

**THE ROLE OF THE GENERAL CONTRACTOR  
IN SUSTAINABLE GREEN BUILDINGS:  
The Case Study of Two Buildings in The Leed Certification in Italy**

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**ABSTRACT**

The role of the General Contractor is fundamental to obtain the LEED (Leadership in Energy and Environmental Design) certification of a sustainable green building. The single most important aspect of the construction phase of a LEED project involves preparation and strict adherence to a site-specific LEED action plan. The plan addresses the process of ensuring compliance to LEED requirements from issuance of a subcontract until occupancy of the building. The LEED rating system assigns one prerequisite and several credits to the General Contractor in some environmental categories: Sustainable Sites, Materials and Resources and Indoor Environmental Quality. In the LEED certification, the general contractor must not only use eco-friendly building materials, but he must also arrange a jobsite that minimally impacts on environmental matrices (water, air, soil and subsoil). This is possible through the development and implementation of LEED construction plans involving the installation and continuous monitoring of specific measures and sustainable construction practices.

To illustrate the contributions that a qualified General Contractor can make towards the goal of LEED certification, in this paper we introduce the successful strategies

employed at two projects recently designed and constructed in Italy to achieve high ratings under LEED rating systems. The paper describes the process in the basic phases and provides specific examples of jobsite strategies that were used on two different projects and with activities targeted towards particular points on the LEED matrix. In particular the first case study is a project under the LEED New Construction v.2.2 rating system and the second is a building under the LEED for Schools.

Key words: Green Building, Eco-Friendly Building Materials, Sustainable Construction Practices.

### Introduction

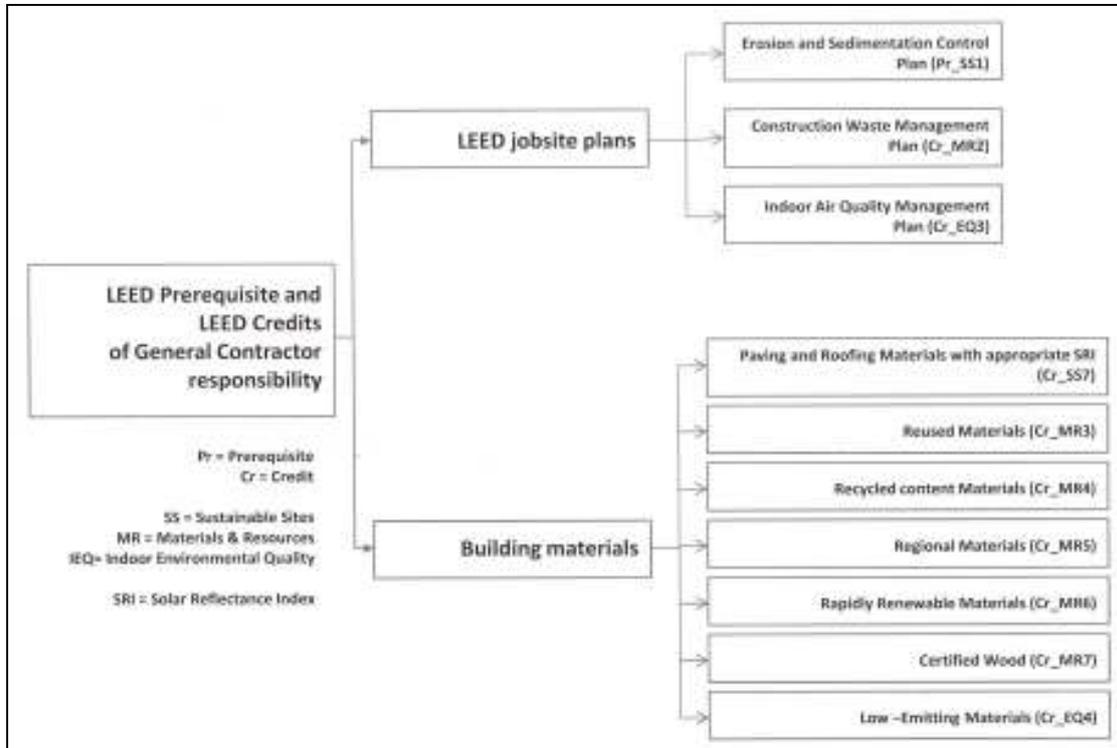
Leadership in Energy and Environmental Design (LEED) is a registered trademark of the U.S. Green Building Council (USGBC). In 2000, USGBC established the LEED rating system as a way to define and measure “green buildings.” LEED is an internationally recognized green building certification system, providing third-party verification that measures how well a building performs across all the metrics that matter most: energy savings, water efficiency, CO<sub>2</sub> emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. Points are awarded to meet LEED criteria according to the following scale: Certified, Silver, Gold, and Platinum.

