

# GREEN BUILDING DESIGN AND CONSTRUCTION

WITH ALTERNATIVE COMPLIANCE PATHS FOR  
EAST ASIA

LEED Reference Guide for Green Building Design and Construction  
For the Design, Construction and Major Renovations of Commercial and  
Institutional Buildings Including Core & Shell and K-12 School Projects  
2009 Edition





# PREFACE FROM USGBC

The built environment has a profound impact on our natural environment, economy, health, and productivity. Breakthroughs in building science, technology, and operations are now available to designers, builders, operators, and owners who want to build green and maximize both economic and environmental performance.

Through the LEED® green building certification program, the U.S. Green Building Council (USGBC) is transforming the built environment. The green building movement offers an unprecedented opportunity to respond to the most important challenges of our time, including global climate change, dependence on non sustainable and expensive sources of energy, and threats to human health. The work of innovative building professionals is a fundamental driving force in the green building moment. Such leadership is a critical component to achieving USGBC's mission of a sustainable built environment for all within a generation.

## USGBC MEMBERSHIP

USGBC's greatest strength is the diversity of our membership. USGBC is a balanced, consensus-based nonprofit with more than 18,000 member companies and organizations representing the entire building industry. Since its inception in 1993, USGBC has played a vital role in providing a leadership forum and a unique, integrating force for the building industry. USGBC's programs have three distinguishing characteristics:

### Committee-based

The heart of this effective coalition is our committee structure, in which volunteer members design strategies that are implemented by staff and expert consultants. Our committees provide a forum for members to resolve differences, build alliances, and forge cooperative solutions for influencing change in all sectors of the building industry.

### Member-driven

Membership is open and balanced and provides a comprehensive platform for carrying out important programs and activities. We target the issues identified by our members as the highest priority. We conduct an annual review of achievements that allows us to set policy, revise strategies, and devise work plans based on members' needs.

### Consensus-focused

We work together to promote green buildings, and in doing so, we help foster greater economic vitality and environmental health at lower costs. We work to bridge ideological gaps between industry segments and develop balanced policies that benefit the entire industry.

Contact the U.S. Green Building Council  
2101 L Street, NW  
Suite 500  
Washington, DC 20037  
(800) 795-1747 Office  
(202) 828-5110 Fax  
[www.usgbc.org](http://www.usgbc.org)

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## **COPYRIGHT**

Copyright © 2014 by U.S. Green Building Council, Inc. All rights reserved.

## **DISCLAIMER**

None of the parties involved in the funding or creation of the Reference Guide supplement, including USGBC, its members, its contractors, or the United States government, assume any liability or responsibility to the user or any third parties for the accuracy, completeness, or use of or reliance on any information contained in the Reference Guide supplement, or for any injuries, losses, or damages (including, without limitation, equitable relief) arising from such use or reliance. Although the information contained in the Reference Guide supplement is believed to be reliable and accurate, all materials set forth within are provided without warranties of any kind, either express or implied, including but not limited to warranties of the accuracy or completeness of information contained in the training or the suitability of the information for any particular purpose.

U.S. Green Building Council  
2101 L Street, NW  
Suite 500  
Washington, DC 20037

## **TRADEMARK**

LEED® is a registered trademark of U.S. Green Building Council.

ISBN # 978-1-932444-37-7

# TABLE OF CONTENTS

<b>Preface</b>	<b>i</b>
<b>Introduction</b>	<b>v</b>
I. Why Make Your Building Green?	v
II. LEED® Green Building Rating System	v
III. Overview And Process	v
IV. LEED Online Documentation Requirements	v
V. Certification Application	v
VI. Certification Strategy	vi
VII. Exemplary Performance Strategies	vi
VIII. Regional Priority	vi
IX. Tools For Registered Projects	vi
X. How To Use This Reference Guide	vi
<b>Sustainable Sites (SS)</b>	<b>1</b>
Prerequisite 2 Environmental Site Assessment	3
Credit 1 Site Selection	5
Credit 4.1 Alternative Transportation—Public Transportation Access	11
Credit 6.1 Stormwater Design—Quantity Control	15
<b>Water Efficiency (WE)</b>	<b>21</b>
Credit 4.2 Water Use Reduction—Cooling Towers	23
<b>Energy and Atmosphere (EA)</b>	<b>25</b>
Prerequisite 2 Minimum Energy Performance	27
Credit 1 Optimize Energy Performance	33
Credit 6 Green Power	39
<b>Materials and Resources (MR)</b>	<b>43</b>
Credit 3 Sustainably Sourced Materials and Products	45
<b>Indoor Environmental Quality (IEQ)</b>	<b>51</b>
Credit 3.1 Construction Indoor Air Quality Management Plan—During Construction	53
Credit 4 Low-Emitting Materials	59
Credit 6.2 Controllability of Systems—Thermal Comfort	67
Credit 7 Thermal Comfort—Design and Verification	71
<b>Glossary</b>	<b>77</b>

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED 2009 Green Building Design and Construction Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



# INTRODUCTION

## I. WHY MAKE YOUR BUILDING GREEN?

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

## II. LEED® GREEN BUILDING RATING SYSTEM

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

## III. OVERVIEW AND PROCESS

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for additional guidance related to the Overview and Process section.

### When to Use LEED 2009 Alternative Compliance Paths

Alternative Compliance Paths (ACPs) to LEED credits provide additional options or approaches that address unique circumstances and accommodate advancements in science and technology. ACPs allow LEED to be more flexible and applicable to a wider range of projects. Global ACPs and Regional ACPs for East Asia are integrated into this guidance document. The LEED 2009 Building Design and Construction (BD&C) Regional ACPs for East Asia were developed for new construction and major renovations of commercial and institutional buildings, core and shell developments, schools, healthcare facilities, and retail projects in East Asia. ACPs can be applied at the discretion of the project team, based on applicability; they are not mandatory for any project. Some ACPs are available only for projects outside the U.S., and others are available for all LEED projects regardless of location, as indicated in the credit language.

Projects may use none, some, or all of the LEED 2009 Global ACPs or Regional ACPs for East Asia and do not need to apply them consistently across credits unless noted in the credit language. Each credit category's Overview section includes a table identifying which credits have Global ACPs or an East Asia ACP.

For specific guidance on which rating system to use, see the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement.

## IV. LEED ONLINE DOCUMENTATION REQUIREMENTS

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

## V. CERTIFICATION APPLICATION

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED 2009 Green Building Design and Construction Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## **VI. CERTIFICATION STRATEGY**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

## **VII. EXEMPLARY PERFORMANCE STRATEGIES**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

## **VIII. REGIONAL PRIORITY**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

## **IX. TOOLS FOR REGISTERED PROJECTS**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for this section of the Introduction.

## **X. HOW TO USE THIS REFERENCE GUIDE**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for additional guidance.

The LEED 2009 BD&C Alternative Compliance Path for East Asia Reference Guide Supplement is a supporting document to the LEED Global ACPs and East Asia. This guide helps project teams understand the criteria, the reasons behind them, strategies for implementation, and documentation requirements. It includes examples of strategies that can be used in each category and additional resources. It does not provide an exhaustive list of strategies for meeting the criteria or all the information that a project team needs to determine the applicability of a credit to the project.

The LEED 2009 BD&C Alternative Compliance Path for East Asia Reference Guide Supplement should be consulted in conjunction with the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement. Information in the reference guide is not repeated in this supplement, which focuses instead on the following:

- information specific to considerations for projects outside the U.S.
- new information for existing credits with new Alternative Compliance Paths

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



### OVERVIEW




See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for additional guidance.

Project teams outside the U.S. face many of the same challenges as their American counterparts when determining where to locate a new project. However, American codes and regulations often prove difficult to apply abroad. The Global Alternative Compliance Paths for Sustainable Sites allow project teams outside the U.S. to select local equivalents to the prescribed U.S. codes and regulations for select credits. In many cases this will lower overall project costs by reducing the required documentation.

Local equivalent standards can be used in place of U.S. government regulations for SS Prerequisite 2 (Environmental Site Assessment), and SS Credit 1 (Site Selection). Project teams outside the U.S. can use a local code or regulation if it meets the intent of the prerequisite or credit.

A new option for SS Credit 4.1 (Alternative Transportation—Public Transportation Access) allows project teams to include additional vehicle types when calculating alternative transportation use for building occupants. The new option for SS Credit 6.1 (Stormwater Design—Quantity Control) allows project teams to calculate stormwater runoff reduction using a method that may be more appropriate in areas where it is difficult to calculate the 1- and 2-year 24-hour design storm.

 **Table 1.** SS Credits with Alternative Compliance Paths

CREDIT	TITLE	HEALTHCARE
<b>SS Prerequisite 1</b>	Construction Activity Pollution Prevention	
<b>SS Prerequisite 2</b>	Environmental Site Assessment	
<b>SS Credit 1</b>	Site Selection	
<b>SS Credit 2</b>	Development Density and Community Connectivity	
<b>SS Credit 3</b>	Brownfield Redevelopment	
<b>SS Credit 4.1</b>	Alternative Transportation—Public Transportation Access	
<b>SS Credit 4.2</b>	Alternative Transportation—Bicycle Storage and Changing Rooms	
<b>SS Credit 4.3</b>	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	
<b>SS Credit 4.4</b>	Alternative Transportation—Parking Capacity	
<b>SS Credit 5.1</b>	Site Development—Protect or Restore Habitat	
<b>SS Credit 5.2</b>	Site Development—Maximize Open Space	
<b>SS Credit 6.1</b>	Stormwater Design—Quantity Control	

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

SS	
HEALTHCARE: NC	Credit ?

CREDIT	TITLE	HEALTHCARE
<b>SS Credit 6.2</b>	Stormwater Design—Quality Control	
<b>SS Credit 7.1</b>	Heat Island Effect—Nonroof	
<b>SS Credit 7.2</b>	Heat Island Effect—Roof	
<b>SS Credit 8</b>	Light Pollution Reduction	
<b>SS Credit 9.1</b>	Connection to the Natural World—Places of Respite	
<b>SS Credit 9.2</b>	Connection to the Natural World—Direct Exterior Access for Patients	

## ENVIRONMENTAL SITE ASSESSMENT

HEALTHCARE: NC	
Prerequisite	SS Prerequisite 2
Points	Required

### Intent

To ensure that the site is assessed for environmental contamination and, if contaminated, that the environmental contamination has been remediated to protect occupant health.

### Requirements

Conduct a Phase I Environmental Site Assessment (as described in ASTM E1527-05) to determine if environmental contamination exists at the site. If contamination is suspected, conduct a Phase II Environmental Site Assessment [as described in ASTM E1903-97, (2002)]. Projects outside the U.S. may use a local equivalent to ASTM E1527-05 Phase I Environmental Site Assessment and ASTM E 1903-97 Phase II Environmental Site Assessment.

### AND

Sites that are contaminated due to the past existence of a landfill on the site are prohibited. If the site is otherwise contaminated, then it must be remediated to meet local, state or federal EPA region residential (unrestricted) standards, whichever is the most stringent. Documentation from the authority must be provided, such as EPA's Ready for Reuse document, to prove "safe" levels of contamination have been achieved. As the remediation process leads to significant environmental benefit, one point (in SS Credit 3, Brownfield Redevelopment) will be given for successful documented remediation of the site.

