Leadership in Energy and Environmental Design

LEED® PREP BD&C

What You Really Need to Know to Pass the LEED AP Building Design & Construction Exam

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Putting It All Together: Construction, Operations, and Maintenance

The Construction Phase

The building's impact on the environment begins during the construction phase. Before that time, a building is just a concept on paper; during construction, that design assumes physical form and begins consuming resources. While the design team will continue to be involved with the project, the day-to-day operations on site are now the responsibility of the general contractor, who must be an integral part of the project team and who will implement the strategy developed in the design phase. A sustainable approach to construction leads to reduced resource use, reduced disturbance of the site, and can also lower costs. Attention to environmental issues during construction also leads to a safer, healthier working environment, first for those who construct the building, and later for those who occupy it.

Environmental guidelines can be established as a part of the construction documents and contract for the project. If contractors are required to follow specific environmental guidelines during the construction process, these requirements must be included in the contract, drawings, and specifications for the project. To develop and implement the guidelines, work with the entire team, including the architect, engineers, and contractors, to consider the best ways to educate contractors about sustainability issues and to get their early commitment to follow sustainability guidance.

Integrating construction guidelines with other sustainability guidelines is an essential part of the whole-building design process. As the project moves from design to construction, much of the responsibility for documentation of products and approaches is transferred to the builder, who will put design strategies discussed earlier in this chapter into effect. Therefore, to complete the requirements of the LEED credits and achieve the associated points, design features must be understood and properly implemented by the construction team. The contractor and subcontractors may be responsible for the following activities while building construction is under way.

- Collaborate with the design team to understand sustainability practices to be implemented on this project.
- Locate trailers, equipment, storage, and construction traffic, including the locations of site entrances and exits, to minimize site impact.

LEED Building Design & Construction Credit Summaries

For success on the second part of the LEED AP Building Design and Construction exam, it is valuable to commit to memory the key components of each prerequisite and credit. The LEED Building Design & Construction Credit Summaries condense information from the *LEED Reference Guide for Green Building Design & Construction* and present it in a format that makes it easier to memorize. The illustrations on the following page show where on each LEED credit summary page you'll find the information you need to know.

Each credit or prerequisite summary begins on a right-facing page (Fig. 11) and continues (when indicated) on to the page that follows. These summaries contain "blanks" throughout. Fill in the blanks as you work your way through each credit or prerequisite, and check your answers against those on the page that follows (Fig. 12). The following key will help guide you through each credit or prerequisite summary.

① **Where:** Answers the question, "Where in the LEED BD&C rating systems can I find this information?"
- Preceding the colon, the credit categories are identified as follows.
  - SS = sustainable sites
  - WE = water efficiency
  - EA = energy and atmosphere
  - MR = materials and resources
  - IEQ = indoor environmental quality
  - ID = innovation in design
  - RP = regional priority
- Following the credit category, the prerequisite (p) or credit (c) designation is identified.
- Following the prerequisite/credit designation, the prerequisite/credit number is identified.
- Following the colon, the prerequisite/credit name is identified.

② **When:** Answers the question, "During which submittal phase can the project team submit the letter template for this prerequisite/credit?"

③ **Who:** Answers the question, "Who is responsible for confirming and submitting the documentation required for this prerequisite/credit?"

④ **Why:** Answers the question, "Why does USGBC encourage project teams to implement this prerequisite/credit strategy?"

⑤ **What:** Answers the question, "What requirements does the project team have to meet to earn this prerequisite/credit?"

⑥ **How:** Answers the question, "How can the project team implement strategies to meet the requirements?"

⑦ **How many:** Answers the question, "How many points can the project team earn for implementing credit strategies?"

⑧ **Credit relationships:** Answers the question, "How does this prerequisite or credit relate to other LEED prerequisites and credits?"

