

NPCA SUSTAINABILITY RESOURCE

Precaster's Guide to LEED v4

National Precast Concrete Association



Precaster's Guide to LEED v4

If you haven't worked on a LEED Leadership in Energy and Environmental Design project recently, chances are high that you will. Since its unveiling in 2000, LEED has become an important and integral part of the green building construction vernacular in North America and around the world. Many NPCA members have supplied precast concrete products to LEED projects and have helped owners attain valuable credits toward their certifications.



As market demand has increased, LEED has evolved, leading the U.S. Green Building Council to develop LEED v4. As of October 2016, LEED v4 became the guiding document for attaining certification as a green building. LEED v4 includes some major changes from the previous version. In response, the NPCA Sustainability Committee has prepared this guide for precast concrete manufacturers.

What changed?

Those familiar with previous versions of LEED will recognize the same fundamental structure. There are still prerequisites and six credit categories, 110 potential points, regional priority credits and pilot credits. LEED v4, however, places more emphasis on USGBC's goal of reducing carbon emissions, and this means increased energy efficiencies across the board. For example, v4 adopted the standards of the American Society of Heating, Refrigerating and Air Conditioning Engineers. There's also a greater emphasis on transparency in terms of the environmental impact of materials.

LEED v4 is technically more rigorous than its predecessor. This version expands the market sectors (21) able to use LEED, including data centers, warehouses and distribution centers, hospitality, existing schools, existing retail and LEED for Homes Midrise.

There are new prerequisites and credits across the LEED categories and rating systems. Point values have also changed. Each rating system has been weighted with LEED points associated with each credit and option.

LEED v4 Summary and Certification Levels

- 6 main credit categories
- 3 ways to get additional points
- Total of 110 possible points
- Certified: 40 to 49 points
- Silver: 50 to 59 points
- Gold: 60 to 79 points
- Platinum: 80 to 110 points

Summary of where precast concrete can directly or indirectly contribute to LEED v4 points

Location and Transportation

Sensitive Land Protection	1
High Priority Site	2
Surrounding Density and Diverse Uses	5

Sustainable Sites

Site Development - Protect or Restore Habitat	2
Open Space	1
Rainwater Management	3
Heat Island Reduction	2

Energy and Atmosphere Credit

Minimum Energy Performance	Required
Optimize Energy Performance	20

Materials and Resources Credit

Construction and Demolition Waste Management Planning	Required
Building Life-Cycle Impact Reduction	5
Building Product Disclosure and Optimization – Environmental Product Declarations	2
Building Product Disclosure and Optimization – Sourcing of Raw Materials	2
Building Product Disclosure and Optimization – Material Ingredients	2
Construction and Demolition Waste Management	2

Indoor Environmental Quality Credit

Low-Emitting Materials	3
Daylight	3
Quality Views	1
Acoustic Performance	1

Innovation Credit

Innovation	5
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Regional Priority Credits

Regional Priority: Specific Credit	4
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Location and Transportation Credit – 16 Points

Neighborhood Development Location

The intent of this credit is to avoid development on inappropriate sites, reduce vehicle miles traveled, enhance livability and improve human health by encouraging daily physical activity. Neighborhoods following the program must include a range of sustainability features, such as walkability, transit access, sensitive land protection, connectivity and shared infrastructure. To meet this credit, the project must be located within the boundary of a LEED-certified Neighborhood Development. Using precast concrete can help earn credits because precast:

- is ideal for compact multi-story construction
- arrives to the site ready to be installed, contributing to a reduced project footprint where land is scarce and/or sensitive
- can be used for shared infrastructure such as wastewater treatment and stormwater treatment and to house utilities
- can help improve energy efficiency with superior thermal mass qualities
- can contribute to heat island reduction through highly reflective surfaces

Credits

(Precast opportunity categories are listed in **bold**)

Sensitive Land Protection	1
High Priority Site	2
Surrounding Density and Diverse Uses	5
Access to Quality Transit	5
Bicycle Facilities	1
Reduced Parking Footprint	1
Green Vehicles	1

The first three credits listed above have a common theme – to guide the selection of a construction site based on environmental impact. The credits reward projects that avoid building on sensitive lands, building in locations with development constraints or building in areas with existing infrastructure.