The quality of a building that aims for LEED certification is achieved at all stages of the building process: design, construction and building management. The LEED certification is the result of a synergic work of designers, contractors, owners and building users.

A GC can provide input on aspects such as, material selection, system performance, decreasing construction waste, improving indoor air quality, etc.. The constructor can also assist in streamlining construction methods and constructability reviews in order to achieve the green project goals [1].

The adoption of the LEED rating system requires within the building firm a structured organization with clearly defined tasks and responsibilities to implement and verify the measures required by the LEED jobsite plans [2]. In addition to the implementation of the LEED jobsite plans, there is the constructor responsibility to select, purchase and install all the products that greatly contribute to the achievement of LEED credits regarding the building materials: reused building products, recycled content materials, materials extracted and manufactured at limited distance from the project site, rapidly renewable materials, low-emitting materials, certified wood, etc. In particular, the LEED rating system assigns one prerequisite and several credits to

the GC in some environmental categories: Sustainable Sites (SS), Materials & Resources (MR) and Indoor Environmental Quality (EQ), (see Figure 1).



**Figure 1 :** Overview of LEED prerequisite and LEED credits typically of responsibility of GC

### Case studies

To illustrate the contributions that a qualified GC can make towards the goal of LEED certification, in this paper we introduce the successful strategies employed at two projects recently constructed in Italy to achieve high ratings under LEED® rating systems.

Since 2008, many Italian projects are achieving the LEED certification. Our case studies are two buildings built in Trentino region (Italy) in the period 2008-2011 by the Martinatti Construction company. Currently (January 2012) both projects are under Construction review (see Figure 2).

The first one is the New multipurpose center of Ceole. The owner is Trentino Sviluppo Spa, an agency set up by the Autonomous Province of Trento for sustainable development of the Trentino system, by taking action and providing services aimed at supporting the growth of business skills and the capacity for innovation. The New multipurpose center of Ceole is a building of more 3000 square meters developed on

several levels. The building includes offices, meeting rooms, a doctor's office, a coffee bar area, a canteen with 100 seats and a technical area where Trentino Network manages the distribution of the fiber optic service in perspective of all users of the Arco town. The certification goal is LEED gold under LEED NC v.2.2.

The second one is the New elementary school of Romarzollo. The owner is the Municipality of Arco. This school is for 300 pupils. The building includes 14 classrooms, 4 laboratory classrooms, common areas, canteen for 200 seats, gym and facilities for extracurricular activities. The total area is about 4720 square meters. The certification goal is LEED platinum/gold under LEED for School.



**Figure 2 :** The New multipurpose center of Ceole and the New elementary school of Romarzollo (Arco-Italy).

### LEED action plan

The GC plays a vital role in the ultimate success of achieving the LEED rating. This paper is focused on the LEED aspects of the three phases where the Contractor's involvement is fundamental:

- Pre-Construction Phase
- Construction Phase
- Closing Phase

With regard to the Commissioning process, the Commissioning activities involve the GC and are completed during and after the Construction Phase. The GC, the Mechanical Contractor and the Electrical Contractor shall be responsible for cooperating, and coordinating their work, with the Commissioning Authority. But this article does not address the Commissioning process and the specific contribution of the GC in the implementation of the Commissioning plan.

### Pre-Construction phase

Key points of the Pre-Construction Phase are: the budget review and the site visit before starting the construction.

Early involvement of the GC can also provide the owner and designers with information related to cost implications of pursuing certain LEED credits. The qualified GC can develop “what-if” scenarios of cost implications of pursuing specific LEED credits. In addition, the constructor can also undertake life cycle cost analysis of materials and products to determine the optimum solution based on the owner’s requirements [2].

The qualified GC should analyze the initial cost budget to know what materials the project can target for the LEED goals. The subcontractor or supplier will appreciate not having to fill out forms for materials that are not relevant, or that have so little cost value that it is a waste of time [3].

The qualified GC should visit the construction site to assess the existing site-specific condition. This is critical to identify features of the land. Understanding the features of the construction site will help the GC develop a better plan to reduce pollution from construction as required by the LEED Prerequisite 1 of the Sustainable Site section.

In the Pre-Construction phase it is important to define the LEED jobsite quality control requirements. For this purpose the GC of the two case studies consulted an expert at developing Erosion and Sedimentation Control (ESC) Plans. Each construction project and ESC plan is unique. Visiting the site is the only way to develop a ECS plan that addresses the unique conditions at the site. Avoid copying ESC plans from other projects save time or money.

### Construction phase

Key points of the Construction Phase are: the jobsite quality control, the documentation and the promotion of the LEED culture throughout the trades and sub trades.