## SS PREREQUISITE 2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for information on environmental and economic issues related to this prerequisite.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a list of credits related to this prerequisite.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for summaries of the ASTM E1527-05, Phase I Environmental Site Assessment, and ASTM E1903-97, Phase II Environmental Site Assessment. If a local equivalent to the ASTM Phase I or Phase II site assessment has been selected, substitute that standard for the listed standards.

## 4. Implementation

If a local equivalent to the ASTM Phase I or Phase II Environmental Site Assessment has been selected, ensure that it is the most widely used and accepted by remediation experts in the project country. It should, at a minimum, test for the presence of any hazardous substances on the property, as indicated through present release, past release, or threat of release into the ground, ground water, surface water, or any structures on the property. If the local equivalent assessment determines that critical levels of contaminants are present at the project site, the site must be remediated to unrestricted use standards. Equivalency means meeting the criteria of the ASTM Phase I or Phase II Environmental Site Assessment listed in the Implementation section of the LEED 2009 Green Building Design and Construction Reference Guide.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this prerequisite.

## 6. Calculations

There are no calculations associated with this prerequisite.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Retain copies of the executive summaries from all local equivalent environmental site assessments performed.
- If remediation efforts were necessary, prepare a description of the efforts.
- Acquire documentation from the local governing authority showing that remediation to unrestricted use standards has been completed. The remediation efforts undertaken must at least match the stringency of the U.S. Environmental Protection Agency (EPA) requirements for residential (unrestricted) use. Residential land use is considered the most restrictive land use by EPA; it assumes that no contaminants are left on site to which children could be exposed.
- Provide documentation from the remediation expert or local authority stating that there are no contaminants remaining at the project site.

## 8. Examples

There are no examples for this prerequisite.

## 9. Exemplary Performance

This prerequisite is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

Preliminary screening levels and remediation criteria may differ by region or country. Please ensure that local equivalents to ASTM assessments meet the intent of the prerequisite and ensure that local or regional criteria at least match the stringency of the EPA and ASTM requirements.

## 11. Operations and Maintenance Considerations

For project sites that use a local equivalent in place of an ASTM Phase I and Phase II assessment process and require ongoing remediation, the project team and owner should keep careful records of remediation activities and develop a plan for ongoing compliance with local regulators' monitoring and reporting requirements.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for resources related to this prerequisite.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for definitions of terms used in this prerequisite.

SS	
HEALTHCARE: NC	Prerequisite 2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

SS

HEALTHCARE:  
NC

Credit ?

## SITE SELECTION

HEALTHCARE: NC	
Credit	SS Credit 1
Points	1 point

### Intent

To avoid the development of inappropriate sites and reduce the environmental impact from the location of a building on a site.

### Requirements

Do not develop buildings, hardscape, roads or parking areas on portions of sites that meet any of the following criteria:

- Prime farmland as defined by the U.S. Department of Agriculture in the United States Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (citation 7CFR657.5). Projects outside the U.S. may use a local equivalent.
- Previously undeveloped land whose elevation is lower than five feet (1.5 meters) above the elevation of the 100-year flood as defined by the Federal Emergency Management Agency (FEMA), an equivalent local regulatory agency, or a professional hydrologist.
- Land specifically identified as habitat for any species on federal or state threatened or endangered lists. Projects outside the U.S. may use a local equivalent.
- Land within 100 feet (30 meters) of any wetlands as defined by the U.S. Code of Federal Regulations 40 CFR, Parts 230-233 and Part 22, or a local equivalent definition outside the U.S., and isolated wetlands or areas of special concern identified by state or local rule, OR within setback distances from wetlands prescribed in state or local regulations, as defined by local or state rule or law, whichever is more stringent.
- Previously undeveloped land that is within 50 feet (15 meters) of a water body, defined as seas, lakes, rivers, streams and tributaries that support or could support aquatic life, recreation or industrial use, consistent with the terminology of the Clean Water Act.
- Land that prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner (park authority projects and projects which are operated by and support the function of the park are exempt).

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of the standards referenced in this credit. If a local equivalent has been selected, substitute that standard for the listed standards.

## 4. Implementation

If the level of the 100-year flood is not defined in the project region or country, engage a professional hydrologist to determine the flood risk of the project site. The professional hydrologist should use the U.S. Federal Emergency Management Agency (FEMA) definition of the 100-year flood (the flood elevation that has a 1% chance of being reached or exceeded each year) to determine flood risk. If the professional hydrologist determines that the project site is less than 5 feet above the level of the 100-year flood, the project is not eligible to earn this credit.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional implementation guidance.

## 5. Timeline and Team

If the level of the 100-year flood is not defined in the project region or country, use a professional hydrologist to determine the flood risk of the project site. See the LEED 2009 Green Building Design and Construction Reference Guide for additional guidance on the timeline and team.

## 6. Calculations

There are no calculations associated with this credit.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Record any special circumstances regarding compliance with the site selection criteria.
- If the level of level of the 100-year flood is defined by a local equivalent to FEMA, include the definition used and the name of the local authority.
- If the level of the 100-year flood is not defined in the project region or country, engage a professional hydrologist to determine the flood risk of the project site. The professional hydrologist should produce a report or an executive summary of findings and supporting documentation, such as site elevations and/or topographic maps and sections identifying the flood risk of the project site.

## 8. Examples

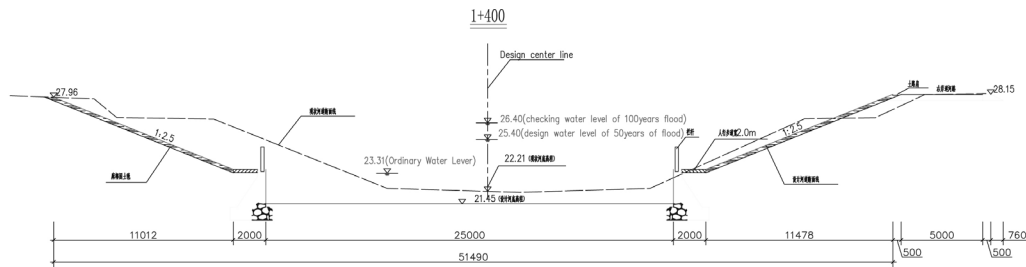
A project outside the U.S. is located in an area where no definition of the 100-year flood exists. The project team has hired a professional hydrologist to identify the flood risk of the project site and produce topographical maps and sections for the area surrounding the project site. The



resulting site elevation map identifies the elevation of the project in meters above sea level. A topographic section identifies the water surface height of a nearby river during normal levels and during a 100-year storm event in relation to the elevation of the project site. This documentation is accompanied by a separate report from the professional hydrologist.

SS	
HEALTHCARE: NC	Credit 1

**Figure 1.** Topographic map identifying level of 100-year flood event and project site.



**Figure 2.** Letter from professional hydrologist explaining topographic map and level of 100-year flood.

Jane Doe  
Hydrologist  
August 13, 2011  
Project: Qingyuan Hospital  
To Whom It May Concern,

Upon performing research on the vulnerability of the site located along the Beijang River in Qingyuan, Guangdong Province, China, it is my professional determination that the project site lies above the level of the 100-year flood. As the attached topographic maps and site elevations indicate, the level of the 100-year flood event has been determined to be 26.4 meters above sea level, whereas the project site is situated 28.2 meters above sea level. This means that the project is located 1.8 meters above the 100-year flood event.

Please see the attached report identifying the project site and its relation to the 100-year floodplain for further verification purposes. This report includes the methodology used to determine the level of the 100-year flood and all associated topographic maps and site plans.

Sincerely,  
*Jane Doe*  
Jane Doe  
Hydrologist  
ACME Geological Consulting, Inc.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

There are no regional variations associated with this credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

**11. Operations and Maintenance Considerations**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.

**12. Resources**

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

**13. Definitions**

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

## ALTERNATIVE TRANSPORTATION—PUBLIC TRANSPORTATION ACCESS

## SS CREDIT 4.1



HEALTHCARE: NC	
Credit	SS Credit 4.1
Points	3 points

### Intent

To reduce pollution and land development impacts from automobile use.

### Requirements

#### OPTION 1. Rail Station, Bus Rapid Transit Station & Ferry Terminal Proximity

Locate the project within 1/2-mile (800 meters) walking distance (measured from a main building entrance) of an existing or planned and funded commuter rail, light rail, subway station, bus rapid transit<sup>1</sup> station or commuter ferry terminal.

For stations located greater than 1/8-mile (200 meters) from building entrance, provide an on-demand shuttle service with a documented service plan.

OR

#### OPTION 2. Bus Stop Proximity

Locate the project within 1/8-mile (200 meters) walking distance (measured from a main building entrance) of one or more stops for two or more public, campus, or private bus lines usable by building occupants.

OR

#### OPTION 3. Rideshare Proximity

Projects outside the U.S. may locate the project within 1/4-mile (400-meter) walking distance (measured from a main building entrance) of 1 or more stops for 2 or more existing rideshare options<sup>2</sup> that meet the definition of public transportation<sup>3</sup> and are authorized by the local transit authority if one exists.

- <sup>1</sup> Bus rapid transit an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way; it is designed to combine the flexibility of buses with the efficiency of rail.
- <sup>2</sup> Rideshare is a transit service that involves sharing a single vehicle with multiple people, excluding large-scale vehicles such as buses and trains. The rideshare transit facility must include a signed stop and a clearly defined waiting area. Additionally, the rideshare must include an enclosed passenger seating area, fixed route service, fixed fare structure, continuous daily operation, and the ability to pick up and drop off multiple riders. Rideshare options must hold 4 or more passengers, except for human-powered conveyances which must hold 2 or more passengers.
- <sup>3</sup> Public transportation consists of bus, rail, or other transit services for the general public that operate on a regular, continual basis.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

There are no standards referenced for this credit.

## 4. Implementation

If Option 1, Rail Station, Bus Rapid Transit Station & Ferry Terminal Proximity, is selected, see the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for implementation guidance.

If Option 3, Rideshare Proximity, is selected, ensure that the vehicles that serve the project site meet the definition of rideshare provided in the Definitions section. See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for additional implementation guidance.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

If Option 3, Rideshare Proximity, is selected, please follow the calculations instructions for Options 1 and 2 in the LEED 2009 Green Building Design and Construction Reference Guide.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.








- Identify local rail stations, bus rapid transit stations, commuter ferry terminals, and bus or rideshare routes serving the project building.
- Develop a site vicinity plan, to scale, and label walking paths between the project building's main entrance and rail stations, bus rapid transit stations, commuter ferry terminals, and bus or rideshare stops.
- If the team anticipates rail service, obtain verification of funding for the rail project.

## 8. Examples

A hospital in Manila is within walking distance of multiple public rideshare lines. Figure 1 shows all rideshare routes within a 1/4-mile (400-meter) walking distance from the building's main entrance. Rideshare stop locations are clearly identified on the vicinity map. The rideshare routes also connect to additional public transportation lines that traverse the city.