These requirements usually involve building on compact and challenging sites with little or no storage ability during construction.



The Precast Advantage

Precast concrete is an excellent choice in these circumstances because building and infrastructure components are versatile. They are made-to-order for the conditions at hand and can also be installed as soon as they are delivered to reduce need for additional storage of manufacturing equipment and materials.

Sustainable Sites Credit – 10 Points

These credits encourage strategies that minimize the impact on ecosystems and water resources.

Credits

(Precast opportunity categories are listed in **bold**)

Construction Activity Pollution Prevention	Required
Site Assessment	1
Site Development: Protect or Restore Habitat	2
Open Space	1
Rainwater Management	3
Heat Island Reduction	2
Light Pollution Reduction	1

Site Development – Protect or Restore Habitat: The intent of this credit is to conserve existing natural areas and restore damaged areas to protect habitat and promote biodiversity. This credit is achieved by using native or adapted vegetation, restoring 30% (including the building

footprint) of all portions of the site identified as previously developed with native or adapted vegetation. Projects that achieve a density of 1.5 floor-area to land-area ratio may include vegetated roof surfaces in this calculation. A multi-story building with a vegetated roof is a great candidate for precast concrete construction. Another potential strategy for increasing density is to locate parking areas within the building footprint to limit site disturbance. A parking garage – often built with precast/prestressed concrete – can be located within a building to help maintain adjoining natural areas that would otherwise be consumed by surface parking.

The Precast Advantage

Using underground precast concrete stormwater detention and retention systems to store and treat rainwater helps protect and restore habitat and eliminates (or minimizes) land required for detention ponds. This credit is worth two points.

Open Space: For this credit, the project must provide an outdoor space greater than or equal to 30% of the total site area (including the building footprint). A minimum of 25% of that outdoor space must be vegetated or have an overhead vegetated canopy. The concept is to encourage interactions with the environment, social interactions and physical activities. For projects with a density of 1.5 floor-area to land-area ratio, vegetated roofs can be used toward the minimum vegetation requirement. Once again, precast concrete multi-story buildings are well suited to support vegetated roofs.

Rainwater Management: This credit's intent is to reduce runoff volume and improve water quality by replicating



the natural hydrology and water balance of the site based on historical conditions and undeveloped ecosystems in the region. The approaches and techniques in this credit involve minimizing disturbed areas on the project site, limiting the amount of impervious cover, and then infiltrating, filtering, storing, evaporating or detaining rainwater runoff at or close to its source.

The Precast Advantage

Precast concrete systems such as filtration planters or bioretention cells mimic natural hydrology by infiltrating runoff water into the groundwater or enabling it to evaporate into the atmosphere. Through a variety of physical, biological and chemical processes, pollutants are removed from the stormwater before returning to underground aquifers or surface waters. The planters act as temporary storage for runoff water, helping minimize discharge rates. In addition, a percentage of captured water provides irrigation for the vegetation in the planters, reducing the volume of stormwater runoff. Versatile and efficient, precast concrete filtration planters can be installed in almost any urban space.



Heat Island Reduction: This credit's intent is to minimize effects on microclimates and human and wildlife habitats by reducing heat islands. The requirements include two options:

Option 1 encourages the use of site shading and reflective pavements and roofing materials or vegetative roofs.