#### Jobsite quality control

The qualified GC should have a LEED consultant with the function of LEED coordinator. The LEED coordinator is an important figure to develop the site specific jobsite LEED plans. In addition, he should participate in the pre-bid meetings to assist the GC in clarifying the project LEED strategy and sustainable goals.

The specifics of the LEED action plan for the construction phase must be presented and discussed before any trade begins. The qualified GC should hold a pre-construction meeting with project managers and foremen to expose the LEED requirements of the Construction LEED Prerequisite and Credits. The orientation for subcontractors is very important, so they will understand what will be expected for the jobsite and the building materials. At this meeting each subcontractors should appoint its own internal coordinator to manage and collect information required to demonstrate LEED compliance.

The GC of the two case studies employed a LEED consultant in order to assure the jobsite quality control. For this the GC collaborated with the Laboratory of Building Design of the University of Trento. The LEED consultant supported the GC in the development of:

- the Erosion and Sedimentation Control (ESC) Plans for all construction activity associated with the projects (SS Pr1);
- the Construction Waste Management (CWM) Plans that identifies the materials to be diverted from disposal and to be sorted (MR Cr2);
- the Indoor Air Quality Management (IAQM) Plans for the construction and pre-occupancy phases of the buildings (EQ CR3.1).

In addition, the LEED consultant helped the GC to draw up the LEED specifications to attach to bid requests and to contractual documentation. The specifications produced for two projects were: General LEED Requirements, LEED Product Requirements, Waste Management and Disposal and Indoor Air Quality Requirements. During a Kick-off meeting pre-construction, the LEED coordinator explained to staff, workers and subcontractors the measures included in the LEED jobsite plans and the LEED requirements.

The qualified GC must carefully review manufacturer data. He needs to collect actual data, costs and test methods and procedures. The vague statements as “Our product will give you a certified wood LEED point” or “Our product is low emitting material” should not be considered. The review of the manufacturer data is important for the approval of building materials before installation.

The qualified GC should identify an on-site LEED operator to work with the foremen and workers on a continuing basis and to make site inspections. The on-site LEED manager checks the implementation of Best Management Practices (BMPs) of the LEED jobsite plans performing regular inspections. His regular presence on jobsite eliminates the possibility that the workers install materials not in compliance with LEED requirements and criteria. In addition, the LEED coordinator also should make periodic visits to the jobsite to verify the ESCP, CWMP and CWMP are being followed.

The qualified GC should train your staff and subcontractors in the basics of erosion and sedimentation control, good housekeeping, pollution prevention, waste management, etc.

For the two case studies the GC appointed an on-site LEED operator. The on-site LEED operators have been instructed by the LEED coordinator to check the jobsite quality with weekly and spot inspections. Site specific checklists for inspections were used to control the real installation and the efficiency of the measures included in the plans. After each inspection the on-site LEED operator completed an inspection report. The inspection reports were used to communicate to GC the need for maintenance or corrective actions. The GC organized short formal and informal training session (on site and in the offices) in order to train staff, subcontractors and suppliers on the implementation of the jobsite LEED requirements. During these meetings it is essential to explain the individual and company responsibilities of all parties involved in the LEED action plan during construction.

### Documentation

The qualified GC should be prepared to keep the material spreadsheets current. Many credits require documentation that can be compiled on a continuing basis, thus allowing the construction team to make informed decisions when faced with changing conditions. For example, if the spreadsheet shows that the recycled percentages of the materials installed exceed expectations, the construction team might choose a product with less recycled content but one that is locally manufactured.

The qualified GC should collect and file the materials documentation and organize a mid project audit with your LEED consultant to review the acquired documentation for completeness.

The qualified GC should understand the importance of the jobsite photos. The photos provide documentation for submittal to the certification reviewers. The GC also has the opportunity with photos to promote sustainable construction practices both on and off the jobsite.

For the two projects the GC used an office worker to collect and file the documentation of building materials. This person was able to keep material spreadsheets current for all of the Materials and Resources credits (C&D waste, recycled content materials, regional materials, rapidly renewable materials, certified wood, low emitting materials). Before the end of the construction for the first case study the material spreadsheet showed that the percentage of the regional materials installed has exceed expectation and it was possible to achieve an exemplary performance.

For both case studies the LEED consultant verified during a mid project audit that the LEED documentation that was being collected consistently and appeared complete and accurate. For both case studies the LEED operators took digital photographs to document the LEED jobsite plans and the installation of eco-friendly materials. In both cases taking photographs helped to identify areas where it was necessary maintenance and to document that maintenance was performed.