**Figure 1.** Sample area drawing: Vicinity map identifying rideshare stop locations and route destination information





-  Project Location
-  1/4 Mile (400 Meters)
-  Waterfront Route  
4.7 mi - about 13 mins
-  Padre Faura & A. Mabini  
Serves the East West Route and the Waterfront Route
-  Padre Faura & M.H. del Pilar
-  East West Route  
3.1 mi - about 15 mins
-  FX Stop - Roxas

Additionally, the project team has identified the type of vehicle, rideshare stop location, and route information for each route identified in a separate table, as shown in Figure 2

SS	
HEALTHCARE: NC	Credit 4.1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

Figure 2. Rideshare transportation table

TRANSPORTATION TABULATION			
	SERVICE IDENTIFICATION (CORRESPONDING TO THE UPLOADED VIGNETTE MAP)	LOCATION	ROUTE
1		Padre Faura corner M.H. del Pilar	Sta. Cruz - Baclaran
2		Padre Faura corner A. Mabini	Divisoria - F.B. Harrison
3	FX ROUTE	Roxas Boulevard	Lawton - Baclaran/Sucot

## 9. Exemplary Performance

Project teams may earn an Innovation in Design credit for exemplary performance by complying with the requirements of 1 of the 2 options described in the Exemplary Performance section of the LEED 2009 Green Building Design and Construction Healthcare Supplement.

Projects located within 1/2 mile (800 meters) of bus rapid transit or commuter ferries are eligible for exemplary performance through Option 2, Double Transit Ridership.

Project teams that select Option 3, Rideshare Proximity, are not eligible for exemplary performance under the Innovation in Design section.

## 10. Regional Variations

There are no regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for resources related to this credit.

## 13. Definitions

**Bus rapid transit** is an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way; it is designed to combine the flexibility of buses with the efficiency of rail.

**Rideshare** is a transit service that involves sharing a single vehicle with multiple people, excluding large-scale vehicles such as buses and trains. The rideshare transit facility must include a signed stop and a clearly defined waiting area. Additionally, the rideshare must include an enclosed passenger seating area, fixed route service, fixed fare structure, continuous daily operation, and the ability to pick up and drop off multiple riders. Rideshare vehicles must hold 4 or more passengers, except for human-powered conveyances, which must hold 2 or more passengers.

**Public transportation** consists of bus, rail, or other transit services for the general public that operate on a regular, continual basis.



## STORMWATER DESIGN—QUANTITY CONTROL

HEALTHCARE: NC	
Credit	SS Credit 6.1
Points	1 point

### Intent

To limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff and eliminating contaminants.

### Requirements

#### OPTION 1. Design Storms

CASE 1. Sites with Existing Imperviousness 50% or Less

##### PATH 1

Implement a stormwater management plan that prevents the post-development peak discharge rate and quantity from exceeding the predevelopment peak discharge rate and quantity for the 1- and 2-year 24-hour design storms.

OR

##### PATH 2

Implement a stormwater management plan that protects receiving stream channels from excessive erosion. The stormwater management plan must include stream channel protection and quantity control strategies.

CASE 2. Sites with Existing Imperviousness Greater Than 50%

Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the 2-year 24-hour design storm.

OR

#### OPTION 2. Percentile Rainfall Events

CASE 1. Non-Zero Lot Line Projects

In a manner best replicating natural site hydrology<sup>1</sup> processes, manage onsite<sup>2</sup> the runoff from the developed site for the 95th percentile of regional or local rainfall events using Low Impact Development<sup>3</sup> (LID) and green infrastructure<sup>4</sup>.

Use daily rainfall data and the methodology in the United States Environmental Protection Agency's Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act to determine the 95th percentile amount.

1 Natural Site Hydrology is defined as the natural land cover function of water occurrence, distribution, movement, and balance.

2 Manage Onsite refers to capturing and retaining the specified volume of rainfall to mimic natural hydrologic function. This includes, but is not limited to, strategies that manage volume through evapotranspiration, infiltration, or capture and reuse.

3 Low Impact Development (LID) is defined as an approach to managing stormwater runoff that emphasizes on-site natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles such as minimizing land disturbance, preserving vegetation, minimizing impervious cover, and design practices like rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, and soil amendments. These are engineered practices that may require specialized design assistance.

4 Green Infrastructure is a soil and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies (US EPA).

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

**SS CREDIT 6.1**

OR

CASE 2: Zero Lot Line Projects

For zero lot line projects located in urban areas with a minimum density of 1.5 FAR (13,800 square meters per hectare net), in a manner best replicating natural site hydrology processes, manage onsite the runoff from the developed site for the 85th percentile of regional or local rainfall events using LID and green infrastructure.



## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### Stormwater Management for Federal Facilities under Section 438 of the Energy Independence and Security Act (USA)

<http://www.epa.gov/owow/NPS/lid/section438/>

Stormwater runoff in urban areas is one of the leading sources of water pollution. Section 438 of the U.S. Energy Independence and Security Act sets guidelines for restoring project sites to their predevelopment hydrology. U.S. EPA's technical guidance for Section 438 provides background information, definitions, and case studies. See the website for additional information and resources.

## 4. Implementation

If Option 1, Design Storms, is selected, see the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for implementation guidance.

### Option 2. Percentile Rainfall Events

Projects that fall under Case 1, Non-Zero Lot Line Projects, should obtain local rainfall data for at least the past 5 years, if available. This information may be obtained from various sources:

- Aquastat
- the local governing authority
- local airports
- universities
- water treatment plants
- other facilities whose monitoring stations record time and total precipitation depth during each time interval

With the rainfall data, calculate the 95th percentile of regional or local storm events using the methodology in Section E of the Technical Guidance on Implementing Stormwater Runoff Requirements from the referenced standard. Determine the volume of rainwater runoff for the project site. Based on the developed project site conditions, identify areas with potential to produce runoff (areas where rainwater will not infiltrate completely into the ground). For these developed site conditions, manage the runoff by using Low-Impact Development (LID) strategies and green infrastructure on site.

If rainfall data are not available for the project's region, natural land cover maps may be used. Determine the natural land cover conditions of the project site and use these conditions to assign runoff curve numbers. Calculate the volume of rainfall using the method described in the LEED 2009 Green Building Design and Construction Reference Guide.

Design the site to manage the volume of runoff for the 95th percentile of regional or local events. There may be multiple low-impact development or green infrastructure rainwater

SS	
HEALTHCARE: NC	Credit 6.1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

management facilities on the site. Consult U.S. EPA for a list of potential LIDs. Consider the following:

- A project site can utilize one or multiple facilities
- Locate facilities strategically to best mimic natural site hydrology (direction of flow, etc)
- Facilities may have different infiltration rates and storage capacity.
- The contaminant removal potential of the facilities

Projects that fall under Case 2, Zero Lot Line Projects, should confirm the zero lot line designation. This means that the building limits align with the site limits and the LEED project boundary. Calculate the density of the area surrounding the project. If the density is 1.5 FAR (13,800 square meters per hectare net) or greater, the project is eligible to use this case.

Follow the steps in Option 2, Case 1, above but calculate the 85th percentile rather than the 95th percentile.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

Instructions for calculating percentile storm events can be found in Section E of the Technical Guidance on Implementing Stormwater Runoff Requirements from the referenced standard. of the referenced standard.

Calculate the runoff volume based on the project's developed conditions; refer to the LEED 2009 Green Building Design and Construction Reference Guide. Size the LID facility based on the projected volume of runoff water for the percentile storm event. All calculated runoff from the percentile storm events must be managed.

Alternatively, if using natural land cover condition maps, refer to the LEED 2009 Green Building Design and Construction Reference Guide and manage the runoff for the developed site conditions.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Gather rainfall event data over at least 5 years and document the source of that information.
- Show the calculations for the 85th or 95th percentile and for volume of runoff based on the developed site area.
- Describe the proposed stormwater management practices used on site, explain what qualifies them as LID or green infrastructure, and show how the design replicates natural site hydrology.

## 8. Examples

See the Technical Guidance on Implementing Stormwater Runoff Requirements from the referenced standard for examples of how to implement LID and green infrastructure practices to manage runoff for the percentile storm event.

## 9. Exemplary Performance

Projects using Option 2, Percentile Rainfall Events, are not eligible for exemplary performance under the Innovation in Design section.

## 10. Regional Variations

There are no regional variations associated with Option 2, Percentile Rainfall Events.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### Aquastat

<http://www.fao.org/nr/water/aquastat/main/index.stm>

This international resource for precipitation data is maintained by the Food and Agriculture Organization of the United Nations.

#### U.S. EPA, Low-Impact Development, Stormwater Management, Section 438

<http://www.epa.gov/owow/NPS/lid/section438/>

This website provides valuable information, including technical guidance and fact sheets, on low-impact development strategies that can be used to mitigate stormwater runoff.

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for additional resources related to this credit.

## 13. Definitions

**Natural site hydrology** is the natural land cover function of water occurrence, distribution, movement, and balance.

**Manage onsite** refers to capturing and retaining the specified volume of rainfall to mimic natural hydrologic function. Strategies may include evapotranspiration, infiltration, and capture and reuse.

**Low- Impact Development (LID)** is an approach to managing stormwater runoff that emphasizes onsite natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles, such as minimizing land disturbance, preserving vegetation, and minimizing impervious cover, and design practices like rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, and soil amendments. These engineered practices may require specialized design assistance.

**Green infrastructure** is a soil- and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies (U.S. EPA).

SS	
HEALTHCARE: NC	Credit 6.1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



# WATER EFFICIENCY

## WE OVERVIEW


### OVERVIEW

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for additional guidance.

Clean water is a precious resource that is in constant demand. As human development spreads and the world's population continues to increase, it is imperative that water resources be preserved. Project teams outside the U.S. encounter seasonal differences when trying to limit the water use of a new building.

Because evaporative condensers are more common than cooling towers in some areas outside the U.S., WE Credit 4.2 (Water Use Reduction—Cooling Towers) has been revised to allow project teams whose healthcare facilities are equipped with evaporative condensers to take credit for their water management strategies.

 **Table 1. WE Credits with Alternative Compliance Paths**

CREDIT	TITLE	HEALTHCARE
<b>WE Prerequisite 1</b>	Water Use Reduction	
<b>WE Prerequisite 2</b>	Minimize Potable Water Use for Medical Equipment Cooling	
<b>WE Credit 1</b>	Water Efficient Landscaping—No Potable Water Use or No Irrigation	
<b>WE Credit 2</b>	Water Use Reduction—Measurement and Verification	
<b>WE Credit 3</b>	Water Use Reduction	
<b>WE Credit 4.1</b>	Water Use Reduction—Building Equipment	
<b>WE Credit 4.2</b>	Water Use Reduction—Cooling Towers	
<b>WE Credit 4.3</b>	Water Use Reduction—Food Waste Systems	

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## WATER USE REDUCTION—COOLING TOWERS

## WE CREDIT 4.2

HEALTHCARE: NC	
Credit	WE Credit 4.2
Points	1 point

### Intent

To reduce or eliminate the use of potable water for non-potable process use in building system equipment.