Option 2 encourages underground or shaded parking areas. For reflective pavements, the requirement is to use paving materials with a three-year aged solar reflectance value of at least 0.28 or an initial SR of at least 0.33. The requirement for SR can usually be met by using precast concrete rather than asphalt for hardscape areas, including sidewalks, parking lots, drives and other impervious surfaces. SR, sometimes called albedo, is a measure of a material’s ability to reflect sunlight (visible, infrared and ultraviolet wavelengths) on a scale of 0 to 1. An albedo value of 0.0 indicates that the surface absorbs all solar radiation, and a 1.0 SR value represents total reflectivity. Generally, light-colored surfaces have a high SR. Conventional grey concrete generally has an initial SR of greater than 0.35. Concrete made with white cement can have an SR greater than 0.70. For a comparison, new asphalt generally has an SR of approximately 0.05. This option of the credit is worth 2 points. ASTM E1980, “Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces,” can be used to calculate the SR Index.



improvement over a baseline building using the ANSI/ASHRAE/IESNA Standard 90.1. Energy performance must be measured by a whole building simulation using the Building Performance Rating Method in Appendix G of the standard.

Optimize Energy Performance: The intent of this credit is to achieve high levels of energy performance beyond the prerequisite standard. This includes establishing an energy performance target in early design phases.

Energy and Atmosphere Credit – 35 Points

These credits promote better building energy performance through innovative strategies.

Credits

(Precast opportunity categories are listed in **bold**)

Fundamental Commissioning and Verification	Required
Minimum Energy Performance	Required
Building-Level Energy Metering	Required
Fundamental Refrigerant Management	Required
Enhanced Commissioning	6
Optimize Energy Performance	20
Advanced Energy Metering	1
Demand Response	2
Renewable Energy Production	3
Enhanced Refrigerant Management	1
Green Power and Carbon Offsets	2

Minimum Energy Performance: The intent here is to reduce the environmental and economic harms of excessive energy usage by achieving a minimum level of energy efficiency for the building and its systems. There are several strategies for achieving this credit, but the most frequently used option is to demonstrate a 5%

The Precast Advantage

Buildings constructed with precast concrete can achieve high levels of energy efficiency. Thermal mass is defined as the inherent property of a material to absorb heat energy. Precast concrete has high thermal mass because a lot of heat energy is required to change its temperature. Lumber products are much easier to heat and therefore have lower thermal mass. With its high thermal mass, precast concrete acts like a thermal sponge, absorbing heat during the summer to keep the building’s interior cool and storing heat from the sun that is released slowly at night when temperatures fall. In many climates, these buildings consume less energy than non-massive buildings with walls of similar insulation. In addition, heating, ventilating and air conditioning needs require smaller capacity equipment.

Materials and Resources Credit – 14 Points

These credits encourage using sustainable building materials and reducing waste. In the past versions of LEED, the focus of material impacts has been on single attributes such as recycled content, rapid renewability or regional materials. Now the focus is on minimizing the embodied energy and other impacts associated with the extraction, processing, transport, maintenance and disposal of building materials. The requirements are designed to support a life cycle approach that improves performance and promotes resource efficiency.

Credits

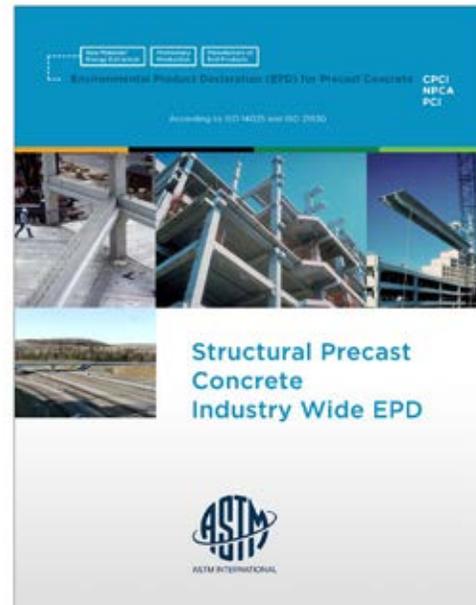
(Precast opportunity categories are listed in **bold**)

