



Parksmart

Certification Standard

Parksmart Certification Standard



Version 1.0 with Addenda

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Preface

Parksmart (formerly known as Green Garage Certification) is the world's only rating system defining and recognizing sustainable practices in parking structure management, programming, design, and technology.

An industry-driven, field-tested road map for high-performance new and existing parking garages, Parksmart recognizes forward-thinking facilities working today to shape tomorrow's transportation ecosystem.

Parksmart is a voluntary, consensus-driven standard promoting an integrated approach enabling parking structures to achieve:

- increased energy efficiency and performance
- reduced environmental impact
- efficient parking space management
- integrated sustainable mobility services and technologies
- diversity of mobility options
- stronger community relationships

This **Parksmart Certification Standard** is used in conjunction with the **Guide to Parksmart Certification**.

This **Standard** defines the performance measures and documentation requirements.

Application procedures, fees, program requirements and certification levels are available in the **Guide to Parksmart Certification**.

Launch Partners

Thank you to these organizations for their generous support. Their contributions made Parksmart certification possible.

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Preparing Cities for Electric Vehicles
[An RMI Initiative]

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Affiliate

ECO Parking Lights

Legacy Parking Company

Nagle Energy Solutions

Parking Panda

Prestige Parking

Resurgens Renewables

SEQUIL Systems, Inc.

Solar Athletic

Solaire

VoicePark

Zenith Motors

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Table of Contents

	Page #
Preface	i
Launch Partners	ii
Contributors & Affiliations	iv
Introduction	viii
Elements of Parksmart Certification	x
Beta Sites	xi

SECTION A **Management** **1**

Measure	Title	Page #
1	Parking Pricing	2
2	Shared Parking	6
3	Transportation Management Association (TMA) / Organization (TMO) Affiliation	9
4	Recycling Program	11
5	Sustainable Purchasing Program	15
6	Proactive Operational Maintenance	19
7	Cleaning Procedures – Occupied Spaces	21
8	Cleaning Procedures – Parking Decks	25
9	Building Systems Commissioning	29
10	Construction Waste Management	32
11	Regional Materials for New Construction, Rehabilitation, or Retrofit	35
12	Regional Labor for New Construction, Rehabilitation, or Retrofit	37
13	Reused, Repurposed or Recycled Materials	39
14	Third Party Sustainability Certification	42
15	Credentialed Management	44
16	Life-cycle Assessment	46

SECTION B **Programs** **51**

Measure	Title	Page #
1	Placemaking	52
2	Access to Mass Transit	59
3	Wayfinding Systems – External	61

4	Wayfinding Systems – Internal	64
5	Traffic Flow Plan	68
6	Carshare Program	71
7	Rideshare Program	73
8	Low-emitting and Fuel-efficient Vehicles	75
9	Alternative Fuel Vehicles	80
10	Alternative Fuel Fleet Vehicles	82
11	Bicycle Parking	85
12	Bicycle Sharing/Rental	89
13	Marketing/Educational Program	92

SECTION C **Technology & Structure Design** **97**

Measure	Title	Page #
1	Idle Reduction Payment Systems	98
2	Fire Suppression Systems	101
3	No/Low-VOC Coatings, Paints and Sealants	103
4	Tire Inflation Stations	106
5	Electric Vehicle (EV) Charging Stations	108
6	HVAC Systems – Occupied Spaces	111
7	Ventilation Systems – Parking Decks	118
8	Lighting Controls	123
9	Energy-efficient Lighting System	126
10	Stormwater Management	131
11	Rainwater Harvesting	134
12	Greywater Reuse	136
13	Indoor Water-efficiency	138
14	Water-efficient Landscaping	140
15	Roofing Systems	142
16	Renewable Energy Generation	146
17	Design for Durability	151
18	Energy Resiliency – Storage	157

SECTION D **Innovation** **159**

Measure	Title	Page #
1	Innovative Approach	160

Introduction

Did you know that transportation in the U.S. now emits more greenhouse gas emissions than power plants,¹ and that parking is one of the largest land uses in cities?² Over the next 20 years, the number of cars in the world is projected to increase even more—to grow from 1.2 billion to almost 2 billion.³ Vehicles are parked for roughly 95% of their lifetimes,⁴ yet we rarely think about how parking spaces affect the environment. In fact, in the U.S., there are upwards of 2 billion parking spaces for roughly 300 million vehicles.⁵

In a time of growing desire for more livable communities alongside a rising concern about our planet, sustainable mobility has become a growing movement. A century after the emergence of the Model T Ford, parking facility owners, developers, planners, architects, operators, policy makers and others are moving from a narrow “Where do we put the cars?” approach toward an integrated vision enabling more varied and sustainable means of mobility. This emerging approach integrates evolving technologies, multimodal mobility, connected cars, consumer choice, smart parking and intelligent transportation innovations.

The parking industry has a unique opportunity: buildings and transportation are the two biggest drivers of CO₂ emissions globally and investors, property owners and consumers are looking for greener solutions. How we operate our parking can significantly reduce our environmental impacts, especially regarding carbon emissions, pollution and fuel consumption. Through collaborative, integrated and innovative green parking practices, we can promote sustainable mobility for all.

Enter Parksmart – formerly Green Garage Certification – the world’s only rating system defining and recognizing sustainable practices in parking structure management, programming, design and technology. Developed by industry experts, the Parksmart framework is a voluntary, consensus-driven standard that guides projects toward innovative, solutions-oriented strategies.

Serving both existing and new parking structures in all markets, including commercial, university, municipal, hospital, retail and hospitality, Parksmart certification allows parking structures to:

- Increase energy efficiency and performance
- Reduce environmental impact
- Offer better lighting and ventilation
- Develop efficient parking structure management
- Promote alternative modes of transportation

1 Plummer, B. (2016, July 13). Power plants are no longer America's biggest climate problem - Transportation is. Retrieved August 11, 2016, from www.vox.com/2016/6/13/11911798/emissions-electricity-versus-transportation

2 Curry, M. (2014, March 20). Rock Star or Comedian? Donald Shoup Takes His Parking Show to Berkeley. Retrieved August 11, 2016, from www.la.streetsblog.org/2014/03/20/ucla-prof-shoup-talks-parking-in-berkeley/

3 Shepard, S., & Jerram, L. (2015). Transportation Forecast: Light Duty Vehicles - Light Duty Stop-Start, Hybrid Electric, Plug-In Hybrid Electric, Battery Electric, Natural Gas, Fuel Cell, Propane Autogas, and Conventional Vehicles: Global Market Forecasts, 2015-2035 (Executive Summary). Navigant Research. www.navigantresearch.com/research/transportation-forecast-light-duty-vehicles

4 Barter, P. (2013, February 22). "Cars are parked 95% of the time"- Let's check! Retrieved August 11, 2016, from www.reinventingparking.org/2013/02/cars-are-parked-95-of-time-lets-check.html

5 Chester, M., & Horvath, A. (2011). Parking Infrastructure and the Environment. Access, 39 (Fall 2011), 28-37. University of California Transportation Center. www.accessmagazine.org/wp-content/uploads/sites/7/2016/01/access39_parking.pdf

- Integrate sustainable mobility services and technologies
- Diversify their mobility options and create stronger community relationships

The Parksmart standard outlines 48 approaches garages can employ to achieve certification and is organized in three major categories, with an added area for innovations:

- Management highlights ways in which garage operations can maximize the use of a parking asset while minimizing waste. Embracing these practices ensures facility staff utilizes resources to their full potential.
- Programming guides garages to new revenue sources, greater customer satisfaction and stronger community relations. Green parking programs ensure effective vehicle ingress/egress, provide access to alternative mobility solutions, and leverage the garage's potential as a public space.
- Technology and Structure Design measures outline the physical attributes a garage can deploy to increase energy efficiency, lower waste and support customer mobility choice.
- Innovative sustainability initiatives not yet included within the program are incorporated through an Innovation category.

The 48 elements of the Parksmart program offer a menu of options for enhancing the sustainability of a parking structure, allowing asset owners to select those initiatives that are most well suited for their operation. Points are assigned to specific measures based on environmental impact, achievability in new and existing structures and relevance to the economics of the asset. A total of 248 points are available, with Parksmart achieved by meeting minimum thresholds for existing and new parking structures.

We know that today's parking structures, practices and business models will not be the same as tomorrow's. Parksmart accelerates the transformation of the parking and mobility marketplace to improve the quality of our built space, mitigate the current challenges associated with parking and enhance sustainable mobility.

Elements of Parksmart Certification

Management	Max Points
Parking Pricing	6
Shared Parking	6
TMO/TMA	4
Recycling Program	4
Sustainable Purchasing Program	2
Proactive Operational Maintenance	6
Cleaning Procedures - Occupied Spaces	2
Cleaning Procedures - Parking Decks	6
Building Systems Commissioning	8
Construction Waste Management	6
Regional Materials	6
Regional Labor	4
Reused/Repurposed/Recycled Materials	6
Third Party Sustainability Certification	12
Credentialed Management	4
Life-cycle Assessment	8
Total Management Points	90

Programs	Max Points
Placemaking	6
Access to Mass Transit	4
Wayfinding Systems - External	4
Wayfinding Systems - Internal	4
Traffic Flow Plan	4
Carshare Program	6
Rideshare Program	6
Low-emitting and Fuel-efficient Vehicles	4
Alternative Fuel Vehicles	6
Alternative Fuel Fleet Vehicles	4
Bicycle Parking	6
Bicycle Sharing/Rental	6
Marketing/Educational Program	4
Total Programs Points	64

Technology and Structure Design	Max Points
Idle Reduction Payment Systems	4
Fire Suppression Systems	2
No/Low VOC Coatings, Paints, Sealants	2
Tire Inflation Stations	2
EV Charging Stations	6
HVAC Systems - Occupied Spaces	6
Ventilation Systems - Parking Decks	6
Lighting Controls	8
Energy-efficient Lighting System	8
Stormwater Management	6
Rainwater Harvesting	4
Greywater Reuse	2
Indoor Water-efficiency	2
Water-efficient Landscaping	2
Roofing Systems	6
Renewable Energy Generation	12
Design for Durability	6
Energy Resiliency - Storage	4
Total Technology & Structure Design Points	88

Innovation	Max Points
Innovative Approach	6
Total Innovation Points	6

Total Parksmart Points	248
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Parksmart Award Levels / Existing Facilities

Certification level	Points
Parksmart Pioneer	90+

Required minimums in Management, Programs and Technology & Structure Design categories: 15 in each category

Parksmart Award Levels / New Construction

Certification level	Points
Parksmart Bronze	110 - 134
Parksmart Silver	135 - 159
Parksmart Gold	160+

Required minimums in Management, Programs and Technology & Structure Design categories: 20 in each category

Beta Sites

We thank the owners and managers of the following parking garage sites for beta-testing Parksmart certification. The field-testing was invaluable to the completion of the program.

1 Greenway Plaza, Houston, TX	Lane Avenue Garage, Columbus, OH
1000 & 1100 Wilson Boulevard, Arlington, VA	LUNA Garage, Pittsburgh, PA
1101 Wilson Boulevard, Arlington, VA	Mandalay Tower, Irving TX
125 Vertical Parking, New York, NY	MAT Garage, Hartford, CT
12th Avenue Garage, Columbus, OH	Miramar College Garage, San Diego, CA
1812 North Moore, Arlington, VA	NC Department of Administration Deck, Raleigh, NC
601 Travis Garage, Houston, TX	NREL Garage, Golden, CO
655 Beach Street, San Francisco, CA	One Alliance Center, Atlanta, GA
9th Avenue East Garage, Columbus, OH	Rappahannock River Parking Deck, Fairfax, VA
ABB Innovation Campus Garage, Wauwatosa, WI	Silver Spring Metro Center, Washington, DC
Bank of America Fifth Avenue Plaza, Seattle, WA	St. George Courthouse Garage, New York, NY
Bank of America Plaza, Los Angeles, CA	Storrs Center Parking Facility, Mansfield, CT
Banker's Hall, Calgary AB, Canada	The Lift, Philadelphia, PA
Boston Common Garage, Boston, MA	The Solaire, New York, NY
Brookfield Place, Toronto, ON, Canada	The Verdesian, New York, NY
Canopy Airport Parking, Commerce City, CO	Two Alliance Center, Atlanta, GA
Centre Square, Philadelphia, PA	William Osler Health Centre, Brampton, ON, Canada
Century Park, Century City, CA	World Trade Center Seaport Hotel Garage, Boston, MA
Charles Square Garage, Cambridge, MA	
Church Street Garage, Hartford, CT	
Clay Commons Garage, Louisville, KY	
Cleveland Clinic, Cleveland, OH	
Convention Center Garage, Hartford, CT	
East Creek Parking Structure, Chaska, MN	
Ellis Garage, Chicago, IL	
Florida International University BG5 Market Station, Miami, FL	
Forensics Services and Coroners Complex, Toronto, ON, Canada	
Franklin Street Parking Deck, Fayetteville, NC	
Garage at Post Office Square, Boston, MA	
Highland Street Garage, Denton, TX	
Houston HOU Airport, Houston, TX	
Houston IAH Airport, Houston, TX	
Hudson Street Garage, Hartford, CT	

SECTION A

Management

- MEASURE 1 **Parking Pricing**
- MEASURE 2 **Shared Parking**
- MEASURE 3 **Transportation Management Association (TMA) / Organization (TMO) Affiliation**
- MEASURE 4 **Recycling Program**
- MEASURE 5 **Sustainable Purchasing Program**
- MEASURE 6 **Proactive Operational Maintenance**
- MEASURE 7 **Cleaning Procedures – Occupied Spaces**
- MEASURE 8 **Cleaning Procedures – Parking Decks**
- MEASURE 9 **Building Systems Commissioning**
- MEASURE 10 **Construction Waste Management**
- MEASURE 11 **Regional Materials for New Construction, Rehabilitation, or Retrofit**
- MEASURE 12 **Regional Labor for New Construction, Rehabilitation, or Retrofit**
- MEASURE 13 **Reused, Repurposed or Recycled Materials**
- MEASURE 14 **Third Party Sustainability Certification**
- MEASURE 15 **Credentialed Management**
- MEASURE 16 **Life-cycle Assessment**

MEASURE 1 Parking Pricing

POINT VALUE 6

Objective

Parking structure charges for the use of parking spaces, allowing for economic and market conditions to impact patrons' decisions on mode of travel.

Description

Charging the true cost of parking for patrons is perhaps the most sustainable action a parking facility can take.

Parking pricing means that motorists pay directly for using parking facilities. Parking pricing provides revenue and cost recovery, encourages more efficient use of parking facilities, reduces parking facility costs and land requirements, reduces vehicle traffic and encourages use of alternative transportation modes. Parking pricing may be implemented to reduce vehicular traffic, as a parking management strategy, to recover parking facility costs, to generate revenue for other purposes or for a combination of these objectives.

Unpriced parking is not really free: consumers ultimately bear parking costs through higher taxes and retail prices, and reduced wages and benefits. The choice is actually between paying for parking directly or indirectly. Paying directly for parking is more equitable and efficient; conversely, underpricing results in inefficient use of parking facilities and excessive parking demand.

Charging motorists directly for parking provides a variety of benefits and imposes several types of costs:

Travel Impacts: Parking pricing can have significant transportation impacts; even modest parking fees can affect vehicle travel patterns. Pricing that applies to commuter parking tends to be particularly effective at reducing peak-period travel. Shifting from free to cost-recovery parking (prices that reflect the full cost of providing parking facilities) typically reduces automobile commuting by 10% to 30%, particularly if implemented with improved transportation choices and other complementary transportation demand management (TDM) strategies.¹

Parking Management: Parking pricing can result in more efficient use of parking facilities, address specific parking problems, ensure that parking is available for intended users, and reduce total parking requirements, providing substantial facility cost savings.

¹ Victoria Transport Policy Institute, www.vtpi.org/tdm/tdm72.htm#_Price_Parking

Reduced Automobile Use and Congestion: Parking pricing is one of the most effective ways to reduce motor vehicle traffic. It typically reduces automobile trips by 10% to 30%, or even more if implemented as part of a comprehensive TDM program. This helps reduce congestion and environmental impacts, and increase road safety.²

Efficient Land Use: Parking pricing supports land use management objectives related to smart growth, location efficient development, new urbanism and access management. Parking Management can reduce urban sprawl and the environmental impacts that result.

Revenues: Parking pricing creates revenues (an economic transfer that is offset by user costs) that can be used to recover parking facility costs and fund other programs.

Equity: Unpriced parking represents a cross-subsidy from people who own fewer vehicles than average and drive less than average, to people who own more vehicles than average and drive more than average. Charging motorists directly for parking tends to increase horizontal equity, and can increase vertical equity, depending on how revenues are used. Parking pricing encourages the use of alternative modes, and helps create more accessible and pedestrian-friendly land use patterns, which tends to benefit people who are transportation disadvantaged. It can improve basic access by guaranteeing that more parking spaces are available for high-value trips, when users are willing to pay.

Options

Parking pricing is most common in major commercial and recreational centers, and large cities. It is particularly appropriate where:

- Land values and parking facility costs are high.
- Parking supply is insufficient to meet demand.
- Traffic congestion or vehicle pollution are significant problems.
- Clustered land use, infill development and reduced pavement area is desirable.
- Administrative and enforcement resources exist.

Prices can be set to recover parking facility costs, to maximize revenue, to balance supply and demand, to encourage use of alternative transportation modes, to shift demand to off-peak times or some combination of these goals.

[6 Points] Parking structure requires payment for use of parking spaces.

² Victoria Transport Policy Institute, "Parking Pricing: Direct Charges for Using Parking Facilities. TDM Encyclopedia, (Updated April 1, 2014), retrieved May 5, 2014, www.vtpi.org/tdm/tdm26.htm.

Documentation Requirements

- Narrative describing all pricing policies.
- Images of entrance signage showing pricing policies and/or printed pricing list demonstrating the active pricing programs.

Industry or Referenced Standards

- Victoria Transport Policy Institute, “Parking Pricing: Direct Charges for Using Parking Facilities. TDM Encyclopedia, (Updated April 1,2014)
(Note: this measure draws heavily from VTPI’s work on Parking Pricing.)
www.vtpi.org/tdm/tdm26.htm
- U.S. Department of Transportation, Federal Highway Administration, “Contemporary Approaches to Parking Pricing: A Primer,” (May, 2012)
www.ops.fhwa.dot.gov/publications/fhwahop12026/index.htm
- Kendra K. Levine, “Resources from the Transportation Library: On-Street Parking Pricing,
www.techtransfer.berkeley.edu/newsletter/11-1/parking.php
- Marcus Enoch and Stephen Ison (2006), “Levying Charges On Private Parking: Lessons From Existing Practice,” World Transport Policy & Practice, Vol. 12, No. 1 pp. 5-14.
www.ecoplan.org/wtpp/general/vol-12-1.pdf
- Daniel B. Hess (2001), “Effects of Free Parking on Commuter Mode Choice: Evidence from Travel Diary Data,” Transportation Research Record: Journal of the Transportation Research Board No. 1753, TRB (www.trb.org), pp. 35-42; at Lewis Center for Public Policy Studies, UCLA.
www.lewis.ucla.edu/publication/effects-free-parking-commuter-mode-choice-evidence-travel-diary-data/
- Donald C. Shoup, The High Cost of Free Parking. Chicago: Planners, American Planning Association, 2005. Print.

Suggested Best Practices

Best practices, according to the Victoria Transport Policy Institute, include:

- Prices should be well publicized and predicable. Use signs, maps, brochures, websites and other resources to provide information to users.
- Payment systems should be convenient. They should accept coins, bills and credit cards, and allow motorists to pay for just the amount of parking they will use (rather than requiring prepayment based on expected parking duration).
- Prices should be structured to maintain 85% to 90% occupancy rates, may vary according to convenience of location and demand periods, and may even fluctuate within a facility according to demand.