### Requirements

- Cooling towers and evaporative condensers for air conditioning systems, such as chilled water systems, shall achieve a minimum of five cycles of concentration based on a ratio of the conductivity of the water being discharged (blowdown) divided by the conductivity of the feed (makeup) water(s), or four cycles of concentration, if the makeup water hardness exceeds 200 mg/l expressed as calcium carbonate, or shall achieve a minimum discharge (blowdown) concentration of 1500 mg/L (1500 ppm) expressed as calcium carbonate, or 175 mg/L (175 ppm) of silica measured as silicon dioxide, whichever is met first.
- Cooling towers and evaporative condensers shall be equipped with makeup and blowdown meters, conductivity controllers and overflow alarms and efficient drift eliminators that reduce drift loss to less than, or equal to, 0.001% of recirculating water in a counter-flow tower or 0.005% in a cross-flow tower.
- Use no more potable water than 2.3 gallons per ton hour (2.5 liters per kilowatt hour) for cooling tower or evaporative condenser make-up.
- Projects without cooling towers or evaporative condensers are ineligible for this credit.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

**1. Benefits and Issues to Consider**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this credit.

**2. Related Credits**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a list of credits related to this credit.

**3. Summary of Referenced Standards**

There are no standards referenced for this credit.

**4. Implementation**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for implementation guidance related to this credit.

**5. Timeline and Team**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance related to this credit.

**6. Calculations**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance related to this credit.

**7. Documentation Guidance**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for documentation guidance related to this credit.

**8. Examples**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance related to this credit.

**9. Exemplary Performance**

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

**10. Regional Variations**

There are no regional variations for this credit.

**11. Operations and Maintenance Considerations**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance Considerations related to this credit.

**12. Resources**

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for resources related to this credit.

**13. Definitions**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for definitions of terms used in this credit.



# ENERGY AND ATMOSPHERE

## EA OVERVIEW




### OVERVIEW

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for additional guidance.

Buildings are a major consumer of energy and electricity across the globe, and predicting and lowering energy consumption in buildings are significant components of LEED. Because energy modeling is a very complex process that involves the use of computer-generated models and stringent energy standards, project teams outside the U.S. seeking to use an alternative to ANSI/ASHRAE/IESNA Standard 90.1-2007 in EA Prerequisite 2 (Minimum Energy Performance) and EA Credit 1 (Optimize Energy Performance) must first submit to a review process, as outlined later in this document.

Project teams seeking to achieve EA Credit 6 (Green Power) may now purchase renewable power from local sources as long as it meets the major Green-e Energy program criteria.

 **Table 1.** EA Credits with Alternative Compliance Paths

CREDIT	TITLE	HEALTHCARE
<b>EA Prerequisite 1</b>	Fundamental Commissioning of Building Energy Systems	
<b>EA Prerequisite 2</b>	Minimum Energy Performance	
<b>EA Prerequisite 3</b>	Fundamental Refrigerant Management	
<b>EA Credit 1</b>	Optimize Energy Performance	
<b>EA Credit 2</b>	On-site Renewable Energy	
<b>EA Credit 3</b>	Enhanced Commissioning	
<b>EA Credit 4</b>	Enhanced Refrigerant Management	
<b>EA Credit 5</b>	Measurement and Verification	
<b>EA Credit 6</b>	Green Power	
<b>EA Credit 7</b>	Community Contaminant Prevention—Airborne Releases	

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## MINIMUM ENERGY PERFORMANCE

HEALTHCARE: NC	
Prerequisite	EA Prerequisite 2
Points	Required

### Intent

To establish the minimum level of energy efficiency for the proposed building and systems to reduce environmental and economic impacts associated with excessive energy use.

### Requirements

#### OPTION 1. Whole Building Energy Simulation

Demonstrate a 10% improvement in the proposed building performance rating for new buildings, or a 5% improvement in the proposed building performance rating for major renovations to existing buildings, compared with the baseline building performance rating.

Calculate the baseline building performance rating according to the building performance rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda) using a computer simulation model for the whole building project. Projects outside the U.S. may use a USGBC approved equivalent standard<sup>1</sup>.

Appendix G of Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all energy costs associated with the building project. To achieve points using this credit, the proposed design must meet the following criteria:

- Comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda) or USGBC approved equivalent.
- Include all energy costs associated with the building project.
- Compare against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda<sup>1</sup>) or USGBC approved equivalent. The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include documentation substantiating that process energy inputs are appropriate.
- Obtain an energy performance rating for estimated energy use of both the baseline and proposed design from EPA's ENERGY STAR Target Finder design tool and submit the Statement of Energy Design Intent document, generated by Target Finder, as part of the project's design submittal.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g., lighting integral to medical equipment) and other (e.g., waterfall pumps).

<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## EA PREREQUISITE 2

Regulated (non-process) energy includes lighting (for the interior, parking garage, surface parking, façade, or building grounds, etc. except as noted above), heating, ventilation and air conditioning (HVAC) (for space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.), and service water heating for domestic or space heating purposes. heating for domestic or space heating purposes.

Process loads must be identical for both the baseline building performance rating and the proposed building performance rating. However, project teams may follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2007 G2.5) or USGBC approved equivalent to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and the proposed design, and theoretical or empirical information supporting these assumptions.

Projects in California may use Title 24-2005, Part 6 in place of ANSI/ASHRAE/IESNA Standard 90.1-2007 for Option 1.

OR

OPTION 2. Prescriptive Compliance Path: ASHRAE Advanced Energy Design Guide (AEDG) for Small Hospitals and Healthcare Facilities.

Comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide for Small Hospitals and Healthcare Facilities. The following restrictions apply:

- Buildings must be 90,000 square feet (8,360 square meters) or less.
- Project teams must fully comply with all applicable criteria as established in the AEDG for the climate zone in which the building is located. Projects outside the U.S. may use ANSI/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.

OR

OPTION 3. Prescriptive Compliance Path: Prescriptive Path for Energy Improvements in Hospitals

- Buildings must be over 90,000 square feet (8,360 square meters).
  1. Comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in ASHRAE Standard 90.1-2007
  2. Incorporate all Energy Efficiency Measures (EEMs) listed below:
    - High Performance Windows and Glazing
    - Thermally broken metal window frames
    - U value at the center of glass < 0.29
    - Solar heat gain coefficient at the center of glass < 0.38
    - U value of the window including framing effects < 0.40
  3. Lighting Power Density (LPD)
    - Reduce interior LPD a minimum of 10% below IESNA/ASHRAE Standard 90.1 –2007.
    - Reduce exterior lighting power density to 20% below IESNA/ASHRAE 90.1-2007 requirements.

## 4. Lighting Controls

Install occupancy sensor lighting controls, at a minimum, in all offices, storage areas and mechanical spaces to achieve the following lighting energy reduction:

- Offices: 15% during the day
- Storage: 60% during the day; 30% at night
- Mechanical Spaces: 50% for 23 hours/day

5. The HVAC system serving all areas shall include Variable Air Volume (VAV) air handling units supplied by a central chilled water and boiler plant. In addition, provide zoning controls to maintain pressure relationships as specified in the 2010 FGI Guidelines for Design and Construction of Health Care Facilities. Zoning controls shall be used on both supply air and return/exhaust air systems.

6. Reduce fan power a minimum of 10% less than the limit under ASHRAE 90.1-2007.

7. Reduce turndown ratio on VAV boxes in accordance with ASHRAE 90.1-2007 Prescriptive Requirement 6.5.2.1.

8. Design the heating plant, including boilers and auxiliary equipment, to achieve a minimum system efficiency (BTUH output/ BTUH input) of 90%

9. Design hot and chilled water pumps (3 hp [2.24 kW] or greater) with variable speed drives and a minimum part load ratio of 30%.

10. For fans and pumps, use only motors that meet National Electrical Manufacturers' Association (NEMA) standards for premium efficiency.

11. Chillers shall operate at a maximum of 0.52 kW/ton (0.15 kW/ kW) at full load and an Integrated Part Load Value (IPLV) of 0.399 kW/ton (0.11kW/ kW).

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

**EA**HEALTHCARE:  
NCPrerequisite  
2**1. Benefits and Issues to Consider**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this prerequisite.

**2. Related Credits**

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this prerequisite.

**3. Summary of Referenced Standards**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a summary of standards referenced in this prerequisite.

**4. Implementation**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for implementation guidance related to this prerequisite.

**5. Timeline and Team**

See the the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this prerequisite.

**6. Calculations**

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations relating to this prerequisite.

**7. Documentation Guidance**

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this prerequisite.

**8. Examples**

See the LEED 2009 Green Building Design and Construction Reference Guide for an example relating to this prerequisite.

**9. Exemplary Performance**

This prerequisite is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

**10. Regional Variations**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information regarding regional variations for this prerequisite.

**11. Operations and Maintenance Considerations**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations relating to this prerequisite.

**12. Resources**

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for resources related to this prerequisite.

### 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

EA	
HEALTHCARE: NC	Prerequisite 2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.





## OPTIMIZE ENERGY PERFORMANCE

HEALTHCARE: NC	
Credit	EA Credit 1
Points	1-24 points

### Intent

To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

### Requirements

#### Whole Building Energy Simulation (1–24 points)

Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda) using a computer simulation model for the whole building project. Projects outside the U.S. may use a USGBC approved equivalent standard. The minimum energy cost savings percentage for each point threshold is as follows:

New Buildings	Existing Building Renovations	Points
12%	8%	1
14%	10%	2
16%	12%	3
18%	14%	5
20%	16%	7
22%	18%	9
24%	20%	11
26%	22%	13
28%	24%	14
30%	26%	15
32%	28%	16
34%	30%	17
36%	32%	18
38%	34%	19
40%	36%	20
42%	38%	21
44%	40%	22
46%	42%	23
48%	44%	24

Appendix G of Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all the energy costs associated with the building project. To achieve points under this credit, the proposed design must meet the following criteria:

- Compliance with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda<sup>1</sup>) or USGBC approved equivalent.
- Inclusion of all the energy costs within and associated with the building project.

<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

## EA CREDIT 1



**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## EA CREDIT 1

- Comparison against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda<sup>2</sup>) or USGBC approved equivalent. The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g., lighting integral to medical equipment) and other (e.g., waterfall pumps).

Regulated (non-process) energy includes lighting (e.g., for the interior, parking garage, surface parking, façade, or building grounds, etc. except as noted above), heating, ventilating, and air conditioning (HVAC) (e.g., for space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.), and service water heating for domestic or space heating purposes.

For this credit, process loads must be identical for both the baseline building performance rating and the proposed building performance rating. However, project teams may follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2007, G2.5) or USGBC approved equivalent to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

Projects in California may use Title 24-2005, Part 6, in place of ANSI/ASHRAE/IESNA Standard 90.1-2007 for Option 1.

## 1. Benefits and Issues to Consider

Refer to the Benefits and Issues to Consider section of EA Prerequisite 2 of the LEED 2009 Green Building Design and Construction Healthcare Supplement for environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

Refer to the Summary of Referenced Standards section of EA Prerequisite 2 of the LEED 2009 Green Building Design and Construction Healthcare Supplement for a summary of ANSI/ASHRAE/IESNA Standard 90.1–2007, referenced in this credit.

Any local alternative to ANSI/ASHRAE/IESNA Standard 90.1–2007 must be approved by USGBC as an equivalent standard, using the process described in the Implementation section.

### ASHRAE/ASHRAE/IESNA Standard 90.1–2007, Appendixes B and D

American National Standards Institute

American Society of Heating, Refrigerating and Air-Conditioning Engineers

Illuminating Engineering Society of North America

[www.ashrae.org](http://www.ashrae.org)

Appendix B of the standard identifies U.S. and global climate zones. Appendix D provides U.S. and global climatic data that can be used to determine the climate zone for the project location.

