

# Sustainable Design and Construction for Industrial Construction: Implementation Resources



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# Sustainable Design and Construction for Industrial Construction: Implementation Resources

*Prepared by the  
Sustainable Design and Construction for Industrial Construction  
Research Team*

*Implementation Resource 250-3*

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## Executive Summary

This CII publication was prepared to help increase the understanding of sustainability for members of the following industrial sectors: manufacturing, mining, minerals and metals, pharmaceutical, petrochemical, pulp and paper, power, and utilities. Members of industrial organizations can evaluate the sustainability of their construction projects using the resources for sustainable development presented here: 1) the Checklist for Sustainable Industrial Construction Job Sites; 2) the Quick Start Guide; 3) the two Industrial Construction Sustainability Maturity Models; and 4) a proposed Industrial Sustainability Index Metric (ISIM). Detailed information on the research conducted by the CII Sustainability in Industrial Construction Research Team (RT 250) is available in CII Research Report 250-11.

This publication contains four chapters. Chapter 1 is an introduction. The Checklist for Sustainable Industrial Construction Sites in Chapter 2 can be used to help assess the sustainability of industrial construction projects. Chapter 3 includes the Quick Start Guide for starting the implementation process for a sustainability program. It also presents the two Sustainability Maturity Models, both of which can be used to evaluate current levels of sustainability. Chapter 3 further includes a pilot Industrial Sustainability Index Metric (ISIM) that is proposed as a method for measuring the sustainability of construction materials as they move through the supply chain. The ISIM is still in the development stage and requires additional research to validate its usefulness to the industrial construction industry and to provide quantifiable data.



## Introduction

The focus of most sustainability research primarily relates to green buildings and does not address projects in the heavy industry sector of the construction industry. In an effort to obtain information on how industrial construction firms can incorporate sustainability practices during the construction of projects, CII established the Sustainable Design and Construction in Industrial Construction Research Team (RT 250). This publication presents one aspect of this study's findings: the actual tools that RT 250 developed. These tools are 1) the Checklist for Sustainable Industrial Construction Job Sites; 2) the Sustainability Quick Start Guide; 3) two Industrial Construction Sustainability Maturity Models; and 4) a proposed Industrial Sustainability Index Metric. The research team produced another implementation resource entitled, *Sustainable Design and Construction for Industrial Construction: A Primer* (IR 250-2). Readers are encouraged to obtain that publication from CII.

Implementing sustainable development practices during industrial construction projects would be beneficial to the environment; this is true especially in the area of material selection, since there is so much embodied energy involved in the extraction, production, and transportation of construction materials. If designers were to incorporate materials that are reusable, recyclable, or that require fewer resources to produce and transport, then those efforts could result in environmental benefits. Similarly, if the methods used produce less waste, the amount of unused construction materials that require disposal will be reduced. At the end of the useful life of a project, the materials that are removed should be recycled or reused rather than disposed of in landfills.

On industrial construction projects, the following areas would most benefit from implementing sustainability practices:

- Planning and financing modifications
- Design modifications
- Material production
- Material transportation
- Resource efficiency

- Selection of environmentally neutral materials
- Alternative energy sources
- Alternative construction equipment and fuel sources
- Compliance with government regulations
- Supplier and vendor social responsibility
- Social and community impacts of projects
- Production operations.

The information that is included in this document is applicable to the following industrial construction sectors:

- a. Manufacturing
- b. Mining, Minerals, and Metals
- c. Petrochemical
- d. Pharmaceutical
- e. Power
- f. Pulp and Paper
- g. Utilities.

The Checklist for Sustainable Industrial Construction Sites (see Chapter Two) can be used to evaluate the sustainability of construction operations or to help incorporate sustainable practices into construction operations. Most of the checklist topics include a reference number to a chapter and section number in *Sustainable Design and Construction for Industrial Construction: A Primer* (IR 250-2), where additional information is provided. Some of the checklist topics include references to other sources for additional information.