Storage and Collection of Recyclables	Required
Construction and Demolition Waste Management Planning	Required
Building Life-Cycle Impact Reduction	6
Building Product Disclosure and Optimization - Environmental Product Declarations	2
Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
Building Product Disclosure and Optimization - Material Ingredients	2
Construction and Demolition Waste Management	2

Construction and Demolition Waste Management

Planning: This prerequisite requires project teams to develop a plan to reduce material disposed in landfills and incineration facilities. Since precast concrete can be crushed and recycled into aggregate for road bases, construction fill or new concrete, the waste management plan should consider waste diversion goals for precast concrete components.

Building Life-Cycle Impact Reduction: This credit encourages reuse and optimization of the environmental performance of products and materials. It offers several options for reducing the impact of buildings, mostly focused on existing building adaptation and reuse. However, for new buildings, Option 4 encourages the use of life cycle assessment to demonstrate lower environmental impact of the proposed building by 10% over a baseline building. The project is awarded



three points for conducting a whole building life cycle assessment of the project's structure and enclosure that demonstrates this 10% reduction in at least three of the following six impact categories:

- global warming potential (greenhouse gases)
- depletion of the stratospheric ozone layer
- acidification of land and water sources
- eutrophication (a type of pollution that stimulates an explosive growth of algae)
- formation of tropospheric ozone
- depletion of nonrenewable energy resources

No impact category assessed as part of the life cycle assessment may increase by more than 5% compared with the reference building.

The Precast Advantage

Precast concrete structures are known for durability and long service life, resulting in a decrease of the environmental impacts associated with reconstruction, repair and maintenance. Precast structures often demonstrate the lowest life cycle impacts. A precast concrete life cycle assessment is available at precast.org/LCA and can be used in the pursuit of this credit.

Building Product Disclosure and Optimization –

Environmental Product Declaration: This credit encourages the use of products and materials for which life cycle information is available and that have environmentally, economically and socially preferred life cycle impacts. This information can be found in

an environmental product declaration. An EPD is an independently verified and registered document that communicates transparent and comparable information about the life cycle environmental impact of building products. It verifies the sustainable attributes of your product.

Option 1 (Disclosure) awards one point for using 20 permanently installed products sourced from at least five different manufacturers that have published EPDs. Under this credit, a plant-specific EPD is more desirable (worth full product) but industry-average EPDs (worth half product) can be used if site-specific EPDs are not available. Industry-wide EPDs are available for a variety of precast concrete products at precast.org/epds.

Option 2 (Optimization) awards one point if it can be demonstrated that 50% (by cost) of all products in the building perform better than the industry-average environmental impacts. The EPD form enables comparisons that may help to attain this point.

The Precast Advantage

Precast concrete environmental impacts – when compared with many other materials – will compare favorably as a primary building and infrastructure material. EPDs are used to perform this comparison and are available for NPCA members at precast.org/epds.

Building Product Disclosure and Optimization –

Sourcing of Raw Materials: The intent is to encourage the use of products and materials that have life cycle information and have environmentally, economically and socially preferred life cycle impacts.

Option 1 (Disclosure) awards one point for selecting from at least five manufacturers 20 products verified to have been extracted or sourced in a responsible manner. Products sourced from manufacturers with self-declared reports are valued as one-half of a product for credit achievement. Responsible sourcing strategies include commitments to long-term ecologically responsible land use, reducing environmental harms from extraction and/or manufacturing processes, and meeting applicable standards or programs voluntarily that address

responsible sourcing criteria. The credit requires Corporate Sustainability Reports from 20 different products, which means precast concrete producers with a CSR can contribute a significant number of products to this option.