## 4. Implementation

The following process is used to determine the equivalency of a local standard to ANSI/ASHRAE/IESNA Standard 90.1–2007.

1. A group interested in determining equivalency of a particular standard should email a request to USGBC through [commonlanguage@usgbc.org](mailto:commonlanguage@usgbc.org).
2. USGBC will collaborate with the group to establish a method for creating an equivalency study and a timeline for completion.
3. The group will conduct the study.
4. USGBC will review the study and bring its recommendation to the LEED International Roundtable with approval by the LEED Steering Committee.
5. Typically, the group putting forward the standard will cover the cost of the study and USGBC review.
6. Priority of USGBC review will be determined based on market transformation potential and representation of the country on the LEED International Roundtable.
7. Approval of equivalency will be determined by the LEED Steering Committee and communicated to the group.
8. Upon approval by the LEED Steering Committee, the equivalency will be made available to projects through a USGBC-administered LEED Interpretation.

Additional information on the LEED International Roundtable can be found at [www.usgbc.org](http://www.usgbc.org)

EA	
HEALTHCARE: NC	Credit 1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

Any local alternative to ANSI/ASHRAE/IESNA Standard 90.1–2007 is desired must be determined equivalent to the U.S. standard, as described in the Implementation section.

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

A project team in Beijing consults ANSI/ASHRAE/IESNA Standard 90.1–2007, Appendix B, to determine the appropriate climate zone for compliance with Option 3 of the credit.

Table B-3 does not give a climate zone for Beijing. The project team finds Beijing in Table D-2, which lists the values for heating degree-days to base 65°F (HDD65) as 5252, and cooling degree-days to base 50°F (CDD50) as 4115. The team uses these values to determine Beijing's climate zone as defined in Appendix B, Section B2 and Table B-4.

The project team finds that Beijing is in a “moist climate” because its warmest month has a mean temperature higher than 72°F (22.2°C) and is therefore too warm to be a “marine climate,” and annual rainfall data indicate that the city is not in a “dry climate.”

Finally, the project team uses the values found in Table D-2 for HDD65 (5252) and CDD50 (4115) in Table B-4 and determines that Beijing is in Zone 4A (“mixed-humid”) because the CDD50 value is 4500 or less, and the HDD65 value is between 3600 and 5400.

## 9. Exemplary Performance

Refer to the Exemplary Performance section of EA Prerequisite 2 of the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance on exemplary performance for this credit.

## 10. Regional Variations

Refer to the Regional Variations section of EA Prerequisite 2 of the LEED 2009 Green Building Design and Construction Healthcare Supplement regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

Refer to the Operations and Maintenance Considerations section of EA Prerequisite 2 of the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

### 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

EA	
HEALTHCARE: NC	Credit 1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## GREEN POWER

HEALTHCARE: NC	
Credit	EA Credit 6
Points	1 point

### Intent

To encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.

### Requirements

Engage in at least a 2-year renewable energy contract to provide at least 35% of the building's electricity from renewable sources, as defined by the Center for Resource Solutions' Green-e Energy product certification requirements or an equivalent.

All purchases of green power shall be based on the quantity of energy consumed, not the cost.

If the green power is not Green-e Energy certified, equivalence must exist for both major Green-e Energy program criteria: 1) current green power performance standards, and 2) independent, third-party verification that those standards are being met by the green power supplier over time.

#### OPTION 1. Determine Baseline Electricity Use

Use the annual electricity consumption from the results of EA Credit 1: Optimize Energy Performance.

OR

#### OPTION 2. Estimate Baseline Electricity Use

Use the U.S. Department of Energy's Commercial Buildings Energy Consumption Survey database to determine the estimated electricity use.

## EA CREDIT 6



**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

No new standards are referenced; see the LEED 2009 Green Building Design and Construction Reference Guide for a summary of Green-e. If a local equivalent to Green-e is selected, ensure that the power performance and independent, third-party verification requirements are equivalent to those of Green-e.

## 4. Implementation

See the LEED 2009 Green Building Design and Construction Reference Guide Implementation section for more information on establishing Green-e equivalency and for more information on other approaches to achieving this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Reference Guide for calculations associated with this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

There are no examples for this credit.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance on exemplary performance for this credit.

## 10. Regional Variations

Renewable energy certificates (RECs) make it possible to substitute green energy even if the project does not have access to green power through the local utility or a competitive electricity marketer. RECs are now widely available in nearly all U.S. states but less prevalent in other countries. Projects outside the U.S. have the option of meeting this credit either by establishing Green-e equivalency, as detailed in the Implementation section of the LEED 2009 Green Building Design and Construction Reference Guide, or by purchasing U.S.-based Green-e certified RECs.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.



## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

EA	
HEALTHCARE: NC	Credit 6

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



# MATERIALS AND RESOURCES


## MR OVERVIEW

### OVERVIEW

See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for additional guidance.

The responsible harvest or extraction of materials used in building products is of universal importance, as is the way they are transported to the project site. Because some transportation methods cause significantly less environmental harm than others, a new compliance path has been added to MR Credit 3 (Sustainably Sourced Materials and Products) to allow for items that are shipped long distances via rail and water. The option involves calculating a weighted total distance rather than using a simple 500-mile (800-kilometer) radius.

 **Table 1.** MR Credits with Alternative Compliance Paths

CREDIT	TITLE	HEALTHCARE
<b>MR Prerequisite 1</b>	Storage and Collection of Recyclables	
<b>MR Prerequisite 2</b>	PBT Source Reduction—Mercury	
<b>MR Credit 1.1</b>	Building Reuse—Maintain Existing Walls, Floors, and Roof	
<b>MR Credit 1.2</b>	Building Reuse—Maintain Existing Interior Nonstructural Elements	
<b>MR Credit 2</b>	Construction Waste Management	
<b>MR Credit 3</b>	Sustainably Sourced Materials and Products	
<b>MR Credit 4.1</b>	PBT Source Reduction—Mercury in Lamps	
<b>MR Credit 4.2</b>	PBT Source Reduction—Lead, Cadmium, and Copper	
<b>MR Credit 5</b>	Furniture and Medical Furnishings	
<b>MR Credit 6</b>	Resource Use—Design for Flexibility	

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## SUSTAINABLY SOURCED MATERIALS AND PRODUCTS

HEALTHCARE: NC	
Credit	MR Credit 3
Points	1–4 points

### Intent

Reduce the environmental burdens of materials and products acquired to construct building and to upgrade building services.

### Requirements

One point and up to a maximum of four will be awarded for each 10% of the total value of all building materials and products used in the project (based on cost) that meet the criteria below. If concrete or steel structural elements are applied toward this credit, the project must include at least two other materials or products from CSI MasterFormat Divisions (other than 03 and 05) to attain the first point. Of the total recycled content, no more than 75% may be steel or concrete.

1. The cost of any individual material or product may be added for each of the following sustainability criteria that the material or product meets:

- Salvaged, refurbished or reused materials.

OR

- Recycled content. The recycled content value is determined by multiplying the recycled content fraction of the assembly (based on weight) by the cost of the assembly. The recycled content fraction is the sum of all post-consumer recycled content plus one-half of the pre-consumer content. Note: The same material cannot contribute to both salvaged and recycled content values.

OR

- Regionally sourced/manufactured materials and products that have been extracted, harvested or recovered, as well as manufactured within 500 miles (800 kilometers) of the project site

OR

- Building materials or products shipped by rail or water have been extracted, harvested or recovered, as well as manufactured within a 500 mile (800 kilometer) total travel distance of the project site using a weighted average determined through the following formula:
- $(\text{Distance by rail}/3) + (\text{Distance by inland waterway}/2) + (\text{Distance by sea}/15) + (\text{Distance by all other means}) \leq 500 \text{ miles [800 kilometers]}$

OR

- Rapidly renewable materials. The rapidly renewable content value is determined by multiplying the rapidly renewable content fraction of the assembly (based on weight) by the cost of the assembly.

## MR CREDIT 3



**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## MR CREDIT 3

OR

- Wood certified, in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria. The certified wood content value is determined by multiplying the certified wood content fraction of the assembly (based on weight) by the cost of the assembly. Note: Only virgin wood stock shall contribute towards the certified wood criteria. Certified wood shall not contribute to the rapidly renewable criteria.

Note: All wood certification requirements will be updated to reflect the new criteria being put forth for member approval across all LEED rating systems.

AND

2. Wall, ceiling and flooring systems and finishes, composite wood, agrifiber and fiberglass products, both exterior and interior adhesives, sealants, coatings, roofing, and waterproofing products must meet the relevant IEQ Credit 4: Low-Emitting Materials requirements to contribute toward the credit.

AND

Mechanical, electrical and plumbing components and specialty items, such as elevators, shall not be included in this calculation. Only include materials permanently installed in the project. Furniture is not included (see Credit 5.1-5.3).

Recycled content shall be defined in accordance with the International Organization of Standards Document ISO 14021-1999—Environmental labels and declarations—Self-declared environmental claims (Type II environmental labeling).

Supplemental cementitious materials derived from coal fired power plant wastes shall not have mercury content >5.5ppb (0.0055 mg/L). Flyash generated as a by-product of municipal solid waste incinerators does not qualify as a recycled-content material for this credit.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a list of credits related to this credit.

## 3. Summary of Referenced Standards

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a summary of standards referenced in this credit.

## 4. Implementation

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for implementation guidance related to this credit.

## 5. Timeline and Team

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance related to this credit.

## 6. Calculations

Follow the instructions in the LEED 2009 Green Building Design and Construction Healthcare Supplement for determining the total materials cost, the percentage of regional materials in assembly items, and the total percentage of local materials used in the project.

The new regional materials compliance path considers the total weighted distance that the project's materials have traveled by rail or water, from extraction or harvest through manufacturing to installation at the project site. The project team must determine the means of transportation for each leg of that journey.

Calculate the weighted average of materials transported to the project site according to the following equation:

$$\text{Total weighted distance} = (DR/3) + (DI/2) + (DS/15) + DO$$

where

DR= distance by rail

DI = distance by inland waterway

DS= distance by sea

DO= distance by other transportation modes

If the result is 500 miles (800 kilometers) or less, the material qualifies as a regional product.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

1. Compile a list of product purchases manufactured, extracted, or harvested regionally.
2. Record manufacturers' names and product costs for all applicable materials installed at the project site.

MR	
HEALTHCARE: NC	Credit 3

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

- Record distances and transportation modes for each product, from extraction or harvest through fabrication and delivery to the project site.
- Where appropriate, retain cutsheets that document materials' origin and manufacture within a 500-mile (800-kilometer) total weighted distance of the project site.
- Where appropriate, maintain a list of materials costs, excluding labor and equipment, for CSI Divisions 03-10, 31 (Section 31.60.00 Foundations), and 32 (Sections 32.10.00 Paving, 32.30.00 Site Improvements, and 32.90.00 Planting); including Division 12 is optional.

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for additional documentation guidance

## 8. Examples

A project in Berlin has imported wood from Norway. The wood was harvested in a forest outside Harestua and transported by truck to Oslo, where it was placed on a ship bound for Germany. Upon arriving at port in Kiel, Germany, the wood was loaded onto a train to Leipzig, where it was milled for use on the project. The finished wood product was transported by truck to the project site in Berlin.