- At more convenient locations, prices should be higher, time increments smaller, and rates may increase over time (e.g., \$1 for the first hour, \$2 for the second hour and \$3 for each subsequent hour) to encourage turnover. Prices should be higher during peak periods and lower during off-peak periods. Less convenient locations can have lower rates and long-term discounts to attract commuters and other longer-term parkers.
- Management programs should anticipate potential spillover problems, and respond with appropriate regulations and enforcement.
- Parking violation enforcement should be predictable and courteous, and adequate to maintain a high level of compliance.
- Parking pricing should be implemented as part of a comprehensive parking management program that includes improved user information, commuter trip reduction programs, and improvements to alternative modes.
- Unbundle parking from building rental fees, so occupants only pay for the number of parking spaces they use.
- Reduce or eliminate minimum parking requirements so developers can decide how much parking to provide at each destination.

Related Measures

- A.2 Shared Parking

MEASURE 2 Shared Parking

POINT VALUE 2 – 6

Objective

Shared parking manages spaces more efficiently among users with different destinations within walking distance of the parking facility. Shared parking maximizes turnover and use of the spaces throughout the parking facility's operating hours.

Description

Shared parking maximizes land utilization by facilitating different user groups with offsetting peak demands. In doing so, multiple users share parking spaces rather than each having a dedicated parking space. Sharing parking resources reduces the total number of spaces needed, meeting overall parking demand more efficiently.

Varying user groups have different peak parking demands, as shown in this table:

Examples of Peak Parking Demands		
Weekday Peaks	Evening Peaks	Weekend Peaks
Banks	Auditoriums	Religious institutions
Schools	Entertainment venues	Parks
Medical clinics	Reception halls	Shops and malls
Offices	Restaurants	Residential
Professional Services	Theaters	
	Residential	

As an example, office complexes can efficiently share parking facilities with restaurants or theaters. Offices require maximum parking during weekdays while restaurants and theaters require maximum parking during evenings and weekends. As a result, the total amount of parking required may be reduced by up to 60% compared with separate parking supplies for each user.¹

Shared parking takes advantage of predictable utilization patterns to maximize use of off-street spaces between various user groups. Many parking structures are only used part-time by a single user group, leaving a significant number of empty spaces during non-peak conditions. By monitoring daily, weekly, and annual cycles in mixed-use areas, management can take advantage of cycles to “oversell” a parking structure and maximize parking efficiency, thus reducing the need for additional parking. Applied effectively, the operator parks more cars in fewer spaces, requiring a smaller structure or negating the need for an additional parking facility.

¹ Victoria Transport Policy Institute, www.vtpi.org/tdm/tdm72.htm#_Share_Parking

Options

There are several options for achieving shared parking for a maximum of 6 points. To comply with this measure, at least 90% of the parking spaces within the project boundary must be unreserved spaces. This calculation shall exclude accessible parking spaces, designated compact car spaces, alternative fuel vehicle spaces, rideshare and carshare spaces.

[2 Points] Shared Parking Program: Parking structure has implemented or participates in a shared parking program by including patrons with offsetting demand peaks.

[2 Points] Oversubscribe Permits: Identify appropriate oversell percentages for permits, (110% to 140% depending on tenant/patron mix), and manage and maintain leasing agreements with mixed use properties and adjust oversell of permits as land uses change.

[6 Points] Shared Parking Analysis: Provide shared parking analysis documenting complementary parking facility uses that reduce spaces required by at least 25% from the requirements specified by code or standard off-street parking requirements.

Documentation Requirements

- Shared Parking Program
 - Narrative describing Shared Parking Program.
- Oversubscription of Parking Permits
 - Narrative documenting oversell of permits.
 - Chart listing total number of spaces within the project boundary and total number of permits issued.
- Shared Parking Analysis
 - Shared Parking Analysis Report demonstrating that a 25% reduction in demand for parking spaces has been achieved through the use of a Shared Parking Program. Analysis must include findings, strategies employed, and resulting land use savings.

Industry or Referenced Standards

- Shared Parking, 2nd Edition, Urban Land Institute, January 2005
- Shared Parking; Sharing Parking Facilities Among Multiple Users: Victoria Transport Policy Institute, 17 June 2011

- Parking Management; Strategies, Evaluation, and Planning: Victoria Transport Policy Institute, 18 February 2011 Todd Litman
- The High Cost of Free Parking, Donald Shoup, Updated Edition, June 2011
- Macht, William P, “Multi-Block Underground Shared Parking: A Critical Stimulus for Mixed-Use Density”, PSU Center for Real Estate, 3rd Quarter 2007, retrieved May 5, 2014, www.portlandtransport.com/documents/multi_block_parking.pdf

Suggested Best Practices

- Off street parking should be priced lower than on-street spaces to maximize turnover and prevent emissions generated by patrons searching for a space.
- Offer transient spaces 24/7 to account for non-peak demand uses, allowing evening spaces to be sold rather than remain unused.
- Pair shared parking efforts with “in lieu fees,” paid by a developer to fund public parking facilities, instead of providing private facilities. A public facility approach can lead to shared parking among multiple users for a more cost-effective and efficient facility build-out.
- Area businesses may be assessed a special assessment or tax to fund parking facilities, instead of each business supplying its own facilities. Most often, this is done through a downtown business improvement district.

Examples

Shared Public Parking

Stoneham, MA

The Town of Stoneham allows shared parking by special permit with the approval of its planning board. Up to 50% of required spaces may be shared with users having different operating hours. The parties must sign a joint use agreement.

Related Measures

- A.1 Parking Pricing

MEASURE 3 Transportation Management Association (TMA) / Organization (TMO) Affiliation

POINT VALUE 4

Objective

Active participation in a local TMA/TMO to generate more efficient use of transportation resources.

Description

Transportation Management Associations (TMAs) or Transportation Management Organizations (TMOs) are private, nonprofit, member-controlled organizations that provide transportation services in a specific area, such as a commercial district, mall, medical center, or industrial park. TMAs/TMOs can provide a variety of services to encourage more efficient use of transportation and parking resources, improving profitability and traffic management and reducing environmental impact.

A TMA/TMO can offer a facility operator or owner alternative transportation promotion and implementation, as well as parking brokerage services. This helps the facility operator minimize parking demand where supply is limited and reduce costs.

TMA/TMO strategies may include carpooling, biking, transit, and walking. Broker parking services allow businesses to share, trade, lease, or rent parking structures.

Options

The garage operator or property owner/manager becomes an active member of a local TMA/TMO. Active membership includes attending meetings and implementing alternative transportation programs and/or broker parking service strategies.

[4 Points] Parking structure management actively engages with a TMA or TMO and its programs.

Documentation Requirements

- Documentation demonstrating the existence of an active TMA/TMO membership (such as an invoice showing payment of annual dues, contract, letter of membership, screen shot of the TMA/TMO web site showing a listing for the parking garage in the active member list).

- One of the following:
 - Narrative of all TMA/TMO activities/promotions/events the parking operator or property owner/manager has participated in over the 3 months prior to the preliminary review submission.
 - Documentation such as marketing materials and brochures, of efforts to work with the TMA/TMO to promote increased carpooling, transit, cycling and walking over the 3 months prior to the preliminary review submission.

Industry or Referenced Standards

- Association for Commuter Transportation (www.actweb.org), a non-profit organization supporting TDM programs including TMAs and TMOs.
- ACT (2001), TMA Handbook, Association for Commuter Transportation (www.actweb.org); at www.nctr.usf.edu/clearinghouse/pdf/tma_handbook_final.pdf.
- Best Workplaces for Commuters (www.bestworkplaces.org/) is a program sponsored by the U.S. Environmental Protection Agency and the U.S. Department of Transportation to recognize employers and worksites that offer outstanding commuter benefits.

Related Measures

- B.1 Placemaking
- B.2 Access to Mass Transit
- B.6 Carshare Program
- B.7 Rideshare Program
- B.11 Bicycle Parking
- B.12 Bicycle Sharing/Rental

MEASURE 4 RECYCLING PROGRAM

POINT VALUE 2 – 4

Objective

Implement and adhere to a comprehensive recycling program for the parking structure's operations staff and patrons.

Description

Recycling recognizes that discarded materials are frequently resources rather than waste and allows these assets to be captured and utilized. Recycling reduces the waste stream and conserves landfill capacity, may reduce waste disposal costs, and may generate revenue through the sale of separated materials. Reusing materials generated through recycling programs conserves valuable natural resources.¹

Some of these benefits accrue locally as well as globally:

- Reduce material in the waste stream and landfills
- Reduce pollution from incineration
- Elimination of pollution created by the manufacturing of products from virgin materials
- Conservation of energy, as virgin materials consume greater energy resources during production
- Conservation of natural resources such as timber, water, and minerals
- Stimulation of the local economy when recycled materials are reconstituted locally²

The EPA reported the national recycling figures in 2009 for 243 million tons of trash generated:

- 82 million tons composted or recycled for recovery rate of 33.8%
- 29 million tons of municipal solid waste (MSW) combusted for energy recovery
- 7 million tons of metals recycled reduced greenhouse gas emissions at equivalent of removing 5 million cars from road for one year³
- 74% of office-type paper recovered
- 60% of landscape trimmings recovered
- 34.5% of metals recycled

¹ Environmental Protection Agency, "Communicating the Benefits of Recycling", retrieved May 3, 2014, www.epa.gov/solidwaste/conserve/tools/localgov/benefits/index.htm

² Environmental Protection Agency, "Communicating the Benefits of Recycling", retrieved May 3, 2014, www.epa.gov/solidwaste/conserve/tools/localgov/benefits/index.htm

³ Environmental Protection Agency, "Greenhouse Gas Emissions," accessed May 2, 2014 www.epa.gov/climatechange/ghgemissions/

Options

A parking structure will be in compliance if all of the following criteria are achieved:

Employee Program:

- Designate a parking structure employee to act as sustainability coordinator
- Comply with federal, state and local recycling laws
- Install recycling bins in employee areas where trash bins are located
- Install proper signage on or near bins that clearly indicates where each type of item is to be deposited
- Recycle at a minimum cardboard, paper, glass, aluminum, PETE (Number 1) and HDPE (Number 2) plastics

Patron Program:

- Comply with federal, state and local laws regarding recycling
- Install recycling bins in all public areas where trash bins are located
- Install proper signage on or near bins, clearly indicating where each type of item is to be deposited
- Recycle paper, glass, aluminum, PETE (Number 1) and HDPE (Number 2) plastics

[2 Points] Facility has an established recycling program, meeting all of the above criteria for both Employee and Patron programs.

[1 Point] At least 25% but less than 50% of all solid waste removed from the parking structure is recycled. Measurement must be made by weight, as recorded by trash hauler invoices or by manual measurement.

[2 Points] At least 50% of all solid waste removed from the parking structure is recycled. Measurement must be made by weight, as recorded by trash hauler invoices or by manual measurement.

Documentation Requirements

- Active Recycling Program
 - Narrative describing the recycling program for both patrons and employees, including the specific materials being recycled and waste stream hauling contract(s), and demonstrating that all required criteria for both Employee and Patron programs have been met.
 - Images of public recycling areas and signage demonstrating that recycling is available wherever regular refuse is collected.
 - Percentage of Recycling

- o Documentation demonstrating the percentage of recycled material to overall waste stream (minimum 7 consecutive days of data). Data can be obtained from hauling company invoices (if each haul is weighed) or by a manual measurement, where all waste and recycling is manually weighed before being hauled from the project site. Data must be gathered no more than 90 days before the preliminary review submission.

Industry or Referenced Standards

Resources for setting up a recycling program:

- Recycling in Seven Steps
www.napcor.com/PET/t-starting.html
- U.S. Environmental Protection Agency – How To Set Up A Recycling Program
www2.epa.gov/recycle

Industry sector specifics:

- Best practices for convention centers, parks, shopping centers, special events, stadiums and airports/ transportation hubs
www.archive.epa.gov/wastes/conserves/tools/rogo/web/html/index-5.html
- Case studies, articles and equipment descriptions
www.wastecare.com/Articles/Waste_Recycling_Articles.htm

Examples

Innovations

Alco Parking collaborated with local partners and Pittsburgh Steeler fans to collect over 22,000 lbs of glass, plastic, cans and cardboard at Heinz Field in 2011. The “Let’s Tackle Recycling” campaign diverted the equivalent of 14 miles of aluminum cans stacked end to end from the waste stream.
www.pittsburgh.cbslocal.com/2011/09/16/lets-tackle-recycling/

Recycle Together suggests: “Setting up recycling bins in the parking lot and also handing out recycling bags to people as they enter the parking lot are effective ways of pre-event recycling” at arenas, stadiums and convention centers.
www.recycletogether.com/venues/arenas-stadiums-convention-centers

Social marketing and competitions can encourage high recycling rates.
www.cbsm.com
www.recyclebank.com

Tools

A variety of durable, attractive collection stations are available for use in outdoor and indoor parking structures. Some stations are designed to offer paid advertising opportunities or free sponsorship branding. The examples to the left and below depict recycling stations in use today. The receptacles to the left have a separate bin for bottles, paper and even compostable waste.



Photo courtesy of U.S. Green Building Council

Suggested Best Practices

- Set up a site-specific or company-wide recycling program with clear staff leadership, targeted waste streams, and monitoring.
- Offer drop-off recycling opportunities for batteries, paints, electronics and other consumer materials at the parking facility.
- Partner with local and national recycling vendors to promote their services, either through direct participation or by offering promotional literature (e.g., notice of upcoming hazardous household waste collections).
- Partner with school or youth groups in recycling collection drives, (e.g., Nike works with local schools to collect worn-out sneakers to use for track and playground surfaces and to make new sneakers).
- Support programs for typically non-recyclable waste, turning the collected waste into new products that range from recycled park benches to upcycled backpacks.
- Integrate collection bins for clothing and book donations to benefit local charitable organizations.
- Integrate social media or competitive recycling contests to increase awareness and success of recycling program.
- Compact trash and recycling to reduce hauling frequency.

Related Measures

- B.13 Marketing/Educational Program
- D.1 Innovative Approach

MEASURE 5 Sustainable Purchasing Program

POINT VALUE 1 – 2

Objective

Actively purchase sustainable and/or locally manufactured products.

Description

Purchasing environmentally sustainable and/or locally manufactured products can reduce a parking operation's environmental footprint. When a product is made from recycled materials or is locally manufactured, fewer resources are required in manufacturing and/or shipping. These products can also provide a visible indicator to patrons that the facility is taking steps to reduce its environmental impact.

The most effective method for sourcing sustainable and/or regionally manufactured products is enrolling in a formal sustainable purchasing program. Many major retailers and distributors offer such purchasing programs to provide their customers with environmentally sustainable products and services. These programs may include manufacturing processes that use fewer resources and energy, the use of non-toxic or organically grown ingredients, or recycled content in the product. By participating, the parking operator commits to sourcing purchases in an environmentally sustainable manner.

In lieu of engaging in a structured sustainable purchasing program, facilities may purchase products that are environmentally sustainable, organic, fair trade and/or regionally manufactured.

- Sustainable products are refurbished, recycled, repurposed or certified organic.
- Regionally manufactured products have been manufactured within 300 miles of the parking facility.

Parksmart recognizes the product groups listed below. A facility may cite a product group for points if all of the purchased products within that group meet the above criteria for environmentally sustainable or regionally manufactured products.

Product groups are:

- Printer toner cartridges
- Office paper
- Paper products (paper towels, toilet paper, etc.)
- Parking ticket paper and receipts
- Packing materials

- Car bumpers
- Bollard covers
- Office furniture
- Food products
- Use of filtered drinking water equipment (instead of bottled water)
- Reusable ceramic or glass mugs / cups (instead of paper or Styrofoam cups)
- Clothing / uniforms

Options

[2 Points] Facility participates in a recognized sustainable purchasing buying program (or can demonstrate a history of sustainable purchasing), and at least 50% of the non-capital purchasing activity (by dollar amount) is sustainable. The facility management commits to continue this level of sustainable purchasing.

[1 Point] All product purchases within 5 or more product groups are environmentally sustainable and/or regionally manufactured. The facility management commits to continue this level of sustainable purchasing.

Documentation Requirements

- Organized Sustainable Purchasing Program
 - o Narrative describing:
 - Nature and content of materials purchased on an ongoing basis
 - Details of sustainable purchasing program(s) through which purchases are made, including evaluation criteria for product selection
 - o Table listing all non-capital purchases over the 3 months prior to the preliminary review submission, including the following information for each material purchased:
 - Material name
 - Material cost
 - Sustainability criteria met, if any
- Purchasing of Product Groups
 - o Narrative detailing the following:
 - Nature and content of materials purchased on an ongoing basis
 - Product groups where ALL products within that group are purchased sustainably
 - Definition of each of the product groups and list of items within each group

- Explanation of why the products being purchased are considered sustainable (e.g. made with recycled materials, manufactured within 300 miles of project location, made with organic materials)
- Signed commitment to continue sustainable purchasing practices on an ongoing basis.

Examples

Responsible Purchasing Network

Responsible Purchasing Network (RPN) is an international network of buyers dedicated to socially responsible and environmentally sustainable purchasing. Their membership program and consulting services provide institutional purchasers with cutting-edge procurement tools and resources designed to save money, conserve resources, reduce waste, and improve efficiency.

University of Colorado

The University of Colorado Sustainable Purchasing Program serves the university community by educating, advising, and engaging students, faculty, and staff in the application of ecological principles to achieve sustainable purchasing solutions. Program goals include:

- Publicize and market sustainable purchasing actions.
- Incorporate sustainable purchasing goals into purchasing specifications.
- Significantly increase purchases of environmentally-friendly goods and services by the university.
- Advise systems administration regarding sustainable purchasing issues.
- Establish sustainable purchasing resource database.

www.colorado.edu/ecenter/greening-cu/environmentally-responsible-purchasing

Suggested Best Practices

- Eliminate purchasing whenever possible. For example, move to electronic validation instead of paper validation tickets.
- Reduce, reuse or eliminate packaging whenever possible.
- Consider expanding sustainable purchasing to a larger scale, such as to extend beyond the single site to the corporate entity or institutional campus.

Additional Resources

- Responsible Purchasing Network
www.responsiblepurchasing.org
- Sustainability Tracking, Assessment & Rating System (STARS) 2.0.1 Technical Manual, Purchasing Credit
www.stars.aashe.org/pages/about/technical-manual.html

- Sustainable Purchasing Leadership Council
www.purchasingcouncil.org/
- Office Depot, Greener Office Program
www.officedepot.com
- Staples Shop Green
www.staples.com/sbd/cre/marketing/easy-on-the-planet/index.html

Related Measures

- A.7 Cleaning Procedures – Occupied Spaces
- A.8 Cleaning Procedures – Parking Decks
- A.13 Reused, Repurposed or Recycled Materials

MEASURE 6 Proactive Operational Maintenance

POINT VALUE 6

Objective

Encourage preventative maintenance to increase facility lifespan and minimize premature structural deterioration.

Description

Construction site debris is a leading contributor to landfills.^{1, 2} A parking structure with a longer lifespan significantly reduces the environmental impact caused by demolition and construction. Parking structures represent a particular challenge compared to other building types when it comes to achieving the desired lifespan. The structure's exposure to the natural elements and wear and tear by its users presents a particular challenge to extending its lifespan, compared to other building types. Extending the structure's life requires the parking structure owner to follow a methodical and consistent maintenance schedule.³

Developing and adhering to a maintenance manual outlining practices to extend the parking structure's lifespan will help ensure the facility's effective upkeep. This plan should address specific demands posed by weather and climate, special use or other unique factors.