- Symbols are used to indicate the relationships as follows.
  - **+** Identifies synergies (credits that the project team will be more likely to achieve by achieving this credit).
  - **–** Identifies tradeoffs (credits that cannot be achieved or are difficult to achieve if this credit's requirements are met).
  - **+/–** Identifies prerequisites/credits that could be a tradeoff or a synergy depending on the way the prerequisite/credit is implemented.
  - ✔ Identifies prerequisites/credits that the project team must achieve before achieving the credit.
  - Identifies credits that, if achieved in the LEED BD&C rating systems, will result in achievement for this credit in the LEED O&M rating system.

⑨ **References:** Answers the question, "Which references are needed to meet prerequisite/credit requirements?" (Further detail regarding these references can be found in the "LEED Referenced Standards" chapter, beginning on page 289.)

⑩ **What else:** Identifies key words and calculations crucial to understanding prerequisites/credits. (All key words are defined in the "Terminology" chapter, beginning on page 311.)

Figure 11 Sample Prerequisite/Credit Summary

①	where	**Stormwater Design—Quantity Control**	SSc6.1	New Construction
②			SSc6.1	Schools
③	**when**	design submittal	SSc6.1	Core & Shell
④	**who**	_____ engineer		
⑤	**why**	To reduce _____ and promote natural hydrology.		
⑥	**what**	Maximize infiltration and minimize pollution from runoff and _____.		
	how	By implementing a stormwater management plan. The post-_____ peak discharge rate and quantity must not exceed the predevelopment peak discharge rate and quantity for the 1- and 2-year 24-hour design storm.		
⑦	**how many**	1 point Exemplary performance: available, but variable and not standardized		
⑧	**credit relationships**	✔ SSc6.2: Stormwater Design—_____ Control – SSc2: Development Density and Community _____ LEED O&M rating system SSc6: Stormwater Quantity Control		
⑨	**references**	None.		
⑩	**what else**	The following terms are crucial to understanding this credit. • stormwater runoff • two-year, _____-hr design storm		

Figure 12 Sample Prerequisite/Credit Answer Key

Answer Key for SSc6.1

where	
when	
who	civil
why	runoff
what	contaminants
how	development
how many	
credit relationships	Quality Connectivity
references	
what else	24

where	**Daylight and Views—Daylight**	IEQc8.1	New Construction
		IEQc8.1	Schools
when	design submittal	IEQc8.1	Core & Shell
who	_____ consultant LEED AP architect		
why	To provide building occupants a connection to the _____.		
what	Provide daylight through one of the four options in at least _____% of the regularly occupied areas of the building. (And 75%–90% of classrooms for LEED for Schools).		
how	*Option 1:* By using _____ simulations. The daylit areas must achieve daylight illuminance levels of between 25 fc (250 Lux) and 500 fc (5300 Lux) in a clear sky condition on _____ 21 at 9 a.m. and 3 p.m. Only areas that provide view preserving automated shades for glare control can be included if they are meeting the 25 fc (250 Lux) minimum, but may exceed _____ fc (5300 Lux) . *Option 2:* By using a _____ compliance path. Project teams must use the equations and diagrams given in the LEED BD&C reference guide to demonstrate proper daylighting (according to the LEED metrics) in the regularly occupied spaces. A team can demonstrate compliance through side-lighting and top-lighting applications. • For side-lighting applications, calculations include visible light _____ and window to floor area. The window area included must be 30 inches (0.76 meters) above the finished floor. • For top-lighting applications calculations are based on the size, location, and quantity of _____ used in the daylight design. Skylight glazing must have a minimum visible light transmittance of _____. *Option 3:* By using records of indoor light _____. Daylit areas must achieve a minimum illumination level of 25 fc (250 Lux) measured on a 10 foot (30 meter) grid in 75% (and/or 90% for Schools) of all regularly occupied spaces. *Option 4:* By using a _____ of these demonstration methods. In all cases, provide daylight redirection and/or glare control devices where necessary.		
how many	1 point for LEED NC and LEED CS 3 points for LEED for Schools • 1 point for daylighting 75% of classroom spaces for LEED for Schools • 1 point for 75% for daylighting regularly occupied spaces for LEED NC and LEED CS, and optional additional point for LEED for Schools • 1 additional point for daylighting 90% of classroom spaces for LEED for Schools		
credit relationships	+ IEQc8.2: Daylight and Views–Views +/– EAc1: Optimize Energy Performance +/– EAp2: Minimum Energy Performance +/– IEQc6: _____ of Systems		
references	• ASTM: Standard D1003-07E1, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*		