First, the team determines the travel distances for each leg of the trip (Figure 1).

**Figure 1.** Example transport of wood from harvest to project site (generated using Google® Maps)



Then the team divides each distance by the divisors in the total weighted distance equation (see Calculations), as shown in Table 1. Transport by truck falls under “other” and thus has no divisor.



**Table 1.** Example determination of weighted distance for wood products

Mode	Leg	Actual distance	Calculation	Weighted distance
Truck	Harestua to Oslo	41 km (25 miles)	41 (25)	41 km (25 miles)
Ship	Oslo to Kiel	682 km (424 miles)	682/15 (424/15)	45 km (28 miles)
Rail	Kiel to Leipzig	454 km (285 miles)	454/3 (285/3)	151 km (95 miles)
Truck	Leipzig to Berlin (project)	190 km (118 miles)	190 (118)	190 km (118 miles)
Total		1367 km (852 miles)		427 km (266 miles)

MR	
HEALTHCARE: NC	Credit 3

Because the total weighted distance traveled is less than 500 miles (800 km), the wood qualifies as a regional material.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance on exemplary performance for this credit.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for resources related to this credit.

## 13. Definitions

An **inland waterway** is a navigable body of water, such as a river, canal, or lake, that is deep, wide, and slow enough for a vessel to pass.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



# INDOOR ENVIRONMENTAL QUALITY

## IEQ OVERVIEW

### OVERVIEW





See the LEED 2009 Green Building Design and Construction Reference Guide and the Healthcare Supplement for additional guidance.

Approaches to indoor environmental quality issues often vary by country. Because of differences in climate, ventilation systems, and environmental standards, many of the prescribed approaches to the credits in the Indoor Environmental Quality section have been difficult to apply outside the U.S. New language allows for local equivalents to many of the standards referenced in IEQ credits.

EQ Credit 3.1 (Construction Indoor Air Quality Management Plan During Construction) is expanded to allow projects in East Asia to use filtration media defined by Chinese Standard GB/T 14295-2008 (空气过滤器) or GB/T 13554-2008 (高效空气过滤器). IEQ Credit 4 (Low-Emitting Materials) accommodates products that meet widely used VOC testing requirements.

Finally, many project teams will be able to use CEN standards in place of ASHRAE 55-2004 and others may choose a local equivalent to ASHRAE in IEQ Credits 6.2 and 7 (Thermal Comfort).

 **Table 1.** IEQ Credits with Alternative Compliance Paths

CREDIT	TITLE	HEALTHCARE
<b>IEQ Prerequisite 1</b>	Minimum Indoor Air Quality Performance	
<b>IEQ Prerequisite 2</b>	Environmental Tobacco Smoke (ETS) Control	
<b>IEQ Prerequisite 3</b>	Hazardous Material Removal or Encapsulation (Renovations Only)	
<b>IEQ Credit 1</b>	Outdoor Air Delivery Monitoring	
<b>IEQ Credit 2</b>	Acoustic Environment	
<b>IEQ Credit 3.1</b>	Construction Indoor Air Quality Management Plan—During Construction	
<b>IEQ Credit 3.2</b>	Construction Indoor Air Quality Management Plan—Before Occupancy	
<b>IEQ Credit 4</b>	Low-Emitting Materials	
<b>IEQ Credit 5</b>	Indoor Chemical and Pollutant Source Control	
<b>IEQ Credit 6.1</b>	Controllability of Systems—Lighting	
<b>IEQ Credit 6.2</b>	Controllability of Systems—Thermal Comfort	
<b>IEQ Credit 7</b>	Thermal Comfort—Design and Verification	
<b>IEQ Credit 8.1</b>	Daylight and Views—Daylight	
<b>IEQ Credit 8.2</b>	Daylight and Views—Views	

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN— DURING CONSTRUCTION

## IEQ CREDIT 3.1

HEALTHCARE: NC	
Credit	IEQ Credit 3.1
Points	1 point

### Intent

To reduce indoor air quality (IAQ) problems and noise and vibration resulting from construction and/or renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

### Requirements

Develop and implement an Environmental Quality Management Plan (EQMP) for the construction and preoccupancy phases of the building. Minimize air and noise pollution during the construction process as prescribed below.

For renovations, additions adjacent to occupied facilities or phased occupancy in new construction:

- Follow the 2010 FGI Guidelines for Design and Construction of Health Care Facilities and the Joint Commission on standards to establish an integrated infection control team comprised of the owner, designer and contractor to evaluate infection control risk and document the required precautions in a project-specific plan.
- Use the Infection Control Risk Assessment (ICRA) standard published by the American Society of Healthcare Engineering (ASHE) and the U.S. Centers for Disease Control and Prevention (CDC), as a guideline for construction activities to assess risk and to select mitigation procedures.

For all projects:

- Develop and implement a moisture control plan to address measures that will maintain dry conditions to protect stored on-site and installed absorptive materials from moisture damage. Immediately remove from site and properly dispose of any materials susceptible to microbial growth and replace with new, undamaged materials. Also include strategies for protecting the building from moisture intrusion and occupant exposures to dangerous mold spores.
- If permanently installed air handlers are used during construction:
  - Filtration media must be used at each return air grille that meets one of the following criteria below.
    - Filtration media with a minimum efficiency reporting value (MERV) of 8 as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda)
    - Filtration media is Class F5 or higher, as defined by CEN Standard EN 779-2002, Particulate air filters for general ventilation, Determination of the filtration performance
    - Projects in East Asia may use filtration media classified as medium efficiency (中效过滤器) or higher as defined by Chinese standard GB/T 14295-2008 (空气过滤器).

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## IEQ CREDIT 3.1

- Filtration media with a minimum dust spot efficiency of 30% or higher and greater than 90% arrestance on a particle size of 3–10 µg
  - Protect active outdoor air intakes and return air grilles with filtration media.
  - Temporary filter media must be evaluated and replaced as necessary.
  - Replace all filtration media immediately prior to occupancy.
- Volatile Organic Compound (VOC) Absorption – Schedule construction procedures to minimize exposure of absorbent materials to VOC emissions. Complete “wet” construction procedures such as painting and sealing before storing or installing “dry” absorbent materials such as carpet or ceiling tiles. These materials accumulate pollutants and release them over time. Store fuels, solvents and other sources of VOCs separately from absorbent materials.
- Tobacco Products – Prohibit the use of tobacco products inside the building and within 50 feet (16 meters) (or greater, if local jurisdiction requires) of the building entrance during construction.
- Noise and Vibration Exposure to Occupants and Construction Crews – Develop a plan based upon the British Standard (BS 5228) to reduce noise emissions and vibrations from construction equipment and other non-road engines by specifying low-noise emission design or the lowest decibel level available that meets performance requirements in the British Standard to insure it is within acceptable limits to the occupants. Construction crews must wear ear protection in areas where sound levels exceed 85 dB for extended periods of time.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### Chinese Standard GB/T 14295-2008 (空气过滤器)

<http://www.sac.gov.cn/>

[http://www.sac.gov.cn/sac\\_en/](http://www.sac.gov.cn/sac_en/)

This national standard is administered by the People's Republic of China's National HVAC and Purification Equipment Standardization Technical Committee and issued by the Standardization Administration and the General Administration of Quality Supervision, Inspection and Quarantine.

This standard presents methods for testing air cleaners for two performance characteristics: the device's capacity for removing particles from the air stream (counting efficiency and arrestance) and the device's resistance to airflow.

This standard also includes air filter terminology and definitions, classification and markings, requirements, test methods, inspection rules and product labeling, packaging, transportation and storage. This standard applies to filters that are used in ventilation, air conditioning and air purification systems or equipment under conditions of normal temperature and humidity.

The classifications range from roughing filters (粗效过滤器) to Sub-HEPA filters (亚高效过滤器). Higher-efficiency filters are addressed in Chinese Standard GB/T 13554-2008 (高效空气过滤器) High Efficiency Particulate Air Filter, which covers high efficiency particulate air filters (高效空气过滤器) and ultra-low penetration air filters (超高效空气过滤器).

### Chinese Standard GB/T 13554-2008 (高效空气过滤器)

<http://www.sac.gov.cn/>

[http://www.sac.gov.cn/sac\\_en/](http://www.sac.gov.cn/sac_en/)

This national standard is issued by the Standardization Administration and the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China.

This standard covers higher-efficiency air filters than GB/T 14295-2008 (空气过滤器) and the classifications range from high efficiency particulate air filters (高效空气过滤器) to ultra-low penetration air filters (超高效空气过滤器).

This standard also includes air filter terminology and definitions, classification and markings, requirements, test methods, inspection rules and product labeling, packaging, transportation and storage. This standard applies to HEPA and ULPA filters that are used in supply air and exhaust air purification systems or equipment under conditions of normal temperature and humidity.

IEQ	
HEALTHCARE: NC	Credit 3.1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

**Table 1. Chinese Air Filter Classifications from Highest to Lowest Efficiency**

Chinese Standard	Air Filter Classification: Chinese	Air Filter Classification: English	LEED Credit Requirement
GB/T 13554-2008	超高效空气过滤器	Ultra-low penetration air filters (ULPA)	Meets requirements of IEQc3.1
GB/T 13554-2008	高效空气过滤器	High efficiency particulate air filters (HEPA)	Meets requirements of IEQc3.1
GB/T 14295-2008	亚高效过滤器	Sub-HEPA (high efficiency particulate air) filter	Meets requirements of IEQc3.1
GB/T 14295-2008	高中效过滤器	high efficiency filter	Meets requirements of IEQc3.1
GB/T 14295-2008	中效过滤器	medium efficiency filter	Meets requirements of IEQc3.1
GB/T 14295-2008	粗效过滤器	roughing filter	Not allowed

#### **CEN Standard EN 779: 2002, Particulate air filters for general ventilation, Determination of the filtration performance**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries for determining filter class for all filtration media.

#### **4. Implementation**

##### **HVAC Protection**

Protect all HVAC equipment from both dust and odors and seal all duct and equipment openings with plastic. If the system must be operated to maintain service to occupied portions of the building or to protect finished work, protect the return (negative pressure) side of the system. If the returns cannot be closed, install and maintain temporary filters over the grilles and openings. All filtration media must be medium efficiency (中效过滤器) or higher as defined by Chinese standard GB/T 14295-2008 (空气过滤器) or have a minimum dust spot efficiency of 30% and at least 90% arrestance on a particle size of 3–10 µg. If an unducted plenum over the construction zone must be used, isolate it by having all ceiling tiles in place. Check for leaks in the return ducts and air handlers and make needed repairs promptly. The contractor should avoid using the mechanical rooms for construction storage.

See the 2009 Green Building Design and Construction Healthcare Supplement for additional implementation guidance.

#### **5. Timeline and Team**

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance related to this credit.

#### **6. Calculations**

There are no calculations required for this credit.



## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for documentation guidance related to this credit.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for an example relating to this credit.

## 9. Exemplary Performance

See the LEED 2009 Green Building Design and Construction Reference Guide for guidance on exemplary performance for this credit.

## 10. Regional Variations

There are no regional variations applicable to this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for resources related to this credit.