Items that may be covered in this maintenance manual include but are not limited to:

- Survey structure on a scheduled regular basis.
- Investigate and repair cracks in concrete as necessary.
- Investigate and replace corroded steel as necessary.
- Survey, maintain and replace joint fillers, roofing, waterproofing and surface sealers as needed.
- Maintain elevator, electrical, plumbing and HVAC systems.
- Maintain finishes, signage and parking control equipment.
- Specify biannual (or more frequently for northern climates) wash downs of slabs.
- Adhere to a regular cleaning schedule using environmentally responsible cleaning process.
- Devise a plan for snow removal, if applicable.
- Educate maintenance staff on the importance of limiting the use of deicers. When deicers are necessary, select deicers which are non-pervasive and non-toxic to flora and fauna.
- Maintain protective coating for structural steel components.

¹ www.wbdg.org/resources/cwmgmt.php

² www.calrecycle.ca.gov/condemo/CaseStudies/DGSDiversion.pdf

³ "Designing and Building Durable Parking Structures" Carl A. Peterson

Options

The following option is available for a facility to be recognized for proactive maintenance.

- [6 Points]** Facility adheres to a maintenance manual that includes the practices outlined above.

Documentation Requirements

- Copy of the facility maintenance manual with locations of the practices outlined in this measure highlighted.
- Maintenance related invoices, logs, schedules, or punch lists that verify the procedures outlined in the manual are being followed.
- Signed commitment to continue to adhere to procedures outlined within the facility maintenance manual.

Industry or Referenced Standards

- National Parking Association and Parking Consultants Council Maintenance Manual Committee, “Parking Garage Maintenance Manual” 4th Edition
- American Concrete Institute and International Concrete Repair Institute, “Concrete Repair Manual” 3rd Edition
- American Concrete Institute, ACI 362.1R-12 “Guide for the Design and Construction of Durable Concrete Parking Structures” Reported by ACI Committee 362
- American Concrete Institute, ACI 362.2R “Guide to Structural Maintenance of Parking Structures”
- K Nam Shiu and Kyle Stanish “Repair and Renovation” CI Concrete International, April 2008, Vol 30 No4

Suggested Best Practices

- Track adherence to the maintenance plan.
- Re-examine the maintenance plan annually to ensure that circumstances have not changed in such a way that should merit altering the procedures.
- Train all new employees on the maintenance plan and review the plan with existing employees periodically.

Related Measures

- A.8 Cleaning Procedures – Parking Decks
- A.16 Life-cycle Assessment
- C.3 No/Low VOC Coatings

MEASURE 7 Cleaning Procedures – Occupied Spaces

POINT VALUE 2

Objective

Implement environmentally safe cleaning procedures, systems and supplies for occupied spaces.

Description

Traditional cleaning supplies can have a significant negative effect on human and environmental well-being because of their chemical composition. The implementation of environmentally safe cleaning supplies can reduce these impacts.

Cleaning methods for occupied spaces should comply with the following criteria.

1. All maintenance personnel are trained to properly use, maintain, and dispose of all cleaning products within the facility's occupied space. This strategy includes written policy directives, guidelines, training, and manuals to ensure proper implementation.
2. Each cleaning product utilized in occupied space must meet at least 1 of the following standards:
 - o Green Seal GS-37 Cleaning Products for Industrial and Institutional Use
 - o UL 2792 Biologically-based Cleaning and Degreasing Compounds (formerly CCD 110)
 - o UL 2759 Hardsurface Cleaners (formerly CCD 146)
 - o Green Seal GS-40 Floor Care Products for Industrial and Institutional Use
 - o UL 2798 Biological Digestion Additives for Cleaning and Odor Control (formerly CCD 112)
 - o UL 2791 Drain and/or Grease Trap Additives – Alternative (formerly CCD 113)
 - o UL 2796 Odor Control Additives (formerly CCD 115/107)
 - o UL 2777 Hard Floor Care Products (formerly CCD 147)
3. Each hand cleaner used in the facility meets at least 1 of the following standards:
 - o Green Seal GS-41 Hand Cleaners for Industrial and Institutional Use
 - o UL 2784 Hand Cleaners (formerly CCD 104)

Options

[2 Points] Parking structure meets (a) Criteria 1, (b) 75% of all cleaning chemicals meet Criteria 2 and (c) 75% of all hand cleaners meet Criteria 3 (calculation based on cost).

Documentation Requirements

- No Cleaning Chemicals
 - Provide a written statement attesting to the use of no cleaning supplies and describing the cleaning practices that are used in lieu of chemicals.
- Cleaning Chemicals
 - Copies of invoices from the cleaning supply distributor(s) detailing purchasing activities of ALL cleaning supplies that are used in the occupied spaces (including both the cleaners that meet the green standards and those that do not meet the standards). Invoices must be provided for the 3 months prior to the preliminary review submission.
 - A table summarizing the information contained in the invoices. One column must list the cleaning products and costs associated with agents that meet 1 of the green cleaning standards and 1 column must list the products and costs of those agents that do not meet any of the green cleaning standards. Include column totals and percentage breakdown demonstrating at least 75% of the cleaning agents meet 1 of the green standards.
 - Documentation of maintenance personnel training that describes the education provided in proper cleaning procurement, use, maintenance, and disposal. This documentation may include cleaning operations manuals, training course syllabi, or training certifications of the operations staff.
- Hand Cleaners
 - Copies of the invoices from the cleaning supply distributor(s) detailing purchasing activities of ALL hand cleaners that are used in the occupied spaces. Invoices must be provided for the 3 months prior to the preliminary review submission.
 - A table summarizing the hand soaps information contained in the invoices demonstrating that 75% of hand cleaners meet at least 1 of the green cleaning standards.
- No Hand Cleaners
 - Provide a written statement attesting that no hand cleaners are used.

Industry or Referenced Standards

- Green Seal GS-37
www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=0&sid=23
- UL 2792 Biologically-based Cleaning and Degreasing Compounds (formerly CCD 110)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=24139
- UL 2759 Hardsurface Cleaners (formerly CCD 146)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=23384
- Green Seal GS-40
www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=0&sid=28
- UL 2798 Biological Digestion Additives for Cleaning and Odor Control (formerly CCD 112)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=24071
- UL 2791 Drain and/or Grease Trap Additives – Alternative (formerly CCD 113)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=24137
- UL 2796 Odor Control Additives (formerly CCD 115/107)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=26250
- UL 2777 Hard Floor Care Products (formerly CCD 147)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=23607
- Green Seal GS-41
www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=6&sid=29
- UL 2784 Hand Cleaners (formerly CCD 104)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=23404

Examples

Copy of invoice from the parking structure's cleaning supply distributor detailing the supplies purchased (red box) and contact information for the distributor (yellow box):

**GREEN CLEAN
SUPPLY CO.**
INVOICE

BILL TO	Bill Smith Hartford Parking 15 Main Street Hartford, CT 06102	SHIP TO	Bill Smith Hartford Parking 15 Main Street Hartford, CT 06102	Invoice # 1019222
				Invoice Date 10/11/11
				Customer ID 10432

DATE	YOUR ORDER #	OUR ORDER #	SALES REP.	F.O.B.	SHIP VIA	TERMS	TAX ID
10/08/11	122	102910291	F. Bush		USPS	-	100092

QTY	ITEM	UNITS	DESCRIPTION	DISCOUNT %	TAXABLE	UNIT PRICE	TOTAL
2	IBFG		Simple Green Clean Building Glass Cleaner Concentrate	-	Yes	\$26.42	\$52.84
1	IIFWEFV		Simple Green Clean Building Bathroom Cleaner Concentrate	-	Yes	\$16.99	\$16.99
						Subtotal	\$69.83
						Tax	\$4.19
						Shipping	\$5.00
						Miscellaneous	-
						BALANCE DUE	\$79.02

66 Long Street
 Deep River CT, 06343
 USA

PHONE (705) 555-0125
 FAX (705) 555-0126
 E-MAIL frank@greensupply.com
 WEB SITE http://www.greensupply.com

Related Measures

- A.5 Sustainable Purchasing Program
- A.8 Cleaning Procedures – Parking Decks

MEASURE 8 Cleaning Procedures – Parking Decks

POINT VALUE 1 – 6

Objective

Implement an environmentally safe and water-efficient surface cleaning process within the parking deck.

Description

Parking structure surfaces collect motor oil, gasoline and other pollutants from vehicles parked in the garage. Stormwater often carries this oil, gasoline and debris from the parking structure into storm sewer systems, which eventually discharge untreated into streams, rivers and lakes. This discharge can have devastating environmental impacts. For example, according to the Air & Waste Management Association, one quart of oil may pollute up to 150,000 gallons of water.¹

A variety of environmentally safe and water-efficient surface cleaning processes can minimize pollutant discharge into storm drains and streets.

- Oil Degreasing
- Power/Pressure Washing
- Sweeping Mechanisms

Oil Degreasing

Oil drippings, grease and other vehicle pollutants often build up on the surface of parking facilities. These pollutants create an environmental hazard when leaked into storm drains and pose a safety hazard to pedestrians if left untreated. Parking operators should ensure that these oil buildups and deposits are removed at least twice a year with appropriate degreasers. Degreasers should meet at least 1 of the following environmentally safe standards:

- Green Seal GS-34: Cleaning and Degreasing Agents
- Green Seal GS-37: Cleaning Products for Industrial and Institutional Use
- UL 2792 Biologically-based Cleaning and Degreasing Compounds (formerly CCD 110)
- Green Seal GS-40: Floor Care Products for Industrial and Institutional Use

¹ Air and Waste Management Association: Oil Spills www.awma.org

Power/Pressure Washing

According to the Parking Garage Maintenance Manual, “Wash-downs should occur monthly in northern and coastal regions, where salts can accumulate on the structure. In other areas, wash-downs should be performed quarterly, or at a minimum, in the Spring and Fall.”² When pressure washing, wastewater must be trapped and collected to avoid entering storm drains or being discharged into streets. Wastewater must be disposed of in an acceptable manner OR properly recycled and reused. Pressure washing systems with water recovery and recycling capability remove oil buildup effectively with minimal water use.

Ionized water should be used in lieu of cleaning chemicals. If cleaners are used during the wash-down procedure they must meet at least 1 of the following environmentally safe standards:

- Green Seal GS-34: Cleaning and Degreasing Agents
- Green Seal GS-37: Cleaning Products for Industrial and Institutional Use
- UL 2792 Biologically-based Cleaning and Degreasing Compounds (formerly CCD 110)
- Green Seal GS-40: Floor Care Products for Industrial and Institutional Use

Sweeping Mechanisms

According to the Parking Garage Maintenance Manual, all parking surfaces should be swept at least monthly and ideally once a week.³ Sweeping machines can perform this job efficiently and economically. Sweeping helps remove debris and pollutants such as brake dust, while also decreasing the need for constant pressure washing and conserving water. Sweeping machines should be electric or use liquid propane to reduce air and noise pollution. Many sweeping mechanisms offer power scrubbing, requiring a fraction of the water used during pressure washing. Ionized water should be used in lieu of cleaning chemicals, but if cleaners are used during the power scrubbing process they must meet at least 1 of the following environmentally safe standards:

- Green Seal GS-34: Cleaning and Degreasing Agents
- Green Seal GS-37: Cleaning Products for Industrial and Institutional Use
- UL 2792 Biologically-based Cleaning and Degreasing Compounds (formerly CCD 110)
- Green Seal GS-40: Floor Care Products for Industrial and Institutional Use

Any waste from oil degreasers, wash downs, sweeping or scrubbing must be disposed of in compliance with local, state and federal regulations.

Options

Oil Degreasing

- [1 Point] Parking structure spot cleans oil spills at least twice a year with an environmentally safe oil degreaser.

² Parking Garage Maintenance Manual. Fourth Edition (2004). National Parking Association & Parking Consultants Council.

³ Parking Garage Maintenance Manual. Fourth Edition (2004). National Parking Association & Parking Consultants Council.

Power Washing

[2 Points] Parking structure uses pressure washing technologies that capture wastewater through sump pumps or vacuum pumps, preventing it from running off into storm drains and/or connecting streets. The collected wastewater is disposed of in compliance with local, state and federal regulations. All cleaning supplies used in the wash down process are environmentally safe as detailed above.

[3 Points] Parking structure uses pressure washing technologies that capture wastewater through sump pumps or vacuum pumps, preventing it from running off into storm drains and/or connecting streets, and recycles the wastewater using a wastewater processor or other wastewater filtration technology. All cleaning supplies used in the wash down process are environmentally safe products as detailed above.

Sweeping Mechanisms

[1 Point] Parking structure is swept at least every month by an electric or propane sweeping mechanism. Any sweeping debris or waste should be disposed of in compliance with local, state and federal regulations.

[1 Point] Parking structure is scrubbed with a power scrubber regularly, decreasing the amount of wash downs needed each year and conserving water. Any scrubbing debris or waste must be disposed of in compliance with local, state and federal regulations. Furthermore, all cleaning supplies used in the power scrubbing process are environmentally safe products as detailed above.

Documentation Requirements

- Signed commitment to continue environmentally safe and water-efficient parking deck cleaning practices on an ongoing basis.
- Spot Cleaning / Oil Degreasing
 - o Narrative describing the procedures for spot cleaning of oil on decks, including:
 - Equipment used
 - Frequency of cleaning
 - Solutions used and identification of related green rating system
 - o Invoices for degreasing solutions.
- Power Washing
 - o Narrative describing the procedures for power washing of the decks and other surfaces, including:
 - Equipment used
 - Frequency of cleaning
 - Solutions used and identification of related green rating system

- Method and equipment used to recapture water
- Method and equipment used for processing or disposing of the recaptured water
- o Invoices from pressure/power washing vendor and/or cleaning supply distributors where solutions were purchased, if applicable.
- Sweeping
 - o Narrative describing procedures for sweeping of the decks, including:
 - Equipment used (electric and propane are eligible)
 - Frequency of sweeping
 - Power scrubber equipment description, if used
 - o Invoices for sweeping vendors and/or suppliers, if applicable.
 - o Model numbers for power sweeping and/or power scrubbing equipment in use.

Suggested Best Practices

- When using cleaning solutions, use concentrated forms of the solutions so that transportation impact is minimized
- Install oil separators in all drainage systems

Industry or Referenced Standards

- Green Seal GS-34
www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=0&sid=20
- Green Seal GS-37
www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=0&sid=23
- UL 2792 Biologically-based Cleaning and Degreasing Compounds (formerly CCD 110)
www.comm-2000.com/ProductDetail.aspx?UniqueKey=24139
- Green Seal GS-40
www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=0&sid=28

Related Measures

- A.6. Proactive Operational Maintenance
- A.7 Cleaning Procedures – Occupied Spaces

MEASURE 9 Building Systems Commissioning

POINT VALUE 4 – 8

Objective

Conduct a standardized commissioning, re-commissioning, or retro-commissioning process.

Description

Building systems, including mechanical, electrical, and plumbing systems, may be well designed but improperly installed, maintained, or operated. These installation or maintenance errors can create energy and resource waste, increase energy and water costs and potentially create air and water pollution.

Building commissioning provides documented confirmation that the systems are functioning according to the project design, and meet the owner's operational needs. Commissioning is a systematic process of planning, delivering, and operating new building construction to ensure its systems work as designed.

Building re-commissioning is a systematic process of investigating, analyzing, and optimizing existing buildings to ensure systems work as originally intended.

Building retro-commissioning is a systematic process of investigating, analyzing, and optimizing existing buildings to ensure its systems efficiently meet the building's current needs. Retro-commissioning existing systems may require developing new functional criteria to address the owner's system performance and functional requirements.

Over the first five years of occupancy, parking structure owners can achieve operational savings of up to \$4 for every \$1 invested in commissioning.¹

Options

The commissioning process reviews the construction, installation, and operation of building systems to ensure that mechanical, electrical, and plumbing systems (as well as geothermal, solar, wind, and a variety of other systems) are installed and operated as designed and intended. Options for compliance include:

[8 Points] LEED 2009 or v4 Enhanced Commissioning Credit.

[6 Points] LEED 2009 Fundamental Commissioning of Building Energy Systems prerequisite or v4 Fundamental Commissioning and Verification prerequisite.

¹ www.facilitiesnet.com/facilitiesmanagement/article/Commission-to-Maximize-Efficiency--8964#

[6 Points] ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1–2007.

[6 Points] California Commissioning Guide for New or Existing Buildings.

[4 Points] ASHRAE Level II Audit.

[4 Points] Comparable established Certified Commissioning Authority (CxA) standards.

Documentation Requirements

- Provide the Commissioning Report and documentation for the highest applicable commissioning level performed and signed-off by a certified commissioning agent.
 - LEED 2009 or v4 Enhanced Commissioning credit
 - LEED 2009 Fundamental Commissioning of Building Energy Systems prerequisite or v4 Fundamental Commissioning and Verification prerequisite
 - ASHRAE Guidelines 0-2005 and 1.1-2007
 - California Commissioning Guide
 - ASHRAE Level II Audit
 - Comparable industry-acceptable CxA standard

Industry or Referenced Standards

- ASHRAE: ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1–2007
www.ashrae.org
- ASHRAE/National Environmental Balancing Bureau (NEBB): Procedural Standards for Retro-Commissioning of Existing Buildings
www.nebb.org
- National Environmental Balancing Bureau (NEBB): Procedural Standards for Whole Building Systems of New Construction
www.nebb.org
- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed
- Green California Guidelines
www.green.ca.gov/GreenBuildings/CommissioningGuidelines.aspx

Additional Resources and Case Studies

- Best Practices in Commissioning Existing Buildings, Building Commissioning Association
www.bcx.org/wp-content/pdf/BCA-Best-Practices-Commissioning-Existing-Construction.pdf
- The Whole Building Design Guide
www.wbdg.org/project/buildingcomm.php (Commissioning Guide)
www.wbdg.org/pdfs/comm_def.pdf (Definitions)
- Energy Design Resources
www.energydesignresources.com/resources/publications/design-guidelines/design-guidelines-commissioning-guidelines.aspx
- Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions
cx.lbl.gov/documents/2009-assessment/LBNL-Cx-Cost-Benefit.pdf

Related Measures

- C.6 HVAC Systems – Occupied Spaces
- C.7 Ventilation Systems – Parking Decks
- C.8 Lighting Controls
- C.9 Energy-efficient Lighting System
- A.14 Third Party Sustainability Certification
- C.16 Renewable Energy Generation

MEASURE 10 Construction Waste Management

POINT VALUE 2 – 6

Objective

Discourage the use of landfills and incineration for the elimination of non-hazardous waste materials associated with new construction or renovation.

Description

More than 40% of the solid waste stream in the U.S. originates from construction and demolition materials.

Building demolitions account for 48% of the waste stream or 65 million tons per year, renovations account for 44% or 60 million tons per year, and 8% or 11 million tons per year is generated at construction sites.¹

Placing construction waste materials into landfills decreases the life expectancy of the landfill and risks groundwater and soil contamination. Incinerating these materials creates air pollution and is energy intensive.

Repurposing construction waste such as asphalt and concrete, recycling steel and copper, and reusing doors and masonry can significantly decrease the project's financial costs and minimize the environmental impacts of discarding materials and manufacturing new ones.

Options

Materials most commonly required in the construction or renovation of parking structures include, but are not limited to:

- Asphalt
- Concrete
- Copper wiring
- Doors
- Gypsum wallboard
- Lighting
- Masonry
- Metal stair railings
- Plumbing
- Reinforcing steel
- Scrap metal
- Wood

Projects that fall within the scope of this measure:

1. Accumulation of all retrofit, renovation and new construction projects performed over the last 5 years that exceed \$100,000 in total cost.

¹ Source: U.S. EPA, *Characterization of Building Related Construction and Demolition Debris in the United States*.

2. If no major project was performed in the last 5 years, the most recent retrofit, renovation or new construction with a project cost exceeding \$500,000 may be considered for this measure.

Points will be allocated based on percentage of construction waste (by weight or volume) that is diverted from landfills through recycling or reuse. Soil, land-clearing debris, and hazardous waste are not to be included in these calculations. For multiple projects within scope, the percentage is based upon the cumulative sum of the solid waste materials across all of the projects.

[6 Points] At least 85% of materials recycled or reused.