## 1.1 Data Collection

The information included in this publication was collected from a variety of U.S. and global sources, including refereed journals, government agencies, government documents, environmental agencies, industrial publications, company annual reports, industry associations, and other data sources. For

detailed information on the data collection process, see CII Research Report 250-11. Data were also collected using a knowledge acquisition system from 30 industrial construction experts; this knowledge includes the perspectives of owners, contractors, and suppliers in the industrial construction industry. The survey used for this research requested information on what sustainability programs and practices are being implemented by industrial firms and on how firms are evaluating their sustainability practices. A copy of the survey and the detailed survey results are available in CII Research Report 250-11. The survey participants provided information on

- sustainability programs currently being utilized.
- implementation of sustainability programs.
- evaluation of sustainability programs.
- barriers to implementing sustainability programs.
- drivers to the implementation of sustainable development practices.
- economic benefits of using sustainable development practices.
- social conditions addressed during construction.
- sustainable alternatives to traditional construction materials.
- measuring the benefits of using sustainable practices on projects.
- techniques for improving sustainable development.
- use of innovative sustainable designs or construction components.
- recycling and reusing wastes generated during construction projects.
- pollution prevention techniques.
- methods for organizations to measure metrics related to sustainable objectives.



## Checklist for Sustainable Industrial Construction Sites

In this chapter, RT 250 provides its checklist for construction personnel who want to evaluate whether they are incorporating sustainable practices and materials into industrial construction projects. Listed in parentheses beside the main categories of checklist items are references to pertinent sections of *Sustainable Design and Construction for Industrial Construction: A Primer* (IR 250–2). Also provided in parentheses are references to specific tables or figures in IR 250-2, and recommendations of other resources that will provide detailed information on the various categories.

The checklist contains 14 categories and numerous subcategories that pertain to construction site activities, along with suggested strategies for sustainability.

### 1. Site Staging and Logistics

- *Temporary Parking* (2.3, 4.2, 2.10.2, 4.3.1, 6.1.4, 6.1.5, 7.4 and Tables 6.1, 7.1, and 7.2)
  - ☐ Review paving materials for environmental reusability.
  - ☐ Use recycled base course materials
- *Temporary Offices* (2.9)
  - ☐ Place facilities with proper solar orientation.
  - ☐ Increase insulation in temporary structures.
  - ☐ Use reusable modular structures.
  - ☐ Use non-toxic sanitation facilities.
  - ☐ Design and construct to take advantage of natural lighting.
  - ☐ Lease or buy used furniture for temporary offices.
  - ☐ Purchase energy-efficient office equipment.
    - ☐ Specify EPEAT monitors and computers for site office equipment.
    - ☐ Use equipment that has sleep mode.
    - ☐ Use printers that print double-sided.
  - ☐ Provide recycle bins.
  - ☐ Use computerized document control.
  - ☐ Reduce use of hard-copy documentation.
  - ☐ Use recycled paper products.
  - ☐ Investigate use of Building Information Modeling (BIM) computer software to help reduce the number of job site design changes or to improve the efficiency of job site changes.

### 1. Site Staging and Logistics (continued)

- *Layout of Structures* (1.3.3, 2.3, 7.11 and Tables 2.1 and 2.2)
  - ☐ Reduce inadvertent ecosystem encroachment.
  - ☐ Minimize disruption to local community.
  - ☐ Reduce noise and spatial pollution.
  - ☐ Minimize removal of natural vegetation.
  - ☐ Place facilities with proper solar orientation.
- *Material Ordering, Delivery, and Lay Down Yard* (Chapter 7)
  - ☐ Order in pre-measured lengths to minimize cutting waste.
  - ☐ Order in quantities packaged in bulk rather than individually.
  - ☐ Locate lay down yard to reduce impact to site and to reduce energy requirements for moving materials.
  - ☐ Reduce amount of time delivery trucks are waiting to be unloaded.
  - ☐ Minimize number of times materials have to be moved around the job site.
- *Efficient Onsite Transportation Patterns* (transportation engineering and productivity improvement textbooks)
  - ☐ Perform traffic study.
  - ☐ Perform process analysis study.
- *Minimizing Disruption of Surrounding Traffic* (productivity improvement books)
  - ☐ Reduce number of trips.
  - ☐ Contract with local suppliers to reduce trip distances.
  - ☐ Store materials close to site.
  - ☐ Perform process analysis study.

### 2. Site Waste Management Plan (1.6, 2.2.1, 2.3.4.2, 2.4, 2.5, 2.6, 2.9, 2.10.2, 3.5, 6.1, 7.3.2, and Tables 2.4 and 2.5)

- ☐ Mulch or compost vegetation debris.
- ☐ Prepare a toxic waste spill plan.
- ☐ Investigate recycling services.
- ☐ Resell reusable wastes.
- ☐ Use licensed hazardous waste disposal services.

### 3. Site Erosion Plan and Control (epa.org)

- ☐ Follow Environmental Protection Agency regulations, even in foreign countries that may have lower standards