## 13. Definitions

**Counting efficiency** is the capability of air filters to capture particles measured by the concentration of test aerosol. It is the ratio between the change in the concentration of aerosol from upstream to downstream air flow and the concentration of aerosol at upstream air flow.

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for definitions of terms used in this credit.

IEQ	
HEALTHCARE: NC	Credit 3.1

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## LOW-EMITTING MATERIALS

HEALTHCARE: NC	
Credit	IEQ Credit 4
Points	1-4 points

### Intent

To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

### Requirements

One point (maximum four) can be achieved for each group of materials that comply with the requirements.

#### GROUP 1: Interior Adhesives and Sealants

All adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following requirements as applicable to the project scope<sup>1</sup>:

- Adhesives, Sealants and Sealant Primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168. Volatile organic compound (VOC) limits listed in the table below correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.
- Aerosol Adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.

Adhesives and sealants shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

#### GROUP 2: Wall and Ceiling Finishes

Paints and coatings used on the interior of the building—defined as inside of the weatherproofing system and applied on-site—shall not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings. (Rules in effect on July 1, 2008.)

Ceiling tiles, including suspended acoustical tiles, and wall coverings shall comply with the testing and product requirements of the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers version 1.1 (CDPH/EHLB Standard Method v1.1) modeled using the standard office building protocol parameters and certified as compliant by an independent third party.

#### GROUP 3: Flooring

Carpet and all hard surface flooring installed in the building interior shall comply with the testing and product requirements of the California Department of Public Health

<sup>1</sup> The use of a VOC budget is permissible for compliance with this credit.

## IEQ CREDIT 4



**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## IEQ CREDIT 4

Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers version 1.1 (CDPH/EHLB Standard Method v1.1), modeled using the standard office building protocol parameters and certified as compliant by an independent third party. Mineral-based finish flooring products, such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring, qualify for credit without any IAQ testing requirements. However, associated, site-applied adhesives, grouts, finishes and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit.

All carpet cushion installed in the building interior shall comply with the requirements of the Carpet and Rug Institute Green Label program.

All flooring related adhesives shall comply with the requirements of Group 1. Grout shall comply with requirements for ceramic tile adhesive.

- For carpet adhesive, concrete, wood, bamboo and cork floor finishes, and tile setting adhesives, compliance can be demonstrated with test results of:
  - Total volatiles fraction, based on one of the following, provided that water and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168:
    - ASTM D2369
    - EPA method 24
    - ISO 11890 part 1
  - Total volatile organic compounds fraction, based on one of the following, provided that all VOCs with a boiling point up to 280°C (536°F) are included, and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168.
    - ASTM D6886
    - ISO 11890 part 2

Concrete, wood, bamboo, cork and other floor finishes, such as sealer, stain and finish, shall not exceed the VOC limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on July 1, 2008.

### GROUP 4: Composite Wood, Agrifiber Products and Batt Insulation Products

Composite wood and agrifiber products used on the interior of the building—defined as inside of the weatherproofing system—shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

Composite wood and agrifiber products are defined as particleboard, medium density fiberboard (MDF), plywood, wheat board, strawboard, panel substrates and door cores. Materials considered furniture, fixtures, and equipment (FF&E) are not considered base building elements and are not included.

Batt insulation products shall contain no added formaldehyde, including urea formaldehyde, phenol formaldehyde, and urea-extended phenol formaldehyde.

**GROUP 5: Exterior Applied Products**

Adhesives, sealants, coatings, roofing and waterproofing materials—defined as from the weatherproofing system out and applied on-site—shall comply with the VOC limits of California Air Resources Board (ARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings and South Coast Air Quality Management District (SCAQMD) Rule 1168 effective July 1, 2005.

Roofing installations shall not use hot-mopped asphalt installation techniques.

Parking lots and other paved surfaces shall not use coal tar sealants.

For any waterproofing, asphalt roofing needing repair, parking lot sealing or other high VOC emissions outdoor construction process, create a plan to manage fumes and avoid infiltration to occupied spaces. Comply with procedures established by NIOSH's Asphalt Fume Exposures During the Application of Hot Asphalt to Roofs (Publication No. 2003-112).

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## IEQ CREDIT 4

Reference Table for all IEQ Credit 4 Groups			
Architectural Adhesives (SCAQMD 1168)	VOC Limit [g/L less water]	Specialty Adhesives (SCAQMD 1168)	VOC Limit [g/L less water]
Indoor Carpet Adhesives	50	PVC Welding	510
Carpet Pad Adhesives	50	CPVC Welding	490
Wood Flooring Adhesives	100	ABS Welding	325
Rubber Floor Adhesives	60	Plastic Cement Welding	250
Subfloor Adhesives	50	Adhesive Primer for Plastic	550
Ceramic Tile Adhesives	65	Contact Adhesive	80
VCT & Asphalt Adhesives	50	Special Purpose Contact Adhesive	250
Drywall & Panel Adhesives	50	Structural Wood Member Adhesive	140
Cove Base Adhesives	50	Sheet Applied Rubber Lining Operations	850
Multipurpose Construction Adhesives	70	Top & Trim Adhesive	250
Structural Glazing Adhesives	100		
Interior Sealants (SCAQMD 1168)		Sealant Primers (SCAQMD 1168)	250
Architectural	250	Architectural Non Porous	775
Other	420	Architectural Porous	750
		Other	750
Exterior Coatings (CARB SCM)		Substrate Specific Applications (SCAQMD 1168)	
Aluminum Roof Coatings	400	Metal to Metal	30
Basement Specialty Coatings	400	Plastic Foams	50
Concrete Curing Compounds	350	Porous Material (except wood)	50
Concrete/Masonry Sealers	100	Wood	30
Driveway Sealers	50	Fiberglass	80
Driveway Sealers	50	Interior Coatings (SCAQMD 1113)	
Floor Coatings	100	Paints (flat & non-flat, except anti-rust)	50
Industrial Maintenance Coatings	250	Clear wood finishes (varnish, lacquer or sanding sealers)	275
Non flat coatings	100	Floor coatings	50
Non flat high gloss	150	Primers and undercoaters	100
Primers, Sealants, and Undercoaters	100	Swimming pool coatings	340
Quick Dry Enamels	150	Sealers: Waterproofing & all others	100
Reactive Penetrating Sealer	350	Shellacs: Clear	730
Rust Preventative Coatings	250	Shellacs: Pigmented	550
Stains	250	Stains	100
Stone Consolidant	450	Aerosol Adhesives (GS-36)	
Traffic Coatings	100	General purpose mist spray	65% VOCs by weight
Waterproofing Membranes	250	General purpose web spray	55% VOCs by weight
Wood Coatings	275	Special purpose aerosol adhesives (all types)	70% VOCs by weight

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for a list of credits related to this credit.

## 3. Summary of Referenced Standards

### ASTM D2369: Standard Test Method for Volatile Content of Coatings

<http://www.astm.org/>

According to the ASTM website, “This test method is the procedure of choice for determining volatiles in coatings for the purpose of calculating the volatile organic content in coatings under specified test conditions. The weight percent solids content (nonvolatile matter) may be determined by difference. This information is useful to the paint producer and user and to environmental interests for determining the volatiles emitted by coatings.”

### ASTM D6886: Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography

<http://www.astm.org/>

According to the ASTM website, “This test method is for the determination of the weight percent of individual volatile organic compounds in low VOC content waterborne latex air-dry coatings. The method is intended primarily for analysis of waterborne coatings in which the material VOC content is below 5 weight percent. The method has been used successfully with higher VOC content waterborne coatings.”

### EPA Test Method 24, Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings

<http://www.epa.gov/>

EPA Test Method 24 provides testing parameters for identifying volatile content in coatings. This testing method references several ASTM sampling methods.

### ISO 11890-1: 2007, Paints and varnishes, Determination of volatile organic compound (VOC) content, Part 1, Difference method

<http://www.iso.org/>

According to the ISO website, “ISO 11890-1:2007 specifies a method for the determination of the volatile organic compound (VOC) content of paints, varnishes and their raw materials. This part may be used where the expected VOC content is greater than 15 % by mass. When the expected VOC content is greater than 0,1 % by mass and less than 15 % by mass, ISO 11890-2 should be employed.”

### ISO 11890-2: 2006, Paints and varnishes, Determination of volatile organic compound (VOC) content, Part 2, Gas-chromatographic method

<http://www.iso.org/>

According to the ISO website, “ISO 11890-2:2006 specifies a method for the determination of the volatile organic compound (VOC) content of paints, varnishes and their raw materials. ISO 11890-2 is preferred if the expected VOC content is greater than 0,1 % by mass and less than about 15 % by mass. When the VOC content is greater than about 15 % by mass, the less complicated method given in ISO 11890-1 may be used.”

IEQ	
HEALTHCARE: NC	Credit 4

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

#### 4. Implementation

See the Implementation section of IEQ Credit 4.1 in the LEED 2009 Green Building Design and Construction Healthcare Supplement for complete implementation guidance related to this credit.

#### 5. Timeline and Team

See the Timeline and Team section of IEQc4.1 in the LEED 2009 Green Building Design and Construction Healthcare Supplement for guidance related to this credit.

#### 6. Calculations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for calculations relating to this credit.

#### 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- Maintain a list of each carpet, carpet cushion, and carpet adhesive installed in the building interior. Record the VOC content for each adhesive. If a European testing method has been selected, ensure that it meets the testing requirements outlined in the rating system.
- Maintain a list of each hard surface flooring product, tile setting adhesive, finishes, and grout installed in the building interior. Record the VOC content for each tile setting adhesive and grout.

#### 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example relating to this credit.

#### 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

#### 10. Regional Variations

European VOC testing methods often vary from those used in the United States. If a European testing method has been selected, ensure that it follows the parameters of the referenced California testing methods. If the European testing methods and calculations differ, multiply the European test results for carpets or floorings by 0.7.

#### 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.



## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

### Websites

#### **ASTM International**

<http://www.astm.org>

#### **International Organization for Standardization (ISO)**

<http://www.iso.org>

#### **U.S. Environmental Protection Agency (EPA)**

<http://www.epa.gov>

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for definitions of terms identified in this credit.

IEQ	
HEALTHCARE: NC	Credit 4

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## CONTROLLABILITY OF SYSTEMS—THERMAL COMFORT

HEALTHCARE: NC	
Credit	IEQ Credit 6.2
Points	1 point

### Intent

To provide a high level of thermal comfort system control<sup>1</sup> by individual occupants or specific groups in multi-occupant spaces and promote their productivity, comfort and well-being.

### Requirements

Provide individual thermal comfort controls for every single occupant patient room.

#### AND

Provide individual thermal comfort controls for 50% (minimum) of the remaining building occupants to enable adjustments to meet individual needs and preferences. Operable windows may be used in lieu of controls for occupants located 20 feet (6 meters) inside and 10 feet (3 meters) to either side of the operable part of a window. The areas of operable window must meet the requirements of ASHRAE Standard 62.1-2007 paragraph 5.1 Natural Ventilation (with errata but without addenda)<sup>1</sup>.

#### AND

Provide comfort system controls for all shared multi-occupant spaces to enable adjustments that meet group needs and preferences.

Conditions for thermal comfort are described in IEQ credit 7: Thermal Comfort—Design and Verification, and include the primary factors of air temperature, radiant temperature, air speed and humidity.