[4 Points] At least 50% and less than 85% of materials recycled or reused.

[2 Points] At least 20% and less than 50% of materials recycled or reused.

Documentation Requirements

Documentation must include all retrofit, renovation and new construction projects performed within 5 years of the preliminary review submission that exceeded \$100,000 in total cost. If no project that exceeded \$100,000 in total cost was performed in the last 5 years, the most recent retrofit, renovation or new construction project with a total cost exceeding \$500,000 may be considered for this measure.

- Summary log of all construction waste generated including tonnage or volume, type of waste, and disposal methods, along with the names of the haulers and recyclers:
 - Include all waste materials for all projects that are applicable for this measure
 - Tabulate all waste materials, including both the recycled and disposed materials and percentages of total
- Invoices from haulers and recycling firms that support the details in the summary log regarding handling of waste.

Industry or Referenced Standards

- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed

Example

Demolition and Reconstruction of Parking Structure

Percent diverted from landfill or incineration = $288.5 / 349.5 = 82.5\%$, which corresponds to 4 certification points.

Related Measures

- A.11 Regional Materials for New Construction, Rehabilitation, or Retrofit
- A.12 Regional Labor for New Construction, Rehabilitation, or Retrofit
- A.13 Reused, Repurposed or Recycled Materials

MEASURE 11 Regional Materials for New Construction, Rehabilitation, or Retrofit

POINT VALUE 3 – 6

Objective

Encourage the use of regional materials for new construction, rehabilitation, or retrofit projects.

Description

A parking structure that uses regional materials stimulates the local economy by supporting local manufacturing and reduces energy consumption by minimizing the distance materials need to be transported.

Options

Use building materials or products that have been extracted, harvested, recovered, and/or manufactured within 300 miles of the project site.

Project sites within 300 miles of an oceanic coastline may add 50% of the total of land mileage lost from this calculation due to the coastline proximity. For example, if the project site is located 80 miles from the coastline, which effectively reduces the project's access by 220 miles in one direction, the project team may add materials extracted, harvested, or recovered from locations within 410 miles of the project in all other directions. This adjusted distance is calculated by taking half the difference between 300 miles and 80 miles and adding that value (110 miles) to the original 300 miles.

Projects that fall within the scope of this measure:

1. Accumulation of all retrofit, renovation and new construction projects performed over the last 5 years with project size exceeding \$100,000.
2. If no major project was performed in the last 5 years, the most recent retrofit, renovation or new construction to take place with a project cost exceeding \$500,000 may be considered for this measure.

Points will be allocated based on percentage of construction materials (by weight) regionally sourced. For multiple projects within scope, the percentage is based upon the cumulative sum of the materials across all of the projects.

If only a fraction of a specific product or material is extracted, harvested, recovered, and manufactured locally, only the regional percentage (calculated by weight) can contribute to the amount of material sourced regionally. All materials used in the project must be factored into the calculation, including structural, mechanical, electrical/lighting, plumbing, glass, etc.

Note: If information on the weight of materials used in the project is unavailable, project cost may be used as alternative for calculating percentages. When calculating the overall percentage of multiple projects toward one certification, either weight or cost must be used for all projects. Weight and cost cannot be intermingled.

The minimum percentage of regional materials for each point threshold is as follows:

[6 Points] At least 75% of materials sourced regionally.

[3 Points] At least 50% and less than 75% of materials sourced regionally.

All materials used in the project must be factored into the calculation, including structural, mechanical, electrical/lighting, plumbing, glass, etc.

Documentation Requirements

Documentation must include all retrofit, renovation and new construction projects performed within 5 years of the preliminary review submission that exceeded \$100,000 in total cost. If no project that exceeded \$100,000 in total cost was performed in the last 5 years, the most recent retrofit, renovation or new construction project with a total cost exceeding \$500,000 may be considered for this measure.

- Table summarizing all materials used including:
 - Item description
 - Place of manufacturing origin
 - Weight (or cost, if weight unavailable)
 - Totals of the products sourced regionally versus outside of region along with percentages of total
- Contractor's schedule of values.

Industry or Referenced Standards

- LEED for Building Operations and Maintenance rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed

Related Measures

- A.10 Construction Waste Management
- A.12 Regional Labor
- A.13 Reused, Repurposed or Recycled Materials

MEASURE 12 Regional Labor for New Construction, Rehabilitation, or Retrofit

POINT VALUE 1 – 4

Objective

Use regional labor for construction of new, rehabilitation, or retrofit projects.

Description

A parking structure that uses local labor stimulates the local economy and reduces the environmental impact of transporting labor.

Options

Utilize employees who reside within 75 miles of the project site for major construction project(s).

Employees considered eligible for inclusion in this calculation comprise on-site labor and management. Applicable positions include project manager, superintendent, foreman, carpenter, tradesman, laborer, or any other title referencing an employee who works on the project site. If an employee is managing and/or working on multiple project sites, apply only the labor hours related to this project.

One additional point will be awarded for the provision of group transportation from a central location to the project site to reduce carbon emissions.

Projects that fall within the scope of this measure:

1. Accumulation of all retrofit, renovation and new construction projects performed over the last 5 years that exceed \$100,000 in total cost.
2. If no major project was performed in the last 5 years, the most recent retrofit, renovation or new construction to take place with a project cost exceeding \$500,000 may be considered for this measure.

Points will be allocated based on percentage of project labor hours using local labor. For multiple projects within scope, the percentage of labor is based on the cumulative sum of the local labor employed across all of the projects.

Points are awarded based on the percentage of labor performed by local labor compared to the total project(s) hours.

[3 Points] At least 60% of project labor hours performed by regional labor.

[1 Point] At least 35% but less than 60% of project labor hours performed by regional labor.

[1 Point] Rideshare transportation program available from central location for laborers.

Documentation Requirements

Documentation must include all retrofit, renovation and new construction projects performed within 5 years of the preliminary review submission that exceeded \$100,000 in total cost. If no project that exceeded \$100,000 in total cost was performed in the last 5 years, the most recent retrofit, renovation or new construction project with a total cost exceeding \$500,000 may be considered for this measure.

- Regional Labor
 - Table showing the details of all labor used:
 - Number of labor hours per individual laborer
 - Location of residence (zip code) of each individual laborer and distance from project site
 - Total number of project hours and percentage of labor hours within 75 miles
- Rideshare for Regional Labor
 - Narrative describing the rideshare program offered to laborers:
 - Rideshare pickup location(s)
 - Rideshare route information
 - Participation levels (percentage of laborers who use rideshare)

Related Measures

- A.10 Construction Waste Management
- A.11 Regional Materials for New Construction, Rehabilitation, or Retrofit
- A.13 Reused, Repurposed or Recycled Materials

MEASURE 13 Reused, Repurposed or Recycled Materials

POINT VALUE 2 – 6

Objective

Source reused, repurposed, or recycled materials for construction projects.

Description

A parking structure that uses reused, repurposed, or recycled materials reduces environmental impacts by reducing the extraction, harvesting, processing, and transportation of natural resources. This limits energy and natural resource use and may reduce project costs. In addition, procuring reused, repurposed, or recycled materials reduces solid waste volumes.

Material reuse refers to materials that are used in a new location or setting with a similar functionality as their original intent. Some common examples of reused materials include door hardware, windows, lighting systems, wood flooring, wiring, and piping.

Repurposed materials are those used in different applications than their prior functionality. Some common examples of repurposed materials include wood beams cut into signposts and brick walls laid as a sidewalk.

Recycled materials are used materials (waste) that have been re-introduced as material feedstock and processed into new products. Examples of materials that may contain recycled content include carpet, asphalt, concrete, steel, and aluminum.

Options

Use reused, repurposed, or recycled building materials and calculate (by weight) the percentage of these materials used in construction or rehabilitation projects. For materials that are partially recycled, only count the portion that is recycled towards the overall calculation.

All items used in the project construction or rehabilitation, including mechanical, electrical, and plumbing components, and specialty items such as elevators, must be included in this calculation.

Projects that fall within the scope of this measure:

1. Accumulation of all retrofit, renovation and new construction projects performed over the last 5 years that exceed \$100,000 in total cost.
2. If no major project was performed in the last 5 years, the most recent retrofit, renovation or new construction to take place with a project cost exceeding \$500,000 may be considered for this measure.

Points will be allocated based on the percentage of construction materials (by weight) that are reused, repurposed or recycled. For multiple projects within scope, the percentage is based upon the cumulative sum of the materials across all of the projects.

Note: If information on the weight of materials used in the project is unavailable, project cost may be used as alternative for calculating percentages. When calculating the overall percentage of multiple projects toward one certification, either weight or cost must be used for all projects. Weight and cost cannot be intermingled.

Points are assessed based on the total percentage of materials that are reused, repurposed or recycled:

[6 Points] At least 80% of all construction materials (by weight), used in project(s), are reused, repurposed, or recycled.

[4 Points] At least 50% but less than 80% of all construction materials (by weight), used in project(s), are reused, repurposed or recycled.

[2 Points] At least 20% but less than 50% of all construction materials (by weight), used in project(s), are reused, repurposed, or recycled.

Documentation Requirements

Documentation must include all retrofit, renovation and new construction projects performed within 5 years of the preliminary review submission that exceeded \$100,000 in total cost. If no project that exceeded \$100,000 in total cost was performed in the last 5 years, the most recent retrofit, renovation or new construction project with a total cost exceeding \$500,000 may be considered for this measure.

- Documentation of total project(s) materials cost.
- Table summarizing all materials used, including:
 - Item description
 - Percentage of the material that is reused, recycled, or repurposed (or zero for virgin material)
 - Weight (or cost, if weight unavailable)
 - Total and percentages of virgin materials versus reused, recycled, repurposed materials
- Contractor or manufacturer certifications that demonstrate the materials were reused, recycled, repurposed and the percentage of this content.

Industry or Reference Standards

- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed

Examples

This Demonstrator Site, Canopy Airport Parking in Commerce City, Colorado, is also a LEED Gold facility. In addition to multiple sustainable strategies, ProPark, the facility owner, committed to responsible construction waste management as well as use of recycled materials in construction, diverting more than 79% of total construction waste, and using recycled materials for 42% of total building materials.



Photo courtesy of Propark America



Photo courtesy of Propark America

Related Measures

- A.10 Construction Waste Management
- A.11 Regional Materials for New Construction, Rehabilitation, or Retrofit
- A.12 Regional Labor for New Construction, Rehabilitation, or Retrofit

MEASURE 14 **Third Party Sustainability Certification**POINT VALUE **2 – 12****Objective**

Recognize parking structures that have achieved a third-party environmental sustainability certification.

Description

LEED and other third party green building certifications offer environmental sustainability verification to building projects that include parking structures. These certifications analyze a parking asset's environmental sustainability from a unique perspective, encouraging initiatives included in the Parksmart Certification Standard and those beyond the program's scope. These ratings systems address a wide range of categories, including, air and water quality, energy efficiency, transportation and environmental health. To recognize their comprehensive commitment to environmental sustainability, garages that have achieved a third-party sustainability certification that complements and aligns with the goals of Parksmart certification will receive points in this measure.

Options

A parking structure may only seek recognition for one third party system and will be awarded points based on the highest level achieved in that selected system for a maximum of 12 points.

LEED Rating System

Parking structure falls within the project boundary of, and was included in, a LEED BD+C or LEED O+M certification.

[12 Points] LEED Platinum, 2009 or v4.

[10 Points] LEED Gold, 2009 or v4.

[8 Points] LEED Silver, 2009 or v4.

[6 Points] LEED Certified, 2009 or v4.

[4 Points] LEED certified to any level, v2.2.

Other Programs

Other programs that offer quality sustainability certification or rating systems may be recognized. For a program to qualify, it must demonstrate quantitative measurements or ratings pertaining to energy conservation or environmental sustainability.

[2-12 Points] Facility is certified or actively engaged and registered in a qualifying energy conservation or environmental sustainability program.

Documentation Requirements

- Documentation demonstrating current LEED or other qualifying program certification. Include relevant documents pertaining to certification level and project boundaries. Documentation and certification must be completed at the time of the Parksmart submission.

Industry or Referenced Standards

- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed
- LEED v4 User Guide, October 2013
- LEED 2009 MPR Supplemental Guidance revision 2 (September 2011)
- ULI Greenprints Center:
www.uli.org/research/centers-initiatives/greenprint-center/

Related Measures

- A.15 Credentialed Management

MEASURE 15 **Credentialed Management**POINT VALUE **1 – 4****Objective**

Management directly responsible for day-to-day parking structure operations has earned and maintained a qualified environmental sustainability credential.

Description

A central tenet of Parksmart certification is environmental sustainability in day-to-day parking facility operations and management. Environmentally sustainable operations extend beyond design and construction to the operational technology, programs and maintenance. By employing operations managers who are accredited in environmental sustainability, a facility owner demonstrates a commitment to achieving environmental sustainability.

Options

A parking structure operations director or manager has earned and maintained accreditation in an area that provides knowledge of environmental sustainability. To qualify, the parking structure manager or director must spend a minimum of 16 hours per month engaged in activity specific to the garage seeking certification. Only 1 designation may be counted towards this measure, for a maximum of 4 points.

[4 Points] LEED AP professional credential.

[3 Points] LEED Green Associate professional credential.

[2 Points] Certified Administrator of Public Parking (CAPP), International Parking Institute (IPI) with documented sustainability curriculum.

[2 Points] Certified Parking Professional (CPP), National Parking Association (NPA) with documented sustainability curriculum.

[1 Point] Facilities Management Administrator (FMA) or Real Property Administrator (RPA), Building Owners and Managers Association (BOMA) International with documented sustainability curriculum.

[1 Point] Certified Facility Manager (CFM), International Facility Management Association (IFMA) with documented sustainability curriculum.

[1 Point] Parksmart Advisor, Green Business Certification Inc. (GBCI).

[1-4 Points] Alternate certification program with documented sustainability curriculum.

Documentation Requirements

- Identity of person credentialed and copy of certificate earned.
- Documentation (e.g. letter, statement, organizational chart) documenting that the accredited person is responsible for day-to-day operations of the facility and that this person spends at least 16 hours per month engaged in activity specific to the garage seeking certification.

Industry or Referenced Standards

- LEED professional credential program
www.usgbc.org
- Certified Administrator of Public Parking Program, International Parking Institute
www.parking.org
- Certified Parking Professional Program, National Parking Association
www.npapark.org

Related Measures

- A.14 Third Party Sustainability Certification

MEASURE 16 Life-cycle Assessment

POINT VALUE 2 – 8

Objective

Perform a life-cycle assessment (LCA), before undertaking new construction or major renovations and retrofits, that validates the construction decisions.

Description

A parking operator is to produce a LCA for the required impact categories (greenhouse gas emissions, energy consumption, resource use, etc.) for new construction or renovation projects.

A proper LCA highlights actions to reduce embodied energy (raw materials acquisition, manufacturing, distribution, and transport) and limit resources required for maintenance (joint/slab repair, washing decks, sealants, etc.). LCA assesses the environmental impacts of inputs and outputs related to resources consumed and waste management, and the reduction of harmful pollutants including greenhouse gas emissions.

Estimating environmental impacts during a parking structure's full life-cycle exposes the greatest opportunities for reducing those impacts and provides guidance during the design phase for identifying reduction opportunities so that the least environmentally impactful designs can be considered.

This measure recognizes parking structures that reduce the life-cycle environmental impact of a new or renovated structure by incorporating savings identified from an LCA in the design and construction plans.

Options

Provide documentation that the design and construction team performed a thorough LCA demonstrating reduced natural resource consumption, embodied energy, maintenance, waste creation, and/or harmful emissions. These should apply to all materials and processes used in the design and construction, including items such as gates and signage, and materials used in the ongoing structural maintenance.

The team must also provide the LCA for a contrasting baseline project design to demonstrate the selected design's benefits. Points will be awarded based on the size of the impact of the LCA, the quality of the supporting data, and the extent of the lifecycle management benefit.

Projects considered for this measure must have identified and implemented at least a 20% environmental savings (consumption of energy or natural resources) as a result of an LCA. All LCAs performed over the last 5 years may be considered in the calculation.

- [8 Points] Construction and/or retrofit project(s) totaling over \$2 million, with an LCA performed and savings implemented.
- [6 Points] Construction and/or retrofit project(s) totaling over \$1 million, with an LCA performed and savings implemented.
- [4 Points] Construction and/or retrofit project(s) totaling over \$500,000 with an LCA performed and savings implemented.
- [2 Points] Construction and/or retrofit project(s) totaling over \$100,000 with an LCA performed and savings implemented.

Documentation Requirements

- LCA reports describing the various construction options, including the typical baseline, and the data associated with each option. Data must include 6 primary categories:
 - Resource extraction and processing
 - Product manufacturing
 - On-site construction of assemblies
 - Related transportation
 - Maintenance and replacement cycles over an assumed building service life
 - Structural system demolition and transportation to landfill
- Invoices or images to demonstrate:
 - The construction option(s) selected was the option that the LCA determined would provide the greater environmental savings
 - The total project(s) cost

Industry or Reference Standards

- United States Environmental Protection Agency, LCA Resources:
www.epa.gov/saferchoice/design-environment-life-cycle-assessments
- Sample LCA Tools:
 - ILCD Handbook
www.eplca.jrc.ec.europa.eu
 - WRI Product Life-cycle Accounting and Reporting Standard:
www.ghgprotocol.org/standards/product-standard
 - Open LCA Software
www.openlca.org

- PRé Software
www.pre-sustainability.com
- GaBi Software
www.gabi-software.com
- EIO-LCA
www.eiolca.net
- Sample Existing LCA Calculators:
 - NREL:
www.nrel.gov/lci/related_links.html
 - BEES system:
www.nist.gov/el/economics/BEESSoftware.cfm
 - Athena Institute:
www.athenasmi.org/our-software-data/ecocalculator/

Suggested Best Practices

LCA can be a complex process to initiate and implement. A number of LCA societies offer professional training and credentialing. Although not required by certification, consulting a certified or trained LCA professional is recommended.

Organizations and resources include:

- The International Society of Sustainability Professionals (ISSP):
www.sustainabilityprofessionals.org
- American Center for Life-cycle Assessment:
www.lcacenter.org

The following questions should be considered while creating an LCA:

- What is the embodied energy of the building and maintenance materials? (How much energy did it take to produce and install them? Will they need to be replaced or maintained?)
- Can the material be recycled or reused at the end of its useful life?
- Do different construction methods or structural systems offer better opportunities for resource recovery at the end of the building's life? (Concrete can be crushed and recycled; steel can be recycled, etc.)
- How much maintenance will the construction and operational materials require over their life? (Will the steel structure's fireproofing need to be replaced? What will be required to maintain the joints in the precast structure? Is there an efficient way to build the structure so it won't leak or rust at the joints and require more frequent replacement?)
- How much maintenance does the structural system require over time? (e.g. Joints, slab replacement, sealants, etc.)

- How energy-intensive is the maintenance regime? (What kind of lighting is used? Is there a design that requires less lighting? What will be required to wash the bird droppings from pre-cast ledges?)
- Are waste byproducts produced during regular operation and maintenance, and if so, how are they handled?
- Does the building material require special coatings, treatments, or fireproofing that could present health or safety hazards?
- If the material off-gasses during and after installation, how is the indoor air quality affected?
- How do the amounts of waste resulting from manufacture, fabrication, and installation compare with those from alternative materials?
- Is the structure automated?