Continued on next page

Answer Key for IEQc8.1

where	
when	
who	lighting
why	outdoors
what	75
how	computer September 500 prescriptive transmittance skylights 0.5 measurements combination
how many	
credit relationships	Controllability
references	
what else	light floor

The test method provides a means for periodic testing of surfaces in the field or in the laboratory. The precision of the average of several measurements is usually governed by the variability of reflectances on the surface being tested.

The value for solar reflectance determined by this method can be used to calculate the solar energy absorbed by an opaque surface using the equation $Q_{abs} = Aq_{solar}(1 - r)$. It is then possible to combine the absorbed solar energy with conductive, convective and other radiative terms to construct a heat balance around an element or calculate a Solar Reflectance Index (SRI).

Related Credits: *NC SSc7.1, NC SSc7.2, CI SSc1, CS SSc7.1, CS SSc7.2, O&M SSc7.1, O&M SSc7.2, Schools SSc7.1, Schools SSc7.2*

ASTM: Standard D1003-07E1, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.* This test method measures the amount of light that is scattered upon passing through a transparent material. It is used to evaluate the amount of light admitted by a skylight.

Related Credits: *NC IEQc8.1, CI IEQc8.1, CS IEQc8.1, O&M IEQc2.4, Schools IEQc8.1*

ASTM: Standard E408-71, *Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection Meter Techniques*. These nondestructive test methods rapidly determine the total normal emittance, or emmissivity, of surfaces by means of portable, inspection-meter instruments. *Total normal emittance* (*N*) is defined as the ratio of the normal radiance of a specimen to that of a blackbody radiator at the same temperature. *Emittance* measures a material's ability to shed heat, and values can be from 0 to 1. The *emittance value* is used to calculate a material's solar reflective index.

Related Credits: *NC SSc7.1, NC SSc7.2, CI SSc1, CS SSc7.1, CS SSc7.2, O&M SSc7.1, O&M SSc7.2, Schools SSc7.1, Schools SSc7.2*

ASTM: Standard E903-96, *Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres*. This test method covers the measurement of spectral absorptance, reflectance, and transmittance of materials using spectrophotometers equipped with integrating spheres. Methods of computing solar weighted properties from the measured spectral values are specified. The standard is referenced in the Energy Star roofing method, which also allows the use of reflectometers to measure solar reflectance of roofing materials. *Solar reflectance* (also called albedo) measures a material's ability to reflect light and is measured as a percentage. A value of 0% equals total absorption (the definition of a black body), and 100% is a perfect reflective surface. The reflectance value is used to calculate a material's SRI.

Related Credits: *NC SSc7.1, NC SSc7.2, CI SSc1, CS SSc7.1, CS SSc7.2, O&M SSc7.1, SSc7.2, Schools SSc7.1, Schools SSc7.2*

ASTM: Standard E1903-97, *Phase II Environmental Site Assessment Process*. A Phase II Environmental Site Assessment (ESA) is conducted to provide testing guidelines and mitigation measures for contaminated soils (prioritizing CERCLA— Comprehensive Environmental Response, Compensation, and Liability Act, or "Superfund"—contaminants) identified in a Phase I ESA. Upon completion, the environmental professional should be able to confirm or deny the presence of hazardous substances or petroleum products that have been improperly disposed of or released on the site. Depending upon the scope of the work, the environmental professional may also be able to provide guidance on the nature and extent of contamination,