Comfort system control<sup>2</sup> for the purposes of this credit is defined as the provision of control over at least one of these primary factors in the occupant's local environment.

1. Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.
2. For the purposes of this credit, comfort system control is defined as control over at least 1 of the following primary factors in the occupant's vicinity: air temperature, radiant temperature, air speed and humidity.

## IEQ CREDIT 6.2



**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**CEN Standard EN15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Used in conjunction with ISO Standard 7730: 2005, it is considered equivalent to ASHRAE 55–2004 for the purposes of this credit.

**ISO Standard 7730: 2005, Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria**

International Organization for Standardization

<http://www.iso.org>

This standard “presents methods for predicting the general thermal sensation and degree of discomfort (thermal dissatisfaction) of people exposed to moderate thermal environments” and should be used in conjunction with CEN Standard EN 15251: 2007.

See the LEED 2009 Green Building Design and Construction Reference Guide for additional standards referenced in this credit.

## 4. Implementation

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for implementation guidance related to this credit.

## 5. Timeline and Team

During schematic design, building designers should evaluate the building’s orientation and consider how heat gain or loss will affect the occupants. Designers should also consider whether site-specific conditions, such as wind, sound, and odors, may affect the location of operable windows. During design development, locate the thermal comfort controls with the help of electrical and mechanical engineers and the construction or development manager. Consider thermal comfort needs as they pertain to ISO 7730: 2005 and CEN Standard EN 15251: 2007 requirements; survey future occupants’ preferences. Evaluate the controls for each space, considering the specific tools and equipment that occupants will use on a daily basis. When evaluating shared occupant spaces, consider the occupancy schedule.

Post installation commissioning of all thermal comfort systems will ensure proper operation. During building operation, the owner should provide training for building maintenance staff in using the controls. Property management and building engineers should periodically review of comfort control systems to ensure that occupants’ needs are met and that controls are working according to design.

## 6. Calculations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for calculations relating to this credit.

## 7. Documentation Guidance

See the LEED 2009 Green Building Design and Construction Reference Guide for documentation guidance related to this credit.

## 8. Examples

See the LEED 2009 Green Building Design and Construction Reference Guide for an example detailing an underfloor air distribution system.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

See the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Reference Guide for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

See the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

IEQ	
HEALTHCARE: NC	Credit 6.2

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



## THERMAL COMFORT—DESIGN AND VERIFICATION

## IEQ CREDIT 7

HEALTHCARE: NC	
Credit	IEQ Credit 7
Points	1 point

### Intent

To provide a comfortable thermal environment that supports and promotes occupant productivity and well-being and provide for the assessment of building occupant's thermal comfort over time.

### Requirements

Design heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of one of the options below, and local codes or current 2010 FGI Guidelines for Design and Construction of Health Care Facilities (Table 2.1-2: Ventilation Requirements for Areas Affecting Patient Care in Hospitals and Outpatient Facilities), where local codes do not apply. Demonstrate design compliance in accordance with the Section 6.1.1 documentation.

#### OPTION 1. ASHRAE Standard 55-2004 or Non-U.S. Equivalent

Meet the requirements of ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy (with errata but without addenda<sup>1</sup>). Demonstrate design compliance in accordance with the Section 6.1.1 documentation. Projects outside the U.S. may use a local equivalent to ASHRAE Standard 55-2004 Thermal Comfort Conditions for Human Occupancy Section 6.1.1.

#### OPTION 2. ISO 7730: 2005 & CEN Standard EN 15251: 2007

Projects outside the U.S. may earn this credit by designing heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of International Organization for Standardization (ISO) 7730: 2005 Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria; and CEN Standard EN 15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.

### AND

Provide a permanent monitoring system to ensure that the building performs to the desired comfort criteria as determined above.

Agree to implement a thermal comfort survey of building occupants<sup>2</sup>, within a period of six to 18 months after occupancy. The survey shall collect anonymous responses about thermal comfort in the building, including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. The plan shall include measurement of relevant environmental

1 Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

2 In acute care hospitals and outpatient healthcare projects, occupants are defined as full-time staff. For residential health care occupancies, such as long term care or rehabilitation facilities, occupants include both full-time staff and residents.

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

**IEQ CREDIT 7**

variables in problem areas in accordance with the standard selected above and 2010 FGI Guidelines for Design and Construction of Health Care Facilities.



## 1. Benefits and Issues to Consider

See the LEED 2009 Green Building Design and Construction Reference Guide for information on environmental and economic issues related to this credit.

## 2. Related Credits

See the LEED 2009 Green Building Design and Construction Reference Guide for a list of credits related to this credit.

## 3. Summary of Referenced Standards

**CEN Standard EN15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics**

Comité Européen de Normalisation

<http://www.cen.eu>

This standard outlines the parameters used in many EU countries to design and assess energy performance of buildings. Used in conjunction with ISO Standard 7730: 2005, it is considered equivalent to ASHRAE 55–2004 for the purposes of this credit.

**ISO Standard 7730: 2005, Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria**

International Organization for Standardization

<http://www.iso.org>

This standard “presents methods for predicting the general thermal sensation and degree of discomfort (thermal dissatisfaction) of people exposed to moderate thermal environments” and should be used in conjunction with CEN Standard EN 15251: 2007.

## 4. Implementation

Local standards for projects outside the United States will be compared with ASHRAE 55–2004 in terms of scope, metrics, and thresholds. Project teams that wish to ensure acceptance of a proposed equivalent to ASHRAE 55–2004 prior to submission for review may choose to submit a Formal Inquiry for a Credit Interpretation Ruling for a single project, or a LEED Interpretation for multi-project use.

In order to demonstrate equivalency using a local standard, the local standard must address all of the critical requirements of ASHRAE 55–2004, identified below.

### Factors Affecting Thermal Comfort (ASHRAE 55–2004, Section 5.1):

There are six primary factors for defining conditions for thermal comfort for occupants. The six factors are metabolic (MET) rate, clothing insulation, air temperature, radiant temperature, air speed, and humidity.

In order to demonstrate equivalency, the local standard shall:

- Define acceptable thermal comfort conditions.
- Include a well-defined procedure to determine thermal comfort conditions.
  - The procedure shall define an acceptable thermal comfort zone.
    - At least 80% of occupants must be satisfied within the zone.
  - The procedure shall include the following parameters in the calculation:
    - Operative Temperature or a combination of air temperature and radiant temperature.

IEQ	
HEALTHCARE: NC	Credit 7

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.

IEQ	
HEALTHCARE: NC	Credit 7

- Humidity
- Air Speed
  1. Require a maximum air speed threshold for supply air systems (40 fpm [0.203 meters per second] is recommended but variances are allowed up to 10%).
- Local Thermal Discomfort
  1. Address temperature variations due to draft, vertical temperature differences, and radiant asymmetry. Thresholds for these may differ from ASHRAE 55-2004 within an acceptable range

## 5. Timeline and Team

Refer to the Timeline and Team sections for IEQ Credit 7.1, Thermal Comfort–Design, and IEQ Credit 7.2, Thermal Comfort–Verification, in the LEED 2009 Green Building Design and Construction Reference Guide for guidance related to this credit. Project teams wishing to use a local equivalent should contact USGBC early in the design phase to ensure that the alternative standard is acceptable.

## 6. Calculations

Refer to the Calculations sections for IEQ Credit 7.1, Thermal Comfort–Design, and IEQ Credit 7.2, Thermal Comfort–Verification, in the LEED 2009 Green Building Design and Construction Reference Guide for calculations relating to this credit.

## 7. Documentation Guidance

As a first step in preparing to complete the LEED Online documentation requirements, work through the following measures. Refer to LEED Online for the complete descriptions of all required documentation.

- For projects using a local equivalent in Option 1, the local standard shall address all the issues identified under Implementation.

If the selected equivalent standard contains deviations or omissions for sections specified under Implementation, provide relevant data to justify the omissions or deviations.

Refer to the Documentation Guidance sections for IEQ Credit 7.1, Thermal Comfort–Design, and IEQ Credit 7.2, Thermal Comfort–Verification, in the LEED 2009 Green Building Design and Construction Reference Guide for additional documentation guidance related to this credit.

## 8. Examples

Refer to the Examples sections for IEQ Credit 7.1, Thermal Comfort–Design, and IEQ Credit 7.2, Thermal Comfort–Verification, in the LEED 2009 Green Building Design and Construction Reference Guide for examples relating to this credit.

## 9. Exemplary Performance

This credit is not eligible for exemplary performance under the Innovation in Design section of the LEED 2009 rating system.

## 10. Regional Variations

Refer to the Regional Variations sections for IEQ Credit 7.1, Thermal Comfort–Design, and IEQ Credit 7.2, Thermal Comfort–Verification, in the LEED 2009 Green Building Design and Construction Reference Guide for regional variations associated with this credit.

## 11. Operations and Maintenance Considerations

See the LEED 2009 Green Building Design and Construction Healthcare Supplement for Operations and Maintenance considerations related to this credit.

## 12. Resources

See USGBC's LEED Resources & Tools (<http://www.usgbc.org/leed/tools>) for additional resources and technical information.

Refer to the Resources sections for IEQ Credit 7.1, Thermal Comfort–Design, and IEQ Credit 7.2, Thermal Comfort–Verification, in the LEED 2009 Green Building Design and Construction Reference Guide for resources related to this credit.

## 13. Definitions

See the LEED 2009 Green Building Design and Construction Reference Guide for definitions of terms used in this credit.

IEQ	
HEALTHCARE: NC	Credit 7

**IMPORTANT!** This reference guide supplement contains only the reference guide sections that pertain to projects using the LEED 2009 Global Alternative Compliance Paths or East Asia ACPs. Use this supplement alongside the LEED Reference Guide for Green Building Design and Construction and the Healthcare Supplement for complete credit information. For the omitted sections, refer to the main reference guide.



**Bus rapid transit** is an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way; it is designed to combine the flexibility of buses with the efficiency of rail.

**Green infrastructure** is a soil- and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies (U.S. EPA).

An **inland waterway** is a navigable body of water, such as a river, canal, or lake, that is deep, wide, and slow enough for a vessel to pass.

**Low- Impact Development** (LID) is an approach to managing stormwater runoff that emphasizes onsite natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles, such as minimizing land disturbance, preserving vegetation, and minimizing impervious cover, and design practices like rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, and soil amendments. These engineered practices may require specialized design assistance.

**Manage onsite** refers to capturing and retaining the specified volume of rainfall to mimic natural hydrologic function. Strategies may include evapotranspiration, infiltration, and capture and reuse.

**Natural site hydrology** is the natural land cover function of water occurrence, distribution, movement, and balance.

**Public transportation** consists of bus, rail, or other transit services for the general public that operate on a regular, continual basis.

**Rideshare** is a transit service that involves sharing a single vehicle with multiple people, excluding large-scale vehicles such as buses and trains. The rideshare transit facility must include a signed stop and a clearly defined waiting area. Additionally, the rideshare must include an enclosed passenger seating area, fixed route service, fixed fare structure, continuous daily operation, and the ability to pick up and drop off multiple riders. Rideshare vehicles must hold 4 or more passengers, except for human-powered conveyances, which must hold 2 or more passengers.