Related Measures

- A.13 Reused, Repurposed and Recycled Materials
- C.17 Design for Durability



SECTION B

Programs

- MEASURE 1 **Placemaking**
 - MEASURE 2 **Access to Mass Transit**
 - MEASURE 3 **Wayfinding Systems – External**
 - MEASURE 4 **Wayfinding Systems – Internal**
 - MEASURE 5 **Traffic Flow Plan**
 - MEASURE 6 **Carshare Program**
 - MEASURE 7 **Rideshare Program**
 - MEASURE 8 **Low-emitting and Fuel-efficient Vehicles**
 - MEASURE 9 **Alternative Fuel Vehicles**
 - MEASURE 10 **Alternative Fuel Fleet Vehicles**
 - MEASURE 11 **Bicycle Parking**
 - MEASURE 12 **Bicycle Sharing/Rental**
 - MEASURE 13 **Marketing/Educational Program**
-

MEASURE 1 **Placemaking**

POINT VALUE 1 – 6

Objective

Parking structures exist within the context of a community. As businesses, these facilities can contribute to the social wellbeing of a community and serve as a positive neighborhood feature.

Description

Structured parking facilities exist within the context of a community, neighborhood, or urban district. A variety of user groups from, residential, office, retail, and entertainment sectors take advantage of a parking facility's services. As such, parking structures serve as a community gateway, not only providing parking services, but also delivering pedestrians onto city and neighborhood streets. As a gateway, the structure can serve as a hub for additional services, information, and connectivity with the community.

Parking infrastructure may also be considered a platform to support community development goals, including integrated residential developments, parks, green or open space, and community gathering places.

As community businesses, parking structures can contribute to economic and community development. In addition to providing employment opportunities and tax revenue, consuming local goods and services, facilities can contribute to economic and neighborhood vitality. This measure envelops innovative and creative programming that can leverage the garage's role as a community gateway.

The following placemaking examples include a suggested range of corresponding point values. The initiatives with higher community value (e.g., greater event frequency, more extensive physical features) are awarded more points. Awarded points may be greater or less than the suggested range.

- Engagement of and support to the arts community and other civic organizations through creative outreach and development programs. Some examples of arts programming include free public concerts, art installations, performing arts events and neighborhood festivals. Points awarded may range from 1-4 points, depending on the frequency of programming events, ease and cost of community access, and level of engagement by the parking site.
- Providing community regular access to parking decks for sporting events, exercise classes or youth activities during the non-peak periods. Examples include installation of ice skating rink in courtyard, basketball courts on roof deck, staging road races to benefit charitable organizations and hosting Tai Chi classes in the early morning. Points awarded may range from 1-3 points, depending on the

frequency of use, ease of public access and the level of engagement with the community organizations by the parking site.

- Green space easily accessed by the public from the street level. This can range from small pocket parks and landscaped walkways or herb gardens to large roof top public parks with community gardens, playing fields, amphitheaters or event programming. Points awarded may range from 1-6 points, depending on the size and scope of the facilities and the extent of the programming being offered.
- Creation of green walls, climbing walls and architectural designs to blend the building into the surrounding neighborhood. Points awarded may range from 1-3 points, depending on the extent of the feature and neighborhood benefit.
- Reinvestment of a portion of parking revenues into downtown and community development programs that support community development goals and “most livable community” standards.¹ Points awarded may range from 1-3 points, depending on the facility’s level of involvement with the programs.
- Collaboration with local associations and private parking owners to develop and disseminate parking and transportation information. Points awarded may range from 1-2 points, depending on the level of involvement with the local associations.
- Provide business opportunities and services for the local community such as providing a space for food trucks or shoe shine vendors. Points awarded may range from 1-2 points, depending on the level of outreach and extent of business access to the site.
- Creation of meeting space within the garage structure to host community activities. Points awarded may range from 1-2 points, depending on the extent of public access to the facility.
- Use of garage space for community activities, including a farmers’ market, rooftop drive- in movie theater or art exhibition space. Points awarded may range from 1-3 points, depending on the frequency of these events and the availability to the community.
- Support for community charitable causes and events. Points awarded might range from 1-2 points, depending on the frequency of events and level of support.
- Use of architectural and aesthetic features to reinforce the identity of the neighborhood. This option recognizes that creative architectural design creates an appealing community gateway. Architectural features may also be designed to retain the historical quality of the neighborhood. Points awarded may range from 1-3 points, depending on the scale and visibility of features.

¹ Most Livable Community www.livable.org

Options

This is a subjective scoring category. Points are awarded in proportion to the relative community benefits, taking into consideration scale, frequency, public access, promotion and parking operator's level of involvement. Multiple placemaking initiatives may be submitted.

[1-6 Points] Parking structure has implemented placemaking features and/or programming on the property that successfully integrate the garage into the surrounding community.

Documentation Requirements

- Event Placemaking
 - o Narrative detailing the event(s), including:
 - Description of the program, idea, or innovation
 - Associated participation from parking facility/employees
 - Demonstrated results
 - Frequency of events
 - Whether it is a public event or restricted to specific groups/individuals
 - Cost for attendees
 - Partner organizations
 - Describe the points being requested and a justification for the number of points
 - o Available literature for events to support the claims in the narrative (e.g., event schedules, event web page screen shot, news stories about the event, brochures, and any relevant promotional materials).
- Physical Placemaking
 - o Narrative detailing the physical features, including:
 - Description of the features
 - Size and scope of the features
 - Associated participation from parking facility/employees regarding upkeep and interaction with the features
 - Benefits of the features to the community
 - Accessibility of the features to the public
 - Justification for the number of points being requested
 - o Images of physical placemaking features.

Additional Resources

- Projects for Public Spaces, - reference for creative placemaking ideas
www.pps.org
- Most Livable Community
www.livable.org

Examples

Physical Placemaking

Miami Courthouse Parking Garage, Miami, FL

The 850-space, mixed-use facility, adjacent to the Federal Courthouse in downtown Miami, also provides public open space. This project is using a land bank to provide a passive reflection park that serves as an attractive community gathering place for the neighborhood's employees, residents and visitors.



Photos courtesy of Timothy Haahs & Associates



Photos courtesy of Timothy Haahs & Associates

Garage and Park Post Office Square, Boston, MA

Formerly the site of an unattractive three-story municipal parking garage, Post Office Square is now home to a 1.7 acre street-level park, as well as a seven-level underground parking garage; it is located in the center of Boston's financial district. There is a major bus stop one block away and subway stops two to three blocks away. Completed in 1991, Post Office Square was the culmination of an effort that began in 1983 with the formation of the Friends of Post Office Square. The park's features include a fountain, a park pavilion, benches, and sitting walls. One gazebo-like structure shelters a café; another covers the escalator entranceway to the garage.

Norman B. Leventhal Park is intended to be a passive park. It has a 24-seat café that leases its space from the park and expands outdoors in good weather, offering additional food carts. Twice a week, local musicians provide live music and at Christmas a brass quintet performs in the park. Underground, the garage houses car care services, shoe shine services, a dry cleaner, telephones, clean restrooms, free phone connection to a 24-hour traffic hot line, and ATM machines. www.pps.org/articles/posquare



Photo courtesy of Garage at Post Office Square

Public Library Community Bookshelf, Kansas City, MO

Local readers nominated their favorite books to adorn the side of this parking garage-turned-Kansas City landmark. More of an oddity than an architectural innovation, each of the 22 spines of classic literature measures 25 feet by 9 feet and is sandwiched between two metal stairwells that act as the bookends.



Photo courtesy of Dimensional Innovations

Event Placemaking

Urban Projections, Hult Center Parking Garage, Eugene, OR

Urban Projections was the first digital art and media projection festival in Eugene. The festival partnered with downtown businesses to present a free public event at the top of the Hult Center Parking Garage. Digital video and art installations by local, national, and international artists were projected onto alley walls and parking garage surfaces in downtown Eugene.

Multi-Story is a project that brings classical music to unexpected places, run by composer Kate Whitley and conductor Christopher Stark. It has been resident orchestra at Bold Tendencies in a multi-storied car park in Peckham, London since 2011.



Photo courtesy of Ambra Vernuccio

Event and Physical Placemaking

High Point Climbing and Fitness, Chattanooga, TN

High Point Climbing and Fitness is a gym with lead, top rope, auto-belay, and speed climbing walls adorning the exterior of a municipal parking garage.

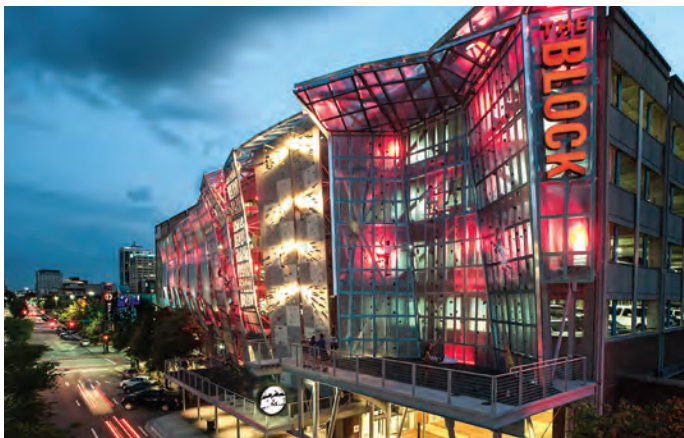


Photo courtesy of www.highpointclimbing.com

Suggested Best Practices

- Safety must always be a priority. When conducting events, make sure it is safe for human occupancy for the size of the anticipated crowd. Safety considerations include, but are not limited to:
 1. Ensure structural loading is sufficient for the weight of the event.
 2. Ensure sufficient fire prevention is in place to meet code, for any portion of the event that is taking place inside of the garage.
 3. Ensure properly sized emergency exits exist.
- Event programming should be recurring with frequency of at least 6 days per year and be open to the public.

Related Measures

- A.2 Shared Parking
- A.3 Transportation Management Association (TMA)/ Organization (TMO) Affiliation
- B.13 Marketing/Educational Program
- C.14 Water-efficient Landscaping
- C.15 Roofing Systems

MEASURE 2 **Access to Mass Transit**

POINT VALUE 4

Objective

Parking structure is located within a one half-mile walking radius of, or provides shuttle service to, at least one operational rail, bus, light rail, trolley, ferry, or other mass transit system/station.

Description

Mass transit benefits the environment by reducing the number of vehicles on the road and their corresponding environmental, energy consumption, parking and traffic congestion effects. A single person who switches from a 20-mile round trip single passenger car commute to using public transportation can reduce annual carbon dioxide (CO₂) emissions by 4,800 pounds per year. This is equal to a 10% reduction in all greenhouse gases produced by a typical two-adult, two-car household. By eliminating one car and taking public transportation instead of driving, the commuter can realize savings of up to 30% of carbon dioxide emissions.¹

If the parking structure is not located within one half-mile of mass transit, management can work with regional transportation districts to add a bus stop or other mass transit hub at or near the facility. This can include petition sign-ups on area websites and solicitation using social or traditional media.

Options

A parking structure must meet 1 of the following criteria:

- Physical proximity to the mass transit station/system is within one half-mile walking distance on a publicly maintained path. Directional signage to the closest mass transit location is clearly visible on the property. Location should be a system, station, or hub, and not a single bus stop. Proximity to multiple bus lines at a single stop may be documented as an option if sufficient access to mass transit is evident.
- Parking structure operator may provide supplemental transportation between the parking facility and a mass transit site, if the distance is greater than one half-mile or not pedestrian-friendly. This transportation could be in the form of a hybrid or conventional shuttle bus, carpool, or other vehicle that delivers users to the mass transit site.

[4 Points] Parking structure is located within a publicly maintained one half-mile walk of a mass transit station, or the facility runs a shuttle service that carries patrons to a mass transit station.

¹ "Public Transportation's Contribution to U.S. Greenhouse Gas Reduction," Science Applications International Corporation, September 2007

Documentation Requirements

- Images of signage, websites, flyers, promotions, and other communications that demonstrate the parking structure is promoting the use of and access to local mass transit.
- Scaled maps or site plans confirming the distance from the parking facility to the mass transit terminal via a pedestrian-friendly path or shuttle route.
- If applicable, documentation of transportation to a mass transit location.

Suggested Best Practices

- If the parking operator is outside of the one half-mile radius to mass transit as defined above and chooses to operate supplemental transportation, we recommend the use of alternative fuel vehicles. In addition, it is recommended that these shuttles are equipped with bicycle racks to encourage bicycle use.
- Parksmart is intended for both new as well as existing parking structures. When a new structure is built according to the Parksmart Certification Standard, site selection is critically important to the building's environmental sustainability. Parking structure development should be on a previously disturbed, infill, or brownfield (surface parking lots are considered previously disturbed). Development and construction on greenfield sites, open space and farmland should be avoided. Additional considerations for site selection include access to mass transit, other nearby uses, relative density, and the ability to promote shared parking to maximize land use.

Related Measures

- A.3 Transportation Management Association (TMA)/ Organization (TMO) Affiliation
- B.13 Marketing/Educational Program
- B.10 Alternative Fuel Fleet Vehicles

MEASURE 3 **Wayfinding Systems – External**

POINT VALUE 1 – 4

Objective

Implement external wayfinding systems to reduce the time drivers spend locating a parking garage.

Description

According to a recent IBM Global Parking survey,¹ more than 30% of a city's traffic congestion is caused by drivers searching for parking spaces. In New York City, 29% of commuters spent an average of 20 minutes locating spaces, and 10% spent more than 40 minutes. IBM stated that in August 2011, Americans drove an extra 1 million miles looking for a parking space,² causing 47,000 additional gallons of fuel consumption, additional air pollution and thousands of hours of worker productivity lost.

This is an environmental and economic issue that can be addressed in part by facilitating the finding and reserving of local parking spaces. Wayfinding systems provide guidance to streamline the parking process, reduce time spent looking for parking, and reduce fuel consumption and auto emissions.

External wayfinding systems assist drivers in locating parking facilities more quickly, and may include reservation systems.

There are several types of external wayfinding systems.

- **Dynamic signage:** Electronic signage in a city or a local neighborhood that provides drivers with information about the location of nearby parking facilities with vacancies, enabling the driver to find a parking structure without circling, thereby reducing miles driven and traffic congestion.
- **Parking Applications & Resources:** Many parking applications and resources are available to drivers via smart phone applications and web sites. Technology offerings enable drivers to locate parking facilities in a specific area as well as determine pricing and parking vacancy information. Some applications provide integration with navigation systems (e.g., Google Maps or GPS systems).
- **Reservation Systems:** Many parking applications and web sites can provide a driver with the option to reserve and pre-pay for a parking space, thus ensuring that the space will be waiting for them at a specific time. Reservations may also be offered by phone or text message.

¹ www-03.ibm.com/press/us/en/pressrelease/35515.wss (April 24, 2014)

² www-03.ibm.com/press/us/en/pressrelease/35359.wss (April 24, 2014)

Options

- [1 Point] Parking structure vacancy is updated on dynamic signage in the local area to provide drivers with parking vacancy information.
- [2 Points] Parking structure is listed on an external wayfinding platform technology (such as a smart phone application or web site) that provides location, navigation and pricing information.
- [1 Point] Parking structure is listed on an external wayfinding platform (such as a smart phone application or website) that allows customers to make reservations prior to entering the facility.

Documentation Requirements

- Dynamic Signage
 - Images of signage showing an example of the dynamic messaging.
 - Map showing location(s) of the signage relative to the parking facility.
- Wayfinding System
 - Include 1 of the following:
 - Documentation of service by external wayfinding service provider that provides location, navigation, and pricing information for the parking facility
 - Screen shot images of a parking application or website showing external wayfinding service that provides location, navigation, and pricing information for the parking facility
- Reservation System
 - Include 1 of the following:
 - Documentation of service by external wayfinding service provider that provides reservation services for the parking facility
 - Screen shot images of a parking application or website showing external wayfinding service that provides reservation services for the parking facility
 - Copies of reservation policy, promotional materials, and, if phone reservations are accepted, information describing the reservation process

Examples

Sampling of Parking Application and Website Parking Resources

- City of Seattle, E-Park
www.seattle.gov/transportation/epark
- ParkHub
www.parkhub.com
- ParkNow
www.park-now.com
- SF Park
www.sfpark.org

Variable Message Signage (VMS)

Variable message signs are a critical component of an effective parking guidance system because they communicate parking availability data to drivers seeking parking in the local area.



"356 Parking Spaces Available" (CC BY 2.0) by jbcurio, www.flickr.com/photos/jbcurio/2297640874



Photo courtesy of GBCI.

Related Measures

- B.4 Wayfinding Systems - Internal
- B.5 Traffic Flow Plan
- C.1 Idle Reduction Payment Systems

MEASURE 4 Wayfinding Systems – Internal

POINT VALUE 1 – 4

Objective

Implement internal wayfinding systems to reduce the time required to locate and park vehicles once drivers have entered the parking facility.

Description

Wayfinding systems provide guidance to streamline the parking process, reducing time spent looking for a particular facility or a parking space within a facility. Limiting drive time reduces fuel consumption and auto emissions.

Internal wayfinding systems, often termed parking guidance systems, provide tools to facilitate efficient parking within a parking structure. Internal wayfinding provides directional information regarding available parking spaces within the facility, significantly reducing the time spent and distance driven to locate a space. The result is less fuel consumed, fewer vehicle emissions produced, greater vehicle throughput and higher customer satisfaction.

A variety of technologies provide parking guidance, including:

- **Single space detection** devices providing an illuminated indicator near each space to notify drivers if the space is available. Technologies include ultrasonic, video and in- ground sensors.
- **Electronic level counting** detects the number of vehicles entering and leaving a garage level or nested section and discloses the number of vacant spaces available in a given area. The counters are most effective if dynamic signage at the entrance of the facility directs drivers to the parking levels with the most available spaces.
- **Variable message sign** parking guidance can provide additional information, including the availability of handicapped or alternative fuel spaces or information about adjacent garages in a multi-garage complex. Alternatively, signage can be physical placards placed on each level as it fills up, directing drivers to the next level.

Option

Credit for this category is awarded for the highest level of wayfinding that the facility provides to its patrons, for a maximum of 4 points.

[4 Points] Parking guidance via single space detection.

[3 Points] Parking guidance via electronic level occupancy detection.

[2 Points] Parking guidance via automatic variable signage.

[1 Point] Parking guidance via manually counted and placed static signage.

Documentation Requirements

- Narrative describing internal wayfinding, including:
 - Specific technologies and type of wayfinding practices that are in use
 - Make/model of any automatic electronic signage and sensor technology in use
 - Floor plan and sensor locations
 - For level counting, details of the boundaries between the level spaces
 - System/process in place for monitoring vehicle counts
 - Process in place for manually validating and correcting vehicle count discrepancies
- Images:
 - Parking facility entrance(s) showing wayfinding signage
 - Representative sample of signage at ramps/levels

Examples

Static Sign Parking Guidance System

Placement of static signs in a garage with active updating can provide a simple parking guidance system. As this is a manual system, its success depends on how well it is managed.



"Lleno" (CC BY 2.0) by Daquella Manera, www.flickr.com/photos/daquellamanera/144520836/

Space Sensors

Space sensors use various detection methods such as ultrasonic, video, and in-ground sensors to detect a vehicle occupying a parking space. This data can then be sent to a display device that quickly alerts drivers to available parking spaces. In the example shown, the green lights provide a clear indication to a driver that there are available spaces in that lane.



Photo courtesy of Brookfield

Variable Message Signage

Variable message signs are a critical component of an effective parking guidance system because they communicate parking availability data to garage patrons. Most systems will use a multi-level master sign deployed at the garage entrance to show all the parking levels. Other systems augment the master sign with smaller level count signs on each level.



"356 Parking Spaces Available" (CC BY 2.0) by jbcurio, www.flickr.com/photos/jbcurio/2297640874



Photo courtesy of Sheriff Technologies Ltd.

Combination Sensors/Signs

Using a combination of space sensors and variable message signs, these dynamic systems provide drivers with real-time information about the location and number of available spaces and direct drivers to these space locations.



Related Measures

- B.3 Wayfinding Systems – External
- B.5 Traffic Flow Plan

MEASURE 5 Traffic Flow Plan

POINT VALUE 2 – 4

Objective

Minimize traffic delays for egress (exit) from parking structure, especially during special events and high-traffic periods.