Option 2 (Optimization) awards one point if 25% (by cost) of all products in the building have demonstrated leadership in the sourcing of raw materials. Several pathways are provided to meet this option, including responsible forestry, material reuse and recycling. Recycled content is the sum of post-consumer recycled content plus one-half the pre-consumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100% of their cost for credit achievement calculation. Precast concrete products can contribute to the Recycled Content option since most concrete contains recycled materials such as fly ash, slag and reinforcing. For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles of the project site are valued at 200% of their base contributing cost. Since precast plants are often located near project sites, this additional benefit may be useful to the project team. A caveat is that structure and enclosure materials may not constitute more than 30% of the value of compliant building products.

The Precast Advantage

Precast concrete can help contribute to recycled content since most structures contain recycled material such as fly ash, slag and reinforcing. Fly ash and slag would be considered pre-consumer recycled content while reinforcing steel is mostly post-consumer.

Building Product Disclosure and Optimization –

Material Ingredients: This item encourages using products and materials that have environmentally, economically and socially preferred life cycle impacts. The intent is to reward project teams for selecting products for which the chemical ingredients are inventoried using an accepted methodology and for selecting products that minimize the use and generation of harmful substances.

Option 1 (Disclosure) provides one point if 20 products in the building disclose chemical ingredients in their products using an accepted methodology.

Option 1 requires reporting of chemical ingredients of products to at least 1% (or 1,000 ppm) in a Health Product Declaration or under another approved program such as GreenScreen or Cradle to Cradle. An HPD is a report of the materials or ingredient contents of a building product and its associated health effects. The HPD provides an inventory of contents and associated health hazards. Precast concrete producers with HPDs can contribute to this option.

Option 2 (Optimization) provides one point if 25% (by cost) of all products in the building are verified to have improved life cycle impacts by optimizing their material ingredient chemistry. Precast concrete is typically an inert material and has one of the lowest levels of volatile organic compounds and off-gassing when compared with other commonly used building materials and can likely meet the credit requirement.

Option 3 provides one point if 25% (by cost) of the total value of products installed are sourced from manufacturers who document at least 99% (by weight) of the ingredients used to make the building product or material. They must also use a third-party system that validates the Environmental Health and Safety program as it pertains to the chemical ingredients in the product.

For credit achievement calculation of options 2 and 3, products sourced (extracted, manufactured or purchased) within 100 miles of the project site are valued at 200% of their base contributing cost.

Construction and Demolition Waste Management: This credit is provided for diverting construction, demolition and land-clearing waste from landfill or incinerator disposal. Since precast concrete can be crushed and recycled into aggregate for road bases, construction fill and new concrete, this credit should be obtainable when precast concrete buildings are demolished.

Option 1 of this credit is worth one point if 50% of the construction, demolition and land-clearing waste is recycled or salvaged, two points if 75% is diverted.

Option 2 is worth two points if the project does not generate more than 2.5 pounds of construction waste per square foot of the building's floor area.



Indoor Environmental Quality Credit – 16 Points

Indoor environmental quality credits promote better indoor air quality and access to daylight and views.

Credits

*(Precast opportunity categories are listed in **bold**)*

Minimum Indoor Air Quality Performance	Required
Environmental Tobacco Smoke Control	Required
Enhanced Indoor Air Quality Strategies	2
Low-Emitting Materials	3
Construction Indoor Air Quality Management Plan	3
Indoor Air Quality Assessment	2
Thermal Control	1
Interior Lighting	2
Daylight	3
Quality Views	1
Acoustic Performance	1

Low-Emitting Materials: The intent of this credit is to reduce concentrations of chemical contaminants that can damage air quality, human health, productivity and the environment. The focus is on eliminating volatile organic compound emissions from indoor air and removing the VOC content of materials in ceilings, walls and floors. Exposed precast concrete is an excellent choice for finish material, eliminating the need for additional material to be applied on the interior. Precast concrete is defined as an “inherently non-emitting source” of VOCs in LEED v4 and therefore can demonstrate compliance to this credit without any VOC emissions testing. This credit is worth three points.

Daylight and Quality Views: The intent of these credits is to provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building. Up to three points can be achieved in the Daylight category through simulation, calculation or measurement.

