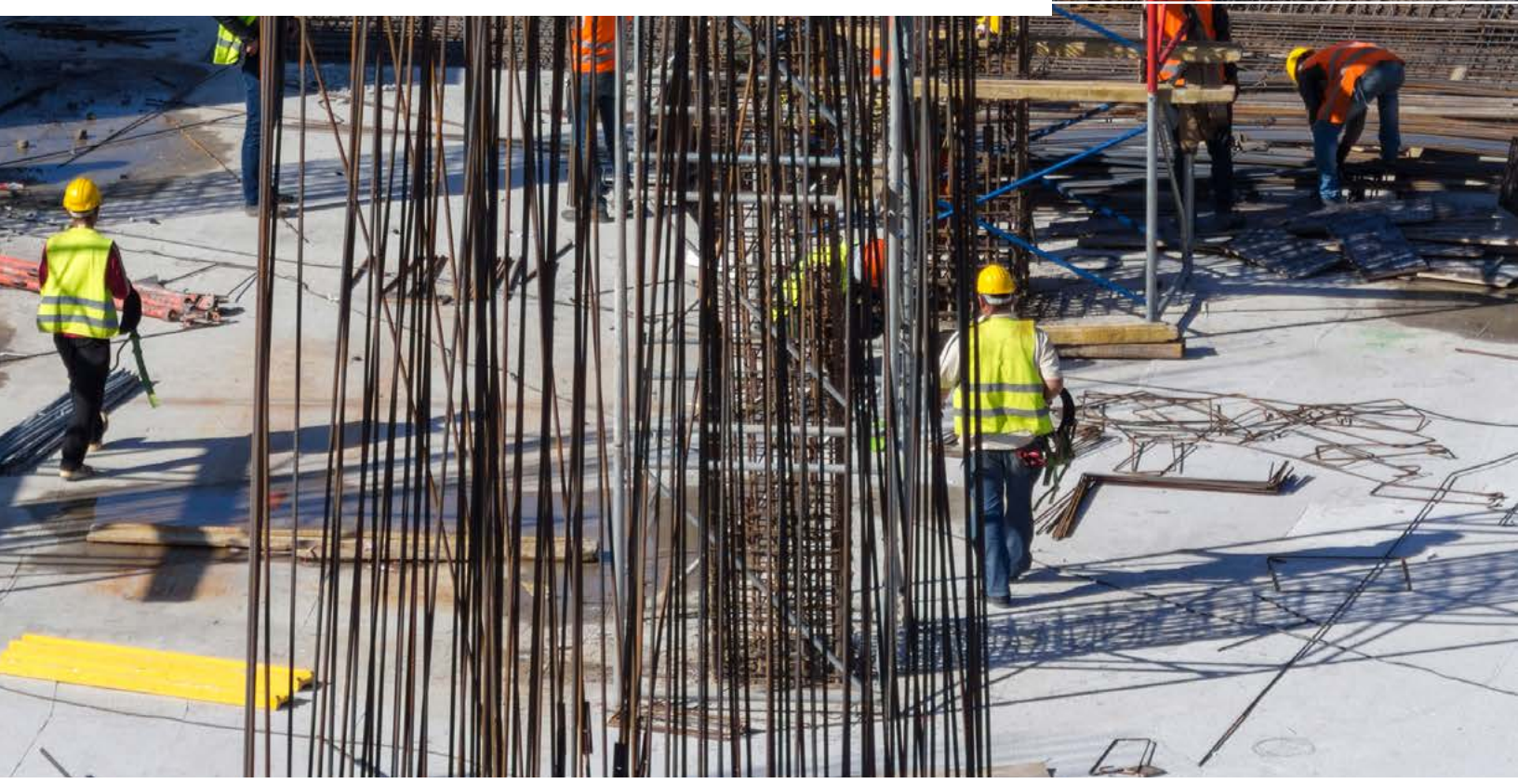
Guidance for **Trades**



This is a section of the document "CEC. 2015. *Improving Green Building Construction in North America: Guide to Integrated Design and Delivery.* Montreal, Canada: Commission for Environmental Cooperation. 84 pp." The full document is available at: http://www3.cec.org/islandora/en/item/11661-improving-green-building-construction-in-north-america-guide-integrated-design.

For the purposes of this Guide, "tradespeople" are defined as those who create, assemble, and install the elements that become a building. The final outcome of any project often relies on them.