Description

Thirty percent of vehicle emissions within parking structures are attributed to engine idling during delays in exiting the garage. Simple procedural changes can reduce or eliminate unnecessary idling, lowering vehicle emissions.

Reducing traffic flow disruptions and vehicle emissions improves air quality and driver satisfaction. Reducing delays inside a parking structure also can improve traffic flow outside of the garage, easing traffic congestion on local streets.

Options

Methods for improving egress traffic flow from a parking structure include the following techniques, which can be applied at all times or temporarily during periods of high egress traffic flow.

- **Enhanced signage:** Provide crisp, clear, easy to read, lit or reflective signage directing drivers to the nearest direct exit.
- **Destination wayfinding signage:** Post destination information for interstate or local streets (complete with color logos and numbers) well in advance of the exit lane.
- **Gate barriers:** Raise, remove or open egress barriers to facilitate speedy and continuous exit (without compromising safety). This strategy may be particularly effective for special events where payment is accepted in advance or at the time of entry.
- **In-garage assistance:** Provide additional visible, well-trained staff for major events to ensure customers exit as quickly as possible.
- **On-street assistance:** Provide traffic directors or local law enforcement on roads outside the parking facility to facilitate quick, continuous exits during peak traffic periods and major events. Traffic exit solutions should be coordinated with local traffic enforcement officers.
- **Single direction:** For consistent traffic flow and rapid exiting, have all vehicles move through the parking facility in a single direction. This strategy may be particularly effective for special events where payment is accepted in advance or at the time of entry.

- **Signal control, manual or electronic:** Traffic signals on adjacent streets that respond to parking facility traffic queues via sensors or manual controls. When queues begin to form, traffic outside the facility is managed to allow vehicles to exit the facility more quickly.
- **Pay before exit:** Drivers pay for parking on entry or at a window or automated machine before returning to their car, thus reducing exiting delays.

To successfully meet the criteria for this category, a parking structure must use the strategies listed above or other comparable strategies, for a maximum of 4 points.

[4 Points] Operator employs a minimum of 4 of the above strategies during all special event and high traffic periods, and 2 during all operations.

[4 Points] Operator can demonstrate that average vehicle idle time does not exceed 5 seconds on egress.

[3 Points] Operator employs a minimum of 3 of the above strategies during special event and high traffic periods.

[2 Points] Operator employs a minimum of 2 of the above strategies during special event and high traffic periods.

Documentation Requirements

- Narrative explaining exit protocols and procedures.
- Images of equipment and signage in use to improve egress traffic flow.

Example

Destination Wayfinding

Exit signage directing traffic to major highways allows vehicles to be positioned in proper lanes for smooth egress traffic flow and rapid exit.



Photo courtesy of John Oglesby

Reversible Exit Signage



Photo courtesy of Sherry Williams, Oxford Properties

Related Measures

- B.4 Wayfinding Systems -Internal
- C.1 Idle Reduction Payment Systems

MEASURE 6 Carshare Program

POINT VALUE 5 – 6

Objective

Implement and promote a carshare program.

Description

Carshare programs reduce the number of miles driven by single occupancy automobiles. On average, a shared car removes between 9 and 13 vehicles from the road.¹ Additionally, the average carsharing participant decreases his or her driving by 27% to 56%,² reducing traffic congestion and automobile emissions.

Options

Parking facilities serving as carshare hubs will satisfy the criteria for this measure. Parksmart defines a carshare hub as a location that is the permanent home for at least 2 carshare vehicles. Three ways to become a carshare hub include:

1. Partner with an existing private or nonprofit carshare program to house 2 or more vehicles used by the program. Programs available throughout the U.S. and Canada include Zipcar, WeCar, City CarShare, Connect by Hertz, and Ucar Share.
2. Purchase at least 2 vehicles and create a local carshare program.
3. Partner with businesses or community organizations to develop a carshare program, which may be funded and operated by any individual or institution, as long as 2 program vehicles are housed in your parking facility.

[5 Points] Parking structure supports a carshare hub with a minimum of 2 vehicles.

[1 Point] Parking structure populates the carshare hub with only hybrid or alternative fuel vehicles (as defined in Section B9).

¹ www.uctc.net/access/38/access38_carsharing_ownership.shtml

² www.uspirg.org/sites/pirg/files/reports/A%20New%20Way%20to%20Go%20vUS1.pdf

Documentation Requirements

- Carshare Program
 - Narrative describing the carshare program, including:
 - Description of organization and implementation of program
 - The entity that owns and maintains the vehicles
 - The entity that manages the users of the program
 - Number and type of vehicles in the program
 - Number of spaces reserved for the program
 - One of the following:
 - Partnership agreement with carshare company
 - Vehicle registration(s), if the facility self-manages the carshare hub
 - Photographs of the parking spaces reserved for the carshare program.
 - Signed commitment to offer carshare program on an ongoing basis.
- Alternative Fuel Carshare Vehicles
 - Documentation verifying that the type of vehicles that are available in the carshare hub are alternative fuel vehicles (e.g., vehicle registrations, invoices, contract with carshare operator).

Examples

Carshare Program



Photo courtesy of Zipcar

Related Measures

- A.3 Transportation Management Association (TMA)/ Organization (TMO) Affiliation
- B.8 Low-emitting and Fuel-efficient Vehicles
- B.9 Alternative Fuel Vehicles
- B.13 Marketing/Educational Program

MEASURE 7 Rideshare Program

POINT VALUE 2 – 6

Objective

Encourage rideshare program participation.

Description

Rideshare (often referred to as carpooling or vanpooling) reduces the prevalence of single occupancy vehicles, lowering traffic congestion, auto emissions, and parking space construction.

Every rideshare passenger corresponds to a reduction in greenhouse gas emissions. For example, on average a 25 mile round trip commute would result in savings of 1,500 pounds of CO₂ for that passenger. “The U.S. could save 33 million gallons of gas – each day – if the average commuting vehicle carried one additional person.”¹

Options

[4 Points] Parking structure reserves at least 2% of parking spaces within the project boundary for rideshare, promotes the availability of these spaces, and commits the property to reserving additional spaces to meet rideshare demand (6% of total parking spaces reserved for “Clean Air Vehicles,” as defined in the California Green Building Standards Code, satisfies the space requirement here, in addition to that for B8 and B9).

[2 Points] Parking structure provides incentives to rideshare users (e.g., discounted parking, raffle or free amenity use) and promotes the availability of these incentives.

Documentation Requirements

- Narrative describing the rideshare program, including:
 - o How the program is administered
 - If applicable, methods used to verify vehicles in reserved spaces are rideshare participants and how enforced
 - o How the program is promoted by the garage management
 - What initiatives are employed to sustain and grow rideshare participation

¹ www.rideshare.com/Easy_Commute/Environmental_Benefits/ (April 29, 2014)

- o Who is eligible and who participates in the program
 - o What, if any, incentives are offered to rideshare participants
- Images of promotional signage.
- Signed commitment to offer rideshare program on an ongoing basis and increase the number of rideshare spaces to meet any increase in demand for these spaces.
- Reserved Spaces
 - o Table demonstrating the number of overall spaces, reserved rideshare spaces, and percentage calculation of rideshare to overall spaces.
 - o Images of reserved rideshare spaces and signage.
- Additional Incentives
 - o Documentation of rideshare financial or program incentives.

Suggested Best Practices

- Promotion of federal, state, regional, or local rideshare programs.
- Promotion of rideshare program via facility website and social media channels.

Related Measures

- A.3 Transportation Management Association (TMA)/ Organization (TMO) Affiliation
- B.1 Placemaking
- B.13 Marketing/Educational Program

MEASURE 8 Low-emitting and Fuel-efficient Vehicles

POINT VALUE 2 – 4

Objective

Parking structure provides incentives to promote the use of low-emitting and fuel-efficient vehicles.

Description

Air pollutants related to car and truck fuel consumption are a significant factor in vehicles' negative environmental impacts and they can be significantly affected by the choice of vehicle make and model. All combustion engines, including diesel, gasoline and even alternative fossil fuels, expel noxious gases such as unburned hydrocarbons and particulates into the atmosphere.

This measure encourages the use of vehicles that use less fossil fuel and emit a lower level of emissions than the average combustion engine vehicle. Operators can use 1 or both of the following programs to determine if a vehicle has high fuel efficiency and low emissions output.

- The American Council for an Energy-Efficient Economy (ACEEE) calculates a Green Score for each car, minivan, pickup, and sport utility vehicle (SUV) on the market, based on government reported emissions and fuel-economy tests, and other specifications reported by auto manufacturers. The Green Score falls on a scale of zero to 100. A higher score implies a greener car, meaning a vehicle having a lower environmental impact.

Consistent with the methodology in LEED v4 Location and Transport Credit: Green Vehicles, Parksmart considers “low-emitting and fuel-efficient vehicles” as those achieving a minimum green score of 45 on the ACEEE annual vehicle rating guide.

- The EPA SmartWay program¹ is to cars and trucks what ENERGY STAR is to buildings and appliances. Each year, the EPA rates every new car, truck, and SUV model for greenhouse gas and smog-forming emissions on a scale of 1 to 10. SmartWay Elite vehicles are the very best environmental performers. To earn the SmartWay Elite designation, a vehicle must receive a combined score on both scales that greatly exceeds the average.

Visit EPA and DOE's www.fueleconomy.gov website to learn more and search for a SmartWay Elite vehicle.

¹ www.epa.gov/smartway

Options

Provide preferred parking or discounted parking rates for low-emitting and fuel-efficient vehicles as described below.

“Preferred parking” refers to the parking spots closest to the main entrance of facility, elevators, and/or sites most frequently visited by garage users. (Exclusive of spaces required for accessibility purposes.) At least 2% of parking spaces within the project boundary must be designated as preferred parking for low-emitting and fuel-efficient vehicles.

“Discounted parking rates” must be discounted at least 20%, available to all monthly and reservation patrons and publicly posted at the entrance of the parking area.

“Low-emitting and fuel-efficient vehicles” are defined as vehicles that have achieved a minimum green score of 45 on the ACEEE annual vehicle rating guide, or vehicles that are listed in the EPA SmartWay Elite program database.

Low-emitting and fuel-efficient vehicle incentive program:

[2 Points] Parking structure offers preferred parking spaces for low-emitting and fuel-efficient vehicles (2% of total parking spaces reserved for “Clean Air Vehicles,” as defined in the California Green Building Standards Code, satisfies the space requirement here).

[2 Points] Parking structure offers discounted rates for low-emitting and fuel-efficient vehicles.

Documentation Requirements

- Narrative describing the low-emitting/fuel-efficient vehicle program, including:
 - How it is administered
 - Who is eligible
 - Procedures, enforcement mechanisms, and utilization data
 - If claiming points for reserved spaces, include a table showing:
 - Number of spaces reserved for use by low-emitting and fuel-efficient vehicles
 - Total number of spaces within the project boundary
 - Percentage of fuel-efficient spaces to total spaces
 - If claiming points for discounted rates, include a table showing:
 - Regular rate structure
 - Discounted rate structure
 - Percentage of savings provided to program participants

- o Images of posted signs showing program discounts and/or offerings.
- o Program documentation and promotional materials.

Industry or Referenced Standards

- Understanding Low-Emission Vehicles
www.jdpower.com/cars/articles/tips-advice/understanding-low-emission-vehicles
- Automobiles and the Environment
www.greencars.org/why-buy-green/automobiles-environment
- How to Buy Green
www.greencars.org/greencars-ratings/how-use-greencars
- How We Rate the Vehicles
www.greencars.org/greencars-ratings/how-we-determine-ratings
- LEED v4 Location and Transport Credit: Green Vehicles

Examples

LEFE (Low Emission Fuel Efficient) Parking

Ohio State University – City of Columbus collaboration

Ohio State University, in cooperation with The City of Columbus, created Campus Partners for Community Urban Redevelopment in 1995 to spearhead the revitalization of the University District. Campus Partners was formed in 1995 as a 501(c)(3), private, non-profit corporation working in the urban neighborhoods surrounding Ohio State University. Campus Partner's South Campus Gateway's LEFE (Low Emission Fuel Efficient) parking program provides short-term, premium parking for low emission and no emission vehicles. The program is intended to educate and inform South Campus Gateway parkers about low and no emission vehicles, while rewarding those who drive fuel-efficient vehicles with premium parking spaces. The LEFE program highlights South Campus Gateway's commitment to sustainability.



Photo source: www.campuspartners.osu.edu/assets/images/IMG_1536.JPG

Vehicles on the ACEEE (American Council for an Energy-Efficient Economy) list of low or no emission vehicles are eligible to park in any of the 58 LEFE spaces in the Gateway Garage. Patrons may also check vehicle eligibility by scanning the QR code with their smart phones on any of the LEFE signage in the Gateway Garage.

www.campuspartners.osu.edu/whats-new/latest-news/news-archive/l.e.f.e.-%28low-emission-fuel-efficient%29-parking-now-available-at-south-campus-gateway.html

Fuel-efficient & Low-emitting Vehicle Parking Program

University of Wyoming

The University of Wyoming is piloting a Fuel-efficient and Low-emitting Vehicle Parking Program to further the University's goals of responsible environmental stewardship and community development. The "LE" parking permit encourages the use of these automobiles through preferred parking in designated University lots. Current and future building projects on campus may consider pursuing the low-emitting and fuel-efficient vehicles parking LEED credit as well, creating additional "LE" permitted spaces.

Program Details and Qualifying Criteria:

- A free University of Wyoming "LE" permit must be obtained and displayed in order to park in "LE" spaces at the Visual Arts building.
- The "LE" permit must be displayed in conjunction with a valid permit for the area.
- To qualify for a free "LE" permit, a vehicle must be ranked by the American Council for an Energy-Efficient Economy (ACEEE) as having a score of 40 or greater.
- "LE" permits can only be displayed on qualifying vehicles, that is, permits cannot be switched between vehicles.
- www.uwyo.edu/tap/parking/leed.html

Preferential Parking

Duke Energy Center, Charlotte, NC

Located in the heart of Charlotte's central business district, Duke Energy Center is the headquarters for Duke Energy Corporation, and the home of several of Charlotte's most prestigious businesses. The Center offers Low-emitting and Fuel-efficient Vehicle Parking (LEFEV) for any vehicle that has either been classified as a Zero Emission Vehicle by the California Air Resources Board or has achieved a minimum green score of 40 on the American Council for an Energy-Efficient Economy (ACEEE) annual vehicle rating guide, upon registration with the parking office. Qualified LEFEV's are provided with a special sticker denoting the vehicle is authorized to park in the LEFEV Zone.

www.dukeenergycenter.info/parking-lefev.aspx

EPA SmartWay Elite

Bellevue College,² Clemson University (employee preferred parking)³ and Harvard University⁴ all use the EPA's SmartWay Elite rating program for low-emission and fuel-efficient vehicles.

Photographs of preferred parking locations for low-emitting/fuel-efficient vehicles and hybrids:



Photo courtesy of Naomi Weisz



"Hybrid parking only" (CC BY 2.0) by Dru Bloomfield - At Home in Scottsdale, www.flickr.com/photos/athomeinscottsdale/2736856744

Related Measures

- B.9 Alternative Fuel Vehicles
- B.10 Alternative Fuel Fleet
- B.13 Marketing/Educational Program
- C.5 EV Charging Stations

² www.bellevuecollege.edu/publicsafety/parking/lefe/

³ www.clemson.edu/campus-life/campus-services/parking/LEV.html

⁴ Harvard University Cambridge Campus Parking and Transportation Demand Management Plan, Annual Progress Report 2013, CommuterChoice and Harvard Planning and Project Management

MEASURE 9 Alternative Fuel Vehicles

POINT VALUE 3 – 6

Objective

Promote the use of alternative fuel vehicles.

Description

Alternative fuel vehicles (AFVs) typically produce fewer hydrocarbon emissions than traditional internal combustion engine (ICE) automobiles. Creating parking incentives for alternative fuel vehicles promotes the use of low-emission automobiles, thereby reducing fossil fuel consumption and air pollution.

To be considered an alternative, the vehicle must be powered by 1 or more of the following:

- Electricity
- Compressed natural gas (CNG)
- Liquefied natural gas (LNG)
- Propane (LPG)
- Hydrogen (H₂)
- Biodiesel
- Ethanol
- Compressed air

Options

The facility provides an AFV incentive program.

[3 Points] Reserve 2% of the parking spaces within the project boundary for AFVs (minimum of 2 spaces per structure). These spaces shall be clearly marked for AFV use. If a facility provides electric vehicle charging stations or other AFV fueling stations, these spaces may be included in AFV count (4% of total parking spaces reserved for "Clean Air Vehicles," as defined in the California Green Building Standards Code, satisfies the space requirement here, in addition to that for B8).

[3 Points] Provide a rate discount to all monthly and reservation AFV patrons of at least 20%.

Documentation Requirements

- Reserved Spaces
 - Narrative describing the AFV program, including:
 - How it is administered
 - Who is eligible
 - The procedures and penalties used to enforce the program
 - A table showing:
 - » Number of spaces reserved for use by AFV vehicles
 - » Total number of spaces within the project boundary
 - » Ratio of AFV spaces to total spaces
 - Images of a representative selection of AFV reserved spaces and signage.
 - Promotional materials about the program (e.g., flyers, contracts, printed brochures, website screen shots).
- Rate Discounts
 - Narrative describing the AFV program, including:
 - How it is administered
 - Who is eligible
 - The procedures and penalties used to enforce the program
 - A table showing:
 - » Regular rate structure
 - » Discounted rate structure
 - » Percentage of savings provided to program participants
 - Images of posted rate signs showing program discounts and/or offerings.
 - Promotional materials about the program (e.g., flyers, contracts, printed brochures, website screen shots).

Related Measures

- A.3 Transportation Management Association (TMA) / Organization (TMO) Affiliation
- B.13 Marketing/Educational Program
- C.5 EV Charging Stations
- C.16 Renewable Energy Generation

MEASURE 10 Alternative Fuel Fleet Vehicles

POINT VALUE 2 – 4

Objective

Encourage the use of shuttle, security and other fleet vehicles that use alternative fuels.

Description

Alternative fuel vehicles (AFVs) produce fewer carbon emissions than their traditional petroleum-powered counterparts. For example, natural gas vehicles typically emit 13% to 21% fewer greenhouse gas emissions than comparable gasoline and diesel vehicles on a well-to-wheels basis.¹

Although the initial cost of AFVs may be higher than petroleum-powered vehicles, a variety of factors, including fuel price, mileage ratings, maintenance costs, resale value, tax incentives, government grants and rebates can render the ownership cost over the life of the AFV vehicle equal to or lower than a traditional internal combustion engine (ICE) vehicle.

Shuttle, security patrol and other fleet vehicles are ideal applications for alternative fuels as they typically make short, scheduled (or predictable) trips and frequent returns to their operations base for refueling.

Options

Alternative fuel fleet vehicles shall be defined as carts, cars, vans, buses, or trucks that support parking facility operations, and are powered by 1 or more of the following:

- Electricity
- Hybrid-electric
- Compressed natural gas (CNG)
- Liquefied natural gas (LNG)
- Propane (LPG)
- Hydrogen (H₂)
- Biodiesel
- Ethanol
- Compressed air

¹ www.ngvamerica.org/natural-gas/environmental-benefits/

Points shall be allocated based on percentage of the overall fleet that uses alternative fuels:

[4 Points] At least 50% of the parking structure fleet vehicles are powered by alternative fuels.

[2 Points] At least 25% and less than 50% of the parking structure fleet vehicles are powered by alternative fuels.

Documentation Requirements

- Narrative describing the fleet vehicles, including:
 - Alternative fuels in use
 - Environmental benefits
- Summary table listing:
 - All vehicles in fleet by fuel source
 - Totals by fuel source and percentages of alternative fuel vehicles in fleet
- Invoices for purchases of AFVs or vehicle registrations.