For Quality Views, one point can be achieved with a direct line of sight to the outdoors via vision glazing for 75% of all regularly occupied floor area. The strategy is to design the building to maximize interior daylighting and views to the outdoors through building orientation, shallow floor plates and increased building perimeter.

The Precast Advantage

Precast concrete floor systems can span large distances with shallow floor plates and column-free spaces to help achieve these credits. Precast concrete can also be exposed on ceilings to reflect light deep into interior spaces.

Acoustic Performance: The intent of this credit is to provide workspaces and classrooms that promote occupants' well-being, productivity and communication through effective acoustic design. Project teams must meet the Composite Sound Transmission Class ratings referenced or local building codes (whichever is more stringent) and meet the reverberation time requirements referenced. Precast concrete offers excellent noise control in two ways. First, precast concrete floors and walls effectively block airborne sound transmission over a wide range of frequencies. Second, precast concrete effectively absorbs noise, thereby diminishing noise intensity. This means that precast concrete can demonstrate compliance to this credit either through calculation or measurement. This credit is worth one point.



Innovation Credit – 6 Points

These credits address sustainable building expertise as well as design measures not covered under the five LEED credit categories.

Credits

*(Precast opportunity categories are listed in **bold**)*

Innovation	5
LEED Accredited Professional	1

Up to five points can be applied to the project for innovative green design strategies that do not fit into the point structure of the six major credit categories or if a credit achievement goes significantly beyond the requirement in one of the existing credit categories, thereby demonstrating exemplary performance. One strategy that has been used to obtain a LEED point in the Innovation credit category is to reduce carbon dioxide embodied in concrete by 40%.

One way to accomplish this is by using high volumes of secondary cementitious materials in concrete such that the result is a decrease in embodied carbon dioxide by 40% over typical mixes. Another potential innovation is to use exposed precast concrete. This strategy would eliminate a significant quantity of wall and floor coverings along with ceiling materials. This strategy could significantly improve indoor air quality. Another option in this credit is for the project team to adopt a Pilot Credit from the USGBC's Pilot Credit Library.

Regional Priority Credits – 4 Points

This credit addresses regional environmental priorities for buildings in different geographic regions.

Credits

*(Precast opportunity categories are listed in **bold**)*

Regional Priority: Specific Credit	1

Regional priority credits are identified by USGBC chapters and regional councils for each “environmental zone.” A maximum of four points is available for project teams to pursue in this credit category. Each USGBC region has the authority to create six potential regional priority credits, of which an applicant may pursue a maximum of four. This allows for the “regional authority” to designate target credits that are of particular importance for a region and potentially give additional credits for projects that meet criteria in existing credit categories. For example, in a region where urban heat island reduction is identified as an important goal, the USGBC chapter could increase the points available for Sustainable Sites: Heat Island Reduction, creating greater incentive for design teams to employ heat island reduction strategies. Since precast concrete contributes to most credit categories, it will play a significant role in achieving Regional Priority credits.

Summary

LEED Could Be an Opportunity

The green building industry is continuing to grow, and LEED has been a big part of that growth. Expand your market by educating yourself on the LEED program. Request information from your suppliers with regard to recycled content and ask for any other documentation that may assist your customers in pursuing LEED credits under the 2009 version or the new v4 version.

For more help with understanding LEED and what you need to supply to your customers, visit precast.org/sustainability.

ACKNOWLEDGEMENTS

Information in this Precaster’s Guide to LEED v4 is based on the United States Green Building Council’s Leadership in Energy and Environmental Design (LEED) website (usgbc.org/leed).

Precast-specific commentary has been added by Claude Goguen, P.E., LEED AP, NPCA director of sustainability and technical education.

For more information about the role of precast concrete in sustainable construction, please visit precast.org/sustainability.

For detailed information about LEED V4, please visit usbgc.org/leed.