For instance, photos of isolated trash bins with signs identifying the types of materials that belong in each bin are useful for MR credit 2 (Construction Waste management). Photos of covered HVAC (Heating Ventilation Air Conditioning) duct openings, of equipments kept sealed in plastic prior to installation, of area kept clean during construction, of protection from moisture, etc. show conformance with EQ credit 3.1 (Construction Indoor Air Quality Management Plan during Construction) (see Figure 3).



**Figure 3 :** New elementary school of Romarzollo (Arco-Italy)- Covered HVAC ducts in conformance with the IAQ PIndoor Air Quality Management Plan during Construction.

#### Promote LEED culture throughout the sub trades

The successful LEED action plan relies on proper implementation by the workers. The qualified GC should go beyond the checklists and the specifications and look for ways to establish a culture that includes the goals of the plan. He should plan incentives for positive results.

Promoting LEED culture increases the chance of the project's success in reaching its certification goals. As the culture is founded, the individual workers will act as advocates for the plan. The plan will then be more likely to succeed [2]. For example, in both case studies, a good way to “market LEED” to the community of workers involved was to post and update signs showing progress towards the diverted construction waste from disposal.

### Closing phase (Project completion)

Key points of the Closing Phase are: the Air testing or flush out and the final documentation.

When construction is concluded and final cleaning is complete the qualified Contractor should perform a building flush-out or test air contaminant levels in the building prior to occupancy [4]. This must be decided during bid process to allow for either time in the schedule for ventilation and cost for testing in the budget. The flush-out is often used where occupancy is not required immediately upon substantial completion of construction. IAQ testing can minimize schedule impacts but may be more costly.

It is critical that qualified GC prepares a complete and consistent final documentation for the Construction LEED prerequisite and credits. For this purpose the LEED consultant plays an important role. He supports the GC to fill the LEED credits templates and to prepare the supporting documentation to submit to certification reviewers. An accurate and consistent final documentation can guard effectively against the following risks: requests for clarification and denied credits.

For both case studies the GC included the air quality testing in the IAQ management plans of two projects. The air quality testing was performed using testing protocols consistent with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air. Favorable test results were strong indicators that: the project has implemented a successful construction IAQ management plan, low-emitting materials have been used, a thorough cleanup has been given and the HVAC system provides adequate ventilation [5].

### Conclusion

The sustainable design process involves an active effort by all members of the design and construction teams. Earning a project certification requires a sustained effort by everyone on the team (owner, architects, engineers, contractors, commissioning agents, and subs) to ensure a project meets the design intent and goals of the LEED rating system and the credits that have been selected for the project.

A significant contributor to a building becoming LEED Certified is the GC. Contractors affect a relatively small percentage of the LEED credits on a project; therefore they should become experts in those credits.

For this purpose it is important to establish best practices for meeting the standards of those credits, and possibly earn innovation points for going above and beyond the credit standards. The qualified GC for the job is one that embraces widely the LEED

philosophy in the company and can demonstrate the management tools necessary for a successful, certified project.

The LEED action plan established for the two LEED projects presented in this article is summarized in the figure below (see Figure 4), but the paper does not address the Commissioning process. It is important that the owners and design teams have a deeper understanding of what they should expect from a “LEED capable” General Contractor. Owners and designers must be ensured that they are adding a team member that will augment their own commitment to the goal.

<p><b>Pre-construction Phase</b></p> <p>A. Budget review</p> <ul style="list-style-type: none"> <li>- develop “what-if” scenarios of cost implications</li> <li>- identify materials to target</li> </ul> <p>B. Site visit</p> <ul style="list-style-type: none"> <li>- assess the existing site-specific condition</li> <li>- define the LEED jobsite quality control requirements</li> </ul>
<p><b>Construction Phase</b></p> <p>A. Jobsite quality</p> <ul style="list-style-type: none"> <li>- have a LEED consultant</li> <li>- held Pre-construction meetings</li> <li>- review manufacturer data and approval of building materials before installation</li> <li>- continuous monitoring</li> <li>- continuous education of staff, subcontractors, workers</li> </ul>
<p>B. Documentation</p> <ul style="list-style-type: none"> <li>- ongoing monitoring of progress concerning LEED goals</li> <li>- collect and file the material documentation</li> <li>- carry out mid project audit</li> <li>- take photos</li> </ul> <p>C. LEED culture and goal throughout the trades</p> <ul style="list-style-type: none"> <li>- plan incentives for positive results</li> <li>- post and update signs showing progress towards the targeted LEED credits assigned to project</li> </ul>
<p><b>Closing Phase (Project completion)</b></p> <p>A. Air Testing or flush-out</p> <ul style="list-style-type: none"> <li>- schedule/cost consideration</li> </ul> <p>B. Final documentation</p> <ul style="list-style-type: none"> <li>- have complete and consistent documentation</li> </ul>

**Figure 4 :** General Contractor’s LEED action plan.

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