Industry or Referenced Standards

- U.S. Department of Energy Alternative Fuels Data Center has a calculator which assesses the specific environmental savings by choosing an alternative fuel vehicle for a specific region,
www.afdc.energy.gov
- National Association for Natural Gas Vehicles
www.iangv.org
- Electric Power Research Institute
www.et.epri.com

Examples

The Parking Spot

The Parking Spot uses compressed natural gas (CNG) shuttle vehicles.



Photo courtesy of The Parking Spot, LLC.



Photo courtesy of The Parking Spot, LLC.

U.S. Department of Energy Alternative Fuels Data Center

www.afdc.energy.gov/case

Related Measures

- B.13 Marketing/Educational Program
- C.16 Renewable Energy Generation

MEASURE 11 **Bicycle Parking**

POINT VALUE 4 – 6

Objective

Encourage bicycle commuting as an alternative to the single occupant vehicle.

Description

Increasing the number of bicycling or pedestrian trips by 12% to 15% would save 3.8 billion gallons of fuel and reduce greenhouse gas emissions by 33 million tons per year. This is equivalent to replacing 19 million conventional cars with hybrid vehicles.¹ Additionally, increasing bicycle adoption creates environmental benefits beyond emission reductions, by reducing the resources required to build and maintain automobiles.

By providing bicycle accommodations, a parking structure can attract additional customers (e.g., those who bicycle to work), encourage bicycling as a form of transportation, and provide community health and environmental benefits.²

Options

There are 2 tiers of points that can be earned for supporting bicycle parking.

Tier 1 Criteria - parking structure must provide all of the following features:

- Provide 100 bicycle parking spaces or 1 bicycle parking space for every 20 vehicle parking spaces within the project boundary
- Sufficiently illuminated area
- Same grade as first floor of parking or accessible via ramp or elevator
- Safe bicycle path/access leading to bicycle parking
- Rack or other means for locking or securing bicycles
- At least 50% of all bicycle parking covered via permanent structure, such as roof overhang, awning, or bicycle locker
- Signage, both interior and exterior, directing people to the designated bicycle parking area

¹ Rails to Trails Conservancy, "Active Transportation for America," 2008.

² Anne Lusk and Jonathan Harris, "Pushing the Design Boundaries: Walk, Bicycle, In-line Skate and Jog" (Report for Walk Boston, Arlington Transportation Advisory Committee and Arlington Safe Routes to School, September 2013).

Tier 2 Criteria - parking structure must provide at least 3 of the following bicycle parking features:

- Bicycle parking is free of charge
- Restrooms and water fountain / access to drinking water
- Showers and/or private changing rooms
- Storage lockers for personal gear
- Additional protection from theft and vandalism through bicycle lockers or limited access rooms with CCTV security or staff attendant
- Mechanic station or work bench with tools to fix simple bicycle repairs, air pump, and proper lighting
- At least 2 spaces for cargo/family/oversize bicycles designated by a sign and requiring no lifting of bicycles
- Bicycle clinics held at least once a year

[6 Points] Parking structure meets both Tier 1 and Tier 2 criteria.

[4 Points] Parking structure meets Tier 1 criteria.

Documentation Requirements

- Narrative describing which bicycle parking criteria the project meets and how those criteria are met.
- Images of each installed feature and associated signage with captions explaining features documented.
- Site plan showing bicycle facilities relative to building entrances.
- Table showing:
 - o Total vehicle parking space count
 - o Total bicycle parking space count
 - o Percentage of bicycle parking compared to vehicle parking

Industry or Referenced Standards

- IGCC Public Version 2.0, November 2010
- LEED for Building Design and Construction rating system (LEED 2009)
www.usgbc.org/leed
- Association of Pedestrian and Bicycle Professionals bicycle Parking Guidelines, Second Edition (2010)

Examples

Several examples of bicycle storage systems, lockers, racks, and signage are shown.

Bicycle Locker Room and Showers



Photo courtesy of Voltaire Villaverde, ABM Parking Services



Photo courtesy of Voltaire Villaverde, ABM Parking Services

External Bicycle Parking Signage



Photo courtesy of Alta Planning + Design

Bicycle Lock Storage Fixture



Photo courtesy of Alta Planning + Design

Bicycle Storage Room



Photo courtesy of Alta Planning + Design



Photo courtesy of Alta Planning + Design

Bicycle Parking Wayfinding



Photo courtesy of MDistrict Park

Related Measures

- A.3 Transportation Management Association (TMA)/ Organization (TMO) Affiliation
- B.2 Access to Mass Transit
- B.12 Bicycle Sharing/Rental
- B.13 Marketing/Educational Program

MEASURE 12 **Bicycle Sharing/Rental**

POINT VALUE 4 – 6

Objective

Support bicycle sharing and encourages bicycle commuting.

Description

Bicycle sharing and rental programs enable the public to cycle on a temporary basis and encourage commuters to travel the “last mile” to their destinations via bicycle. They provide an alternative to motorized public transportation and can reduce greenhouse gas emissions, traffic congestion, and noise pollution, while improving public health through exercise.

Most bicycle sharing programs consist of multiple bicycle hubs (storage systems containing bicycles) strategically located in places where there is substantial foot traffic. The bicycle hubs are often automated kiosks that release a bicycle to a member of a bicycle sharing network or to an individual who pays for the bicycle at the time of use.

Options

There are 2 options for achieving points for bicycle sharing/rental. A parking structure can only apply for 1 option.

- Contain a bicycle sharing/rental hub within the garage meeting all criteria below:
 - o Hub with minimum of 5 bicycles
 - o Well-maintained by the parking operator or third party vendor
 - o The parking garage features signage/information indicating the presence of the bicycle sharing/rental hub

[6 Points] Parking facility contains, maintains and promotes a bicycle sharing or bicycle rental hub.

- Promote a bicycle sharing/rental hub(s) located within a one quarter mile walking radius of the garage, meeting the following criteria:
 - o The parking garage features signage/information promoting and encouraging the use of a nearby bicycle sharing/rental hub located within a one quarter mile walking radius of the garage.

[4 Points] Parking structure promotes or sponsors a bicycle sharing or bicycle rental hub located within a one quarter mile walking radius of the garage.

Documentation Requirements

- On-site Bicycle Sharing
 - Documentation describing:
 - Number of bicycles and kiosk(s)
 - Mapped location of kiosk(s)
 - Images showing bicycles and bicycle storage mechanism.
 - Images of program marketing materials, user agreements, and signage.
- Off-site Bicycle Sharing
 - Printed map showing:
 - Parking structure
 - Location of bicycle sharing kiosk(s)
 - Walking path and distance between the parking structure and bike sharing kiosk(s)
 - Images of program marketing promotions and signage located within the parking garage project boundary.

Industry or Referenced Standards

- Association of Pedestrian and Bicycle Professionals - Bicycle Sharing Programs - Webinar, 2011
- Minneapolis' Bicycle Sharing Program (www.niceridemn.org)

Examples

B-Cycle Bike-Sharing Program, Denver, CO

B-Cycle, a bicycle sharing program, was introduced for city employees of Denver in early 2009.



Nice Ride Bike Share, Minneapolis, MN

How it Works

Nice Ride is fast, easy, affordable and open to everyone. Simply take a bike when you need one, and return it to any station in the system when you arrive at your destination.

Get moving with Nice Ride bike share

Nice Ride has over 1700 bikes available 24/7 from 190 locations in Minneapolis and St. Paul. Get on a bike at any station and return it anywhere in the system. Take a spin around the lake, ride to work or across town. When you reach your destination just return your bike to the nearest station and check out another one for the return trip.

1 Year Membership
\$75
Sign up Today

Bike fitting:

Source: www.niceridemn.org/how_it_works/

Suggested Best Practices

- Additionally, successful bicycle sharing and rental programs typically offer the following:
 - Local maps with area attractions, recommended trails, bicycle lockup points, and other drop-off stations
 - Comprehensive website outlining rider responsibilities, maps, rules of the road, and safety tips

Related Measures

- A.3 Transportation Management Association (TMA)/Organization (TMO) Affiliation
- B.1 Placemaking
- B.2 Access to Mass Transit
- B.11 Bicycle Parking
- B.13 Marketing/Educational Program

MEASURE 13 Marketing/Educational Program

POINT VALUE 4

Objective

Parking structure incorporates a public, permanent educational program to demonstrate environmentally sustainable design and operations.

Description

Marketing to and educating the public about Parksmart certification will increase the public body of knowledge regarding sustainability in parking design and operations. These efforts will educate facility users and the public, furthering the understanding of environmental sustainability and its role in the parking profession.

Options

The program should include a targeted educational segment accessible to both patrons and the general public. Examples could include displays, visuals, or graphics inside the structure; multimedia or online services; and environmental sustainability tours or educational programs with schools and other organizations. A facility will be in compliance if all of the following criteria are achieved:

- Permanent educational display/program within the project boundary
- Accessible to patrons and the public
- Free of charge
- Addresses specific environmental sustainability aspects of the structure, programming and operations
- Program must be in place and available at the time of application submission

[4 Points] Parking structure successfully meets all criteria.

Documentation Requirements

- Narrative describing the marketing/educational program, including:
 - Overview of program, scope, and audience
 - Program objective
 - List of environmental benefits that are promoted to the public

- How the program is implemented
- Availability, location, frequency, and any other relevant information
- Photos or other files as appropriate to validate the claims in the narrative.

Suggested Best Practices

- Integrating environmental sustainability campaigns and educational materials with electric vehicle charging stations (EVSE) and alternative fuel vehicle programs is a useful method for promoting environmental sustainability to patrons and the public. For example, the facility may include signage and placards next to EVSE devices documenting the environmental benefits of electric vehicles and renewable energy sources.

Examples

The following examples demonstrate parking structure educational programs.

Monday Properties Marketing/Educational Program, Arlington, VA



*Photos courtesy of Rachel Yoka,
Timothy Haahs & Associates*



*Photos courtesy of Rachel Yoka,
Timothy Haahs & Associates*

Monday Properties clearly displays its environmental sustainability strategies and programs through the use of murals and brightly painted flooring. This installation emphasizes carshare, bicycle parking, parking for alternative, and fuel-efficient vehicles, electric car charging stations, and tire inflation stations. This vivid approach draws patrons' attention with a clean and bright interior aesthetic.

Canopy Airport Parking, Signage and Ticket Educational Program, Commerce City, CO

Canopy places environmental sustainability messages on all facility locator slips and signage, incorporating fun facts to educate guests on “green” technologies at the facility. Each guest receives a Canopy Locator Slip when they park Open Air, Self Park, or Covered Self Park. Each slip contains a “Did You Know” environmental sustainability fact, with the same “Did You Know” facts promoted throughout the facility.

SECTION B Programs

Sample facts include:

- Canopy's solar array generates 24,000 kilowatt hour/yr.
- Canopy's asphalt comes from recycled roof shingles.
- Canopy offers Free Juice Bar recharging for electric cars.
- Canopy wind turbines are virtually silent.
- Canopy's LED lights are 70% more efficient.
- Geothermal energy is used to heat and cool Canopy's buildings
- Juice Bar rechargers are 2 to 3 times faster than 120v.
- Covered parking reduces gasoline consumption – less AC.

“Why is Blue Green?” Signage, Garage at Post Office Square, Boston, MA

As part of integrated water management and green infrastructure project, reclaims groundwater that would be otherwise sent to the sewer. It conserves drinking water as well, using the reclaimed water, dyed blue, to flush its toilets. Garage at Post Office Square produced educational materials about this project.



Photo courtesy of the Garage at Post Office Square, Boston, MA

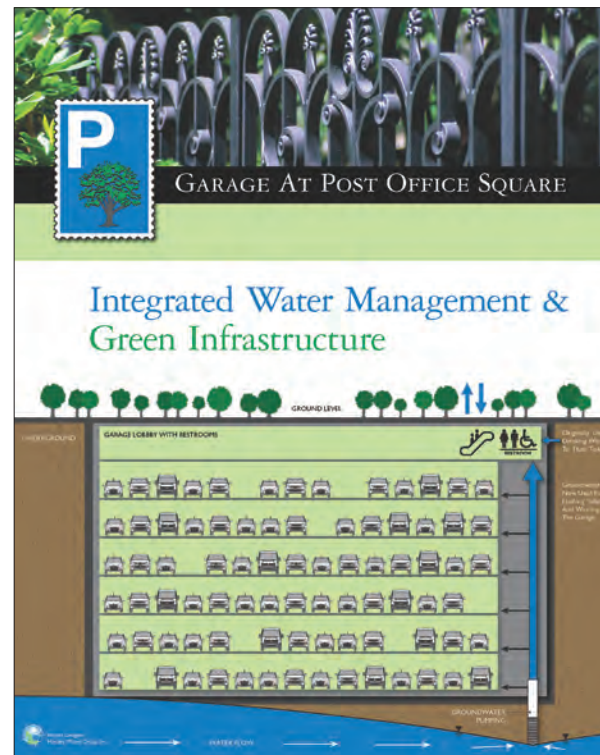


Photo courtesy of the Garage at Post Office Square, Boston, MA

Related Measures

- A.4 Recycling Program
- B.1 Placemaking
- B.6 Carshare Program
- B.7 Rideshare Program
- B.12 Bicycle Sharing
- C.4 Tire Inflation Stations
- C.7 EV Charging Stations

SECTION C

Technology & Structure Design

- MEASURE 1 **Idle Reduction Payment Systems**
- MEASURE 2 **Fire Suppression Systems**
- MEASURE 3 **No/Low-VOC Coatings, Paints and Sealants**
- MEASURE 4 **Tire Inflation Stations**
- MEASURE 5 **Electric Vehicle (EV) Charging Stations**
- MEASURE 6 **HVAC Systems – Occupied Spaces**
- MEASURE 7 **Ventilation Systems – Parking Decks**
- MEASURE 8 **Lighting Controls**
- MEASURE 9 **Energy-efficient Lighting System**
- MEASURE 10 **Stormwater Management**
- MEASURE 11 **Rainwater Harvesting**
- MEASURE 12 **Greywater Reuse**
- MEASURE 13 **Indoor Water-efficiency**
- MEASURE 14 **Water-efficient Landscaping**
- MEASURE 15 **Roofing Systems**
- MEASURE 16 **Renewable Energy Generation**
- MEASURE 17 **Design for Durability**
- MEASURE 18 **Energy Resiliency – Storage**

MEASURE 1 Idle Reduction Payment Systems

POINT VALUE 4

Objective

Implement a payment system that reduces idling upon exit.

Description

Properly configured payment systems allow vehicles to efficiently exit the garage. These systems can significantly reduce the amount of time vehicles wait in line to make payment. This reduced idling conserves energy, time and natural resources while limiting greenhouse gas emissions, improving air quality and increasing customer satisfaction.

Idle reduction payment systems include:

Pay-on-foot: Requires patrons to pay for their parking fee on foot before returning to their vehicles at automated kiosks or tellers near pedestrian doorways, concourses, elevators, and stairwells. After paying, patrons receive exit tickets used to activate the gate at the facility exit.

Pay-by-cell: Allows users to pay for parking using their mobile devices, eliminating the need for payment in the exit lane.

Automated Vehicle Identification (AVI): Typically, this technology is used in garages that accommodate monthly parkers. Monthly parkers prepay for parking and an AVI system allows them to access and exit the facility with little or no idling. Examples of AVI system technologies include:¹

- **Radio Frequency Identification (RFID):** An automatic identification method that relies on storing and remotely retrieving data using RFID transponders. RFID is used mainly in access and revenue control facilities and is another form of permit.
- **License Plate Recognition (LPR):** A vehicle identification technology that uses cameras to scan license plate numbers. LPR, sometimes called NPR (automatic number plate recognition) is common in access control, tolling, and stolen vehicle detection applications.
- **Toll Transponder Readers:** Government issued devices providing a highly efficient vehicle identification system that eliminate the need to produce the cost and waste of producing additional devices for patrons.

¹ www.parking.org/2016/01/03/recognizing-advances/

Options

Parking facility implements payment system to reduce or eliminate idling upon exit.

Idle reduction payment options include, but are not limited to:

- Pay-on-foot
- Pay-by-cell
- Automated Vehicle Identification

[4 Points] Parking structure has implemented a payment system that reduces or eliminates idling in the egress parking lanes.

Documentation Requirements

- Narrative of idle reduction system, including:
 - Payment system(s) in use
 - Description of how the payment system reduces idling time
- Images of entrance and exit lanes.
- Images of payment systems.

Examples

Pay on Foot (POF) system where patron makes payment before going back to vehicle.



Photo courtesy of Garage at Post Office Square, Boston, MA.

Suggested Best Practices

- It is common practice to place at least one payment system in an exit lane to allow patrons a final opportunity to pay before exiting the facility. By pairing at least one pay-in-lane station with a pay-on-foot system, the facility owner ensures a payment option for patrons who fail to pay before arriving in the exit lane. This prevents individuals who fail to utilize the pay-on-foot system from creating unnecessary exit lane traffic.

Related Measures

- B.5 Traffic Flow Plan

MEASURE 2 Fire Suppression Systems

POINT VALUE 2

Objective

Implement a halon-free, environmentally safe fire suppression system.

Description

Any fire suppression system that emits halon contains bromine, which depletes the ozone atmospheric layer.¹ Changes in the earth's atmosphere caused by halon can be harmful to humans and the environment.²

U.S. federal law ended the production of halon on December 31, 1993, but recycled halon is still available and used in building systems. Garages that have not been retrofitted or renovated may still use fire suppression systems containing halon.

Options

Parking structure implements a fire suppression system that does not use halon. There are 2 categories of fire suppression equipment, both of which need to be free of halon:

- Total flooding fire suppression system, defined by the U.S. Environmental Protection Agency (EPA) as an automatic system that discharges a specific concentration of extinguishing agent in an enclosed area by an automatic system.
- Streaming application fire suppression, defined by the EPA as portable fire extinguishers that emit an extinguishing agent directly on a fire.

[2 Points] All of the fire suppression equipment in the parking structure is documented to be free of halon.

Documentation Requirements

- For each type of fire suppression device include 1 of the following:
 - Image of fire extinguisher or suppression system label or inspection tag clearly demonstrating the extinguisher/suppression system does not contain halon
 - Technical specification sheet that lists the chemicals within the system

¹ "Ozone Layer Protection Glossary", Environmental Protection Agency, Retrieved May 10, 2014, www.epa.gov/ozone/defs.html#Halon

² "Health and Environmental Effects of Ozone Layer Depletion", Environmental Protection Agency, Retrieved May 10, 2014, www.epa.gov/ozone-layer-protection/health-and-environmental-effects-ozone-layer-depletion

MEASURE 3 No/Low-VOC Coatings, Paints and Sealants

POINT VALUE 2

Objective

Installation and application of only no- or low-volatile organic compound (VOC) coatings, paints and sealants to the parking structure.

Description

Volatile organic compounds (VOCs) are gases emitted from a variety of solids and liquids that may have short and long-term adverse human health effects. Examples of VOCs include paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions.¹

Using no- or low-VOC materials reduces the quantity of odorous air contaminants that are harmful to human health.

Options

The garage operator must implement appropriate policies and procedures to ensure all paints, coatings, and sealants applied to the parking structure are no- or low-VOC.

The 2009 LEED BD+C rating systems cite the following no- or low-VOC standards. Parking facilities must comply with these standards to receive credit for this measure.

- Architectural paints and coatings applied to walls and ceilings must not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
www.greenseal.org/Portals/0/Documents/Standards/GS-11/GS-11_Paints_and_Coatings_Standard.pdf
- Anti-corrosive and anti-rust paints applied to ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
www.greenseal.org/Portals/0/Documents/Standards/GS-11%20Sn%20Dev/anti-corrosivepaints.pdf

¹ An Introduction to Indoor Air Quality (IAQ), Retrieved May 2, 2014 from www.epa.gov/iaq/voc.html

- Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to facility elements must not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
www.usgbc.org/resources/south-coast-air-quality-management-district-scaqmd-rule-1113-architectural-coatings-rules-

[2 Points] Parking structure has procured and applied only no- or low-VOC materials, as defined above, over the last 2 years and intends to continue utilizing these materials in the future.

