. Department of Defense/Tricare Management Activity
U.S. Department of Energy
U.S. Department of Health and Human Services
U.S. Department of State
U.S. Department of Veterans Affairs
U.S. General Services Administration

AMEC
AZCO
Alstom Power
Audubon Engineering Company
Aveng Group
BIS Industrial Services
Baker Concrete Construction
Bateman Engineering
Bechtel Group
Bentley Systems
Black & Veatch
Burns & McDonnell
CB&I
CCC Group
CDI Engineering Solutions
CH2M HILL
CSA Group
Corewors
Day & Zimmermann
Dresser-Rand Company
eProject Management
ENGlobal Corporation
Emerson Process Management
Faithful+Gould
Flad & Associates
Flint Energy Services
Fluor Corporation
Foster Wheeler USA Corporation
GS Engineering & Construction Corporation
Gross Mechanical Contractors
Hargrove Engineers + Constructors
Hilti Corporation
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JV Driver Projects
Jacobs
KBR
Kvaerner North American Construction
Lauren Engineers & Constructors
Matrix Service Company
McDermott International
Midwest Steel
M. A. Mortenson Company
Mustang
Parsons
Pathfinder
Quality Execution
S&B Engineers and Constructors
SAIC Constructors
SKEC USA
SNC-Lavalin
SOG – Óleo e Gás S/A – SETAL
The Shaw Group
Siemens Energy
Technip
URS Corporation
Victaulic Company
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