Role to Play in an Integrated Approach

One of the main principles of integrated design and delivery is to involve the trades early in the design process in order to ensure that construction documents are complete, changes that might improve installation and maintenance are identified, and that all tradespeople begin construction with a full understanding of the systems they are asked to install. This is particularly necessary on green projects, where systems are carefully detailed for optimum performance and new technologies may be implemented. Having that feedback also reduces change orders and delays once the project moves into construction, which ultimately cuts costs (case study: Barus and Holley Hall, Prince Laboratory, p. 54). Not only does a greater understanding of design decisions help ensure that building features will be installed and assembled as intended, but the input that tradespeople can offer during design will help ensure that project documents are complete and avoid problems during construction.

Experienced, involved tradespeople can:

- **Offer design input using knowledge about how systems are installed.**
- **Provide input on constructability and installation processes.**
- **Remain vigilant to quality throughout construction to ensure green and other performance goals are achieved.**
- **Minimize change orders and delays once construction begins.**

The Trades Already Know the Value of Early Involvement

Many tradespeople are familiar with looking at architectural drawings and will know if they won't work or that they lack detail. These errors or omissions also lead to rework, for which the trades are held accountable. A study found that the estimated cost of rework typically accounts for 7 to 11 percent of total construction costs and frequently causes delays (Zach 2013). Those numbers do not include flawed installations that are not reworked. Any slight penetration of a critical barrier, or a valve installed upside down, can cause the most expensive system to underperform and, in the case of a green building, might cause the whole building to fall short of its performance goals.

Selling One's Expertise

Although early trade involvement is critical, the owner or general contractor may be hesitant to pay for the "extra" time. Tradespeople may have to make the case for their early involvement by demonstrating the value they bring to the table. In such cases it is helpful to emphasize experience in any project management or facilitation training that would be valuable in fostering coordination and communication between different trade groups. Those skills demonstrate an ability to act in a collaborative fashion. An owner or contractor pursuing integrated projects is also likely to be interested in performance testing skills, since it is increasingly common for the trades to test the performance of the systems they install, even before commissioning (CEC 2013).

> **"We kind of laugh at the integrative design process, because we've known all along that we are the ones that make it work—the drawings don't make it work. It's best to get us involved as early as possible."**
>
> – John Sullivan, UA Plumbers Local Union No. 1

The Integrated Building and Construction Solutions (IBACOS) sample "High Performance Scopes of Work" (Yost 2010) offers performance testing checklists that are sequentially linked to ensure that nothing gets missed in the handoffs between trades, and that can be a powerful tool for enhanced coordination. Those checklists are relevant to contractors working in residential foundation, framing, windows, drainage plane, air sealing and insulation, and heating, ventilation, and air conditioning (HVAC).

Exceptional expertise that you as a tradesperson might offer a project:

- **Emphasize any project management or facilitation training.**
- **Offer performance testing before commissioning process.**

Building on Lean Practices

With the mantra of "maximizing value while minimizing waste," Lean design and construction practices encourage collaboration as a means to efficiency and provide an entry point into integrated design and delivery because of some of their overlapping principles. They also support the efficient use of materials, which is an important sustainability objective. To that end, many Lean practices could be useful tools in an integrated project: The Last Planner® System consists of layers of increasingly detailed schedules that help effect a more reliable production schedule during construction, created by "collaborative pull scheduling;" Just-in-time Delivery offers a system that minimizes materials waste and storage problems; and Root Cause Analysis offers a collaborative problem-solving tool. These tools and more may all be incorporated into the construction process, but a focus on early alignment and participatory input in early design are still needed to ensure that they are successful.

Examples of key Lean practices to implement:

- **Last Planner® System**
- **"Pull" planning and production**
- **Just-in-time Delivery**
- **Root cause analysis ("5 Whys Analysis")**

Tools to Manage Obstacles

Integrated design and delivery will not prevent all possible obstacles and project-specific challenges that may arise, but it will help teams find solutions collaboratively without grinding to a halt. Lean construction offers some tools for managing obstacles, getting to the root of a problem, and finding the right person to find a solution. The "5 Whys Analysis" technique helps a team find the reasons for a problem by formulating a "why" question five times in response to each answer. This may be particularly useful to help identify who should be involved in finding a solution, since so many players have had a stake in the project by the time construction begins. (A short primer on the 5 Whys Analysis can be found at Six Sigma 2015.) Another tool, the "Constraint Log," helps keep track of challenges and holds certain players accountable for resolving a problem by a certain date. This ensures the project keeps moving forward, and that obstacles are resolved as they develop (Lean Construction Institute 2015).

- **5 Whys Analysis: The problem-solving technique used to dig for the root cause of a condition by asking "why" successively (at least five times) whenever a problem exists, in order to get beyond the apparent symptoms.**
- **Constraint Log: A list of constraints, with identification of an individual promising to resolve the item by an agreed-upon date. Typically developed during a review of the Six-Week Look-Ahead Plan when it is discovered that activities are not constraint-free.**

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