Documentation Requirements

- Table showing:
 - Manufacturer and product name of all coatings applied to parking deck surfaces, walls, and interior spaces within 2 years of the preliminary review submission
 - Areas where each coating has been applied and purpose of coating
 - Application dates
 - Relevant standard under which the no/low-VOC product is listed
- Specification sheets verifying each coating as no- or low-VOC.
- Policies and procedures regarding no- or low-VOC materials.

Industry or Referenced Standards

- U.S. Code of Federal Regulations 40 CFR 59.402 (VOC Content Limits)
- LEED for Building Design and Construction rating system (LEED 2009 and LEED v4)
www.usgbc.org/leed
- National Green Building Program
www.nahbgreen.org
- Ozone Transport Commission
www.otcair.org
- South Coast Air Quality Management District
www.aqmd.gov
- California EPA Air Resources Board
www.arb.ca.gov
- Paintinfo
www.paintinfo.com
- Ohio EPA
www.epa.state.oh.us

Examples

333 Longwood Ave, Brookline, MA

The parking structure located at 333 Longwood Ave in Brookline, MA, is located across the street from Boston Children's Hospital and Harvard Medical School. The facility owners have implemented a policy of using no-VOC paint for all facility maintenance projects. This includes traffic island and curb paints, stairwell railings and treads, and elevator lobby walls. In addition, the facility's traffic marking contractor is required to use low-VOC materials during annual garage deck maintenance.

Related Measures

- C.6 HVAC Systems – Occupied Spaces

MEASURE 4 Tire Inflation Stations

POINT VALUE 2

Objective

Deployment, promotion and management of strategically-placed tire inflation station(s) for the use of parking structure patrons at no charge.

Description

Properly inflated automobile tires maximize vehicles' fuel efficiency, and increase vehicle safety. The U.S. Environmental Protection Agency (EPA) estimates that fuel economy can be improved up to 3.3% by maintaining proper tire inflation.¹

Options

Parking structure must meet all of the following criteria:

- A permanently installed pedestal or wall-mounted electric tire inflation station
- Signage directing patrons to location of the tire inflation station
- Dedicated area or stall for safe operation of tire inflation station
- Tire inflation station is easily accessible by all patrons
- Use of the tire inflation station is free of charge

[2 Points] Parking structure has met all of the criteria outlined above for tire inflation stations.

Documentation Requirements

- Tire inflation device make and model.
- Image of the dedicated area where patrons can access the inflation station.
- Image showing proper signage and instructional information for patrons to operate equipment.

¹ www.drivegreen.com

Examples

Bank of America Plaza, Los Angeles, CA

The self service amenity bay at Bank of America Plaza includes a tire inflation station, car vacuum and windshield washer.



Suggested Best Practices

- Post signage within the facility educating patrons on the benefits of proper tire inflation.

Related Measures

- B.13 Marketing/Educational Program

MEASURE 5 **Electric Vehicle (EV) Charging Stations**POINT VALUE **1 – 6****Objective**

Parking facility is outfitted with electric vehicle supply equipment (EVSE), commonly referred to as EV charging stations.

Description

Plug-in electric vehicles (PEVs) utilize EV charging stations. According to Navigant Research, global electric vehicle sales are expected to exceed 6 million in 2024.¹ Widespread deployment of EVSE is critical to the growth of this more environmentally responsible form of transportation.

The various levels of EV charging available in North America provide operators with the opportunity to choose between charging speed and cost.

- **Level I** charging operates at 120 VAC (up to 15 A, 1.8 kW), plugs into a standard three-pronged power wall outlet, and supports the standard North American vehicle SAE J1772 connector.
- **Level II** charging operates at 208-240 VAC (up to 60 A, 14.4 kW) and supports the standard North American vehicle SAE J1772 connector.
- **DC Charging** operates at high voltage DC (typically 20KW or higher) and is often referred to as “fast charging”. There are multiple competing standards for the plug type and operators should support either multiple plug types or determine the best plug type for their anticipated clientele.

Charge time varies by vehicle, battery size and amount of discharge in the battery.

Options

Facility must meet all of the following criteria for a maximum of 6 points:

- Clear signage promoting EVSE
- Operational plan for handling charging turnover
- Reserved parking spaces next to charger for exclusive use by EVs
- Policy to enforce access rules for EV spaces

¹ *Electric Vehicle Market Forecasts*, retrieved July 21, 2016, www.navigantresearch.com/research/electric-vehicle-market-forecasts

DC Fast Charging

[5 Points] 2 or more DC fast charging ports are installed.

[4 Points] 1 DC fast charger installed.

Level II Charging

[5 Points] 2 or more AC Level II EV charging ports, equaling at least 1% of total available parking spaces.

[4 Points] 2 or more AC Level II EV charging ports, equaling at least 0.5% and not more than 1% of total available parking spaces.

[2 Points] At least 1 AC Level II EV charger equaling less than 0.5% of the total available parking spaces.

Level I Charging

[1 Point] Level I equipped reserved parking spaces equaling at least 0.5% of total available parking.

Cost to Access

[1 Point] No additional payment is required for drivers to charge their vehicles.

Documentation Requirements

- List of EV charging stations in operation in the parking facility, including:
 - Equipment make and model
 - Charging level
 - Quantity of stations
 - Quantity of charge points (some devices provide more than 1 charge point)
- Images of installed device(s) with accompanying signage.
- Narrative describing usage, including:
 - Access policies
 - Pricing plan and system to enforce access rules
- If applicable, documentation that charging is available at no additional cost.

Suggested Best Practices

- Integrate EV charging stations with on-site renewable energy generation (e.g., wind turbine or solar carports) or with renewable energy purchase programs, to enable the automobile to be charged with clean energy.

Examples



Photo courtesy of Garage Juice Bar, LLC



Photo courtesy of Control Module, Industries

Brookfield Properties has installed several EVSE charging devices for use by its patrons at Bank of America Plaza in Los Angeles, CA.



Photo courtesy of ABM Parking Services

Related Measures

- B.9 Alternative Fuel Vehicles
- B.13 Marketing/Educational Program
- C.16 Renewable Energy Generation

MEASURE 6 HVAC Systems – Occupied Spaces

POINT VALUE 1 – 6

Objective

Incorporate energy-efficient, environmentally favorable Heating Ventilation and Air Conditioning (HVAC) systems and controls for all occupied spaces.¹

Description

The occupied space in a building is defined by the U.S. Department of Energy as the space within a building or structure that is normally occupied by people, and that may be conditioned (heated, cooled and/or ventilated).² This includes but is not limited to office, retail, residential, and other auxiliary occupied spaces on-site and/or contiguous to a parking garage.

While mechanical systems for occupied spaces in parking structures are generally small in comparison to the size of the structure, any operating efficiency improvement and energy consumption reduction will lessen the environmental impact. High-efficiency HVAC systems reduce levels of greenhouse gases, providing further benefits and improving health and safety of the space.

There are a variety of HVAC technologies available that reduce energy consumption, minimize environmental impact and/or improve air quality.

- Energy-efficient Mechanical Systems
- HVAC Control Systems
- Environmentally Responsible Coolants

Energy-efficient Mechanical Systems

According to the U.S. Environmental Protection Agency (EPA), replacing components of a less efficient HVAC system typically cuts energy costs by about 20%.³ In addition, many emerging climate control technologies are more efficient than conventional technologies. Parksmart recognizes the following established system types. All devices and components installed to improve the HVAC system must be ENERGY STAR rated, when available.

- **Geothermal Heat Pumps (GHPs)** are among the most efficient and comfortable heating and cooling technologies available. These systems use the earth's consistent temperature to provide heat sinks for heating and cooling. With additional equipment, this system can also be used to heat water. Geothermal heat pumps are 25% to 50% more efficient than Air-Source Heat Pumps.⁴

¹ The air quality and ventilation systems for the parking decks are assessed separately in measure C7 "Ventilation Systems – Parking Decks"

² www1.eere.energy.gov/tribalenergy/guide/glossary.html (April 19, 2014)

³ www.epa.gov/greenhomes/ReduceEnergy.htm (April 19, 2014)

⁴ www.energy.gov/sites/prod/files/guide_to_geothermal_heat_pumps.pdf (April 19, 2014)

- **Air-Source Heat Pumps (ASHP)** are efficient heating and cooling devices that work best in moderate temperate climates. These systems use refrigeration compressor principles to move heated air into a space in the winter and out of a space in the summer. Although not as efficient as GHP, these systems are up to 45% more efficient than standard electric air conditioners and up to 70% more efficient than fuel-burning heating systems.⁵
- **Variable Frequency Drives (VFD)** modulate electricity supplied to blower motors and circulating fans, slowing down or speeding up the motors based on the demand required. Circulating motors rarely need to run at full capacity in order to move sufficient air through the space. Allowing motors to run at lower speeds, when possible, consumes less energy than consistently running motors at full speed.
- **Variable Refrigerant Flow (VRF)** is an HVAC technology that can provide efficient heating and cooling simultaneously in small zones close to one another by connecting multiple indoor evaporators to a single condensing unit. This technology is particularly applicable to occupied spaces with multiple zones requiring varying needs of temperature control.
- **Energy Recovery Systems** include heat recovery ventilators (HRV) and energy recovery (or enthalpy recovery) ventilators (ERV). Both types include a heat exchanger, 1 or more fans to push air through the machine, and some controls. With an energy recovery ventilator, the heat exchanger transfers a certain amount of water vapor along with heat energy; a heat recovery ventilator only transfers heat.

HVAC Control Systems

The following control systems can be installed to run the HVAC system only at the operating levels needed to adequately heat, cool or ventilate the occupied space. This reduces or eliminates periods of unnecessary and wasteful system operation, limiting mechanical wear and energy consumption.

- **Air Quality Monitoring Devices** ensure that the air in parking structures do not contain higher than usual levels of pollutants because of continuous exposure to automobile exhaust. Therefore, the air in the occupied spaces should be monitored and pollutants extracted to safe levels in order to maintain a healthy environment for all persons occupying these spaces.

Carbon monoxide (CO), a byproduct of automobile exhaust, is considered an indoor air contaminant. Additional likely pathogens in car exhaust include nitrogen dioxide (NO₂), sulfur dioxide (SO₂), suspended particles, benzene, formaldehyde, and some types of hydrocarbons. All of these can negatively affect human health.

- **Programmable Thermostats** with set-back controls are used to control room temperatures based on time of day and sometimes by day of week, so that systems can be operated less frequently, at a lower level, or turned off completely, when the space is unoccupied. To meet the requirements for this measure, a facility must demonstrate that the programming sequences in each thermostat are set up to reduce the heating/cooling operations when the spaces are not likely to be occupied.

⁵ www.energysaversair.com/which-is-best-for-you-high-efficiency-vs.-geothermal-heat-pumps.html (April 19, 2014)

Environmentally Safer Coolants

HVAC systems that use chlorofluorocarbons (CFCs), or to a lesser extent hydrochlorofluorocarbons (HCFCs), as a refrigerant are environmentally damaging and contribute to the depletion of the stratospheric ozone layer.

Alternative coolants are available that are less damaging to the environment and do not compromise efficiency.

To receive credit for using environmentally favorable refrigerants, the parking facility must demonstrate that no CFCs or HCFCs are present. The following Environmental Protection Agency (EPA) Database lists acceptable substitutes for both CFCs and HCFCs: www.epa.gov/snap/acceptable-substitutes-residential-and-light-commercial-air-conditioning-and-heat-pumps

Options

Points will be awarded as follows.

Energy-efficient Systems

- [2 Points] One or more of the energy-efficient mechanical systems listed above has been installed in equipment serving the occupied spaces.

HVAC Control Systems

- [1 Point] Sensors capable of detecting unsafe levels of CO are installed and engage the ventilation system at appropriate power levels to maintain safe air quality at all occupied times.
- [2 Points] Programmable thermostats have been installed and programmed with temperature setbacks to reduce the system demand when the occupied spaces are vacated.

Environmentally Safer Coolants

- [1 Point] Parking structure does not use any CFCs or HCFCs as HVAC coolants.

Documentation Requirements

- Energy-efficient HVAC systems
 - Narrative describing energy-efficient systems, including:
 - Type of system
 - Conditioned zones
 - Energy-efficient properties
 - Specification data sheet for each HVAC system.
 - Images of rating plates, model number, and ENERGY STAR certification.
- CO Sensors
 - Narrative describing air quality sensor system, including:
 - Make and model of components
 - Locations of sensors
 - Types of contaminants being monitored
 - Specification sheets for air quality sensors and control systems.
- Programmable Thermostat
 - Narrative describing thermostat controls, including:
 - Make, model, and quantity of each thermostat unit in use
 - Heating/cooling zones
 - Locations of thermostats
 - Description of Building Management System (BMS), if in use.
 - Documented operational plan detailing the time and temperature settings and setbacks, including:
 - Procedures for altering the plan to accommodate changes of season, daylight savings time shifts, holidays, and any other applicable scheduling changes
 - Images of thermostat devices, showing units are not obstructed.
- Environmentally Safer Coolants
 - One of the following:
 - Model, make, and specification data sheet for each system that utilizes coolant, with the coolant type clearly identified
 - Images of equipment label showing the coolant type used for each HVAC system in use

Suggested Best Practices

- Commission HVAC systems after installation and periodically re-commission these systems to ensure they are operating according to design.

Recommendations from the U.S. EPA⁶

- Set back the thermostat in the evenings and other times when the space isn't occupied. Adjust thermostats for seasonal changes.
- Regularly change or clean HVAC filters every month during peak cooling or heating season. Dirty filters cost more to use, overwork the equipment, and result in lower indoor air quality.
- Use shades and blinds to control direct sun through windows in both summer and winter to prevent or encourage heat gain.
- Control direct sun through windows depending on the season and local climate. During cooling season, block direct heat gain from the sun shining through glass on the east and especially west sides of the facility. Depending on the facility, options such as "solar screens," "solar films," awnings and shading vegetation such as trees are beneficial. Interior curtains or drapes are beneficial. During heating season, with the sun low in the south, unobstructed southern windows can enable solar heat gain.
- Calibrate thermostats to ensure that their ambient temperature readings are correct.
- Make sure that areas in front of vents are clear of furniture and paper. As much as 25% more energy is required to distribute air if vents are blocked.
- Shorten the intervals for replacing air handler filters. New filters keep air clean and prevent equipment from working harder to force air through dirty filters.
- Clean the evaporator and condenser coils on heat pumps, air-conditioners, or chillers. Dirty coils inhibit heat transfer; keeping coils clean saves energy.
- Repair leaks and adjust pressure in compressed air systems.
- Repair steam trap leaks; replace malfunctioning steam traps.
- Repair missing insulation in high pressure steam distribution systems.
- Keep exterior doors and windows fully closed while running your HVAC.

⁶ www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/stamp-out-energy-waste#Heating-cooling (April 19, 2014)

Industry or Referenced Standards

- ENERGY STAR
www.energystar.gov
- EPA Significant New Alternatives Policy (SNAP) Program list is used to validate which chemicals are acceptable refrigerants
www.epa.gov/ozone/snap
- LEED for Building Design and Construction rating system (LEED 2009 and LEED v4)
www.usgbc.org/leed
- The United States Department of Labor, Occupational Safety & Health Administration (OSHA) Guidelines
- The United States Environmental Protection Agency National Ambient Air Quality Standards (NAAQS)
www.epa.gov/criteria-air-pollutants/naaqs-table

Resources

- U.S. Environmental Protection Agency info on Indoor Air Quality (IAQ)
www.epa.gov/iaq
- American Chemistry Council on IAQ
- U.S. Department of Labor OSHA Technical Manual, Section III: Chapter 2 – Indoor Air Quality Investigation
- American Society for Heating, Refrigerating and Air-conditioning Engineers (ASHRAE). 1981 Thermal Environmental Conditions for Human Occupancy. ASHREA Standard 55- 1981.

Examples

Energy-efficient Systems

This is an example of the outside unit for a heat pump. Heat pumps are an extremely efficient heating and cooling system for moderate climates. In more extreme climates, geothermal heat pumps are more efficient because they utilize the stored energy in the earth and subterranean water sources to provide heating and cooling. Geothermal systems are more complex, however, since they require drilling to install water wells.



Source: Wikimedia Commons
www.commonswiki.org/wiki/File:Outunit_of_heat_pump.jpg

HVAC Control Systems

Programmable Thermostat



Source courtesy of GBCI

Related Measures

- A.9 Building Systems Commissioning
- C.7 Ventilation Systems – Parking Decks

MEASURE 7 Ventilation Systems – Parking Decks

POINT VALUE 1 – 6

Objective

Utilize energy-efficient ventilation systems to reduce energy consumption in enclosed parking structures while maintaining or exceeding existing garage air quality standards.

Description

Vehicles with internal combustion engines (ICE) produce emissions that are harmful to human health and must be mitigated with either natural or mechanical ventilation.

Ventilation systems use a significant amount of energy to operate large fans that provide a fresh air supply to the garage. Many older facilities or structures with traditional ventilation systems run ventilation fans at full power for 24 hours per day. This is highly inefficient as the fan motors are often operating when there is no need for ventilation or when the ventilation is not needed at full capacity.

Parking structures can improve air quality, increase health and safety,¹ reduce greenhouse gas emissions and reduce operating expenses by upgrading ventilation systems to energy-efficient, controlled technology. Several technologies can optimize ventilation efficiency and may be implemented independently or in combination for a more robust system.

- Variable Air Flow Systems
- Demand Controlled Ventilation (DCV)
- Schedule and Occupancy Controls

Variable air flow systems provide a higher level of efficiency because they can adjust the air flow and by extension, the amount of energy consumed. Schemes for varying the flow rate include:

- **Variable Frequency Drives (VFD)** consist of motors that can operate at various voltage levels to produce a range of fan frequencies. This enables the ventilation system to operate at an optimal air flow rate and ensure safe air quality without wasting energy.
- **Fan walls** also provide a facility with a variable rate of air flow in order to maintain air quality at an optimal energy rate. A fan wall consists of several fans residing together, with each fan individually controlled. When the flow rate needs to be adjusted, individual fans can be turned on or off as needed.

¹ Spengler, J.D. and Chen, Q. 2000. "Indoor air quality factors in designing a healthy building," *Annual Review of Energy and the Environment*, 25, 567-600.

An additional benefit of these variable system designs is the soft start capability that keeps energy demand charges low and reduces the energy needed to maintain air quality.

Efficient ventilation systems require controls to activate (or increase) and deactivate (or decrease) the fan motors. Multiple technologies for controlling these motors include:

- **Demand Controlled Ventilation (DCV):** The most reliable and efficient control system is managed by a series of air quality sensors in the facility. These sensors typically detect the presence of high levels of carbon monoxide (CO), nitrogen dioxide (NO₂) and sometimes other gases such as Volatile Organic Compounds (VOCs). The ventilation system is only activated when high levels of these gases are detected. Local building, mechanical and/or fire codes dictate, which gases must be monitored and controlled (carbon monoxide, nitrogen dioxide, and/or hydrogen) as well as the gas concentration levels which trigger increased ventilation or audible/visual annunciation. The garage operator is responsible for complying with all applicable codes. DCV systems reduce energy use by up to 90% compared to a baseline system that runs the ventilation systems constantly.² As with any type of sensor based system, DCV systems utilize either “on/off” motors, where motors are always fully on or fully off, or “VFD” motors, where the fan motors can run over a wide range of frequencies.
- **Scheduling and occupancy controls:** Some control systems can activate/deactivate the ventilation systems based on detected or predictable human or environmental behavior. These systems are less effective than DCV air quality control because they do not measure the actual air quality and therefore may operate the fan motors more often or less often than necessary. Systems include:
 - o Scheduling uses mechanical timers to activate the motors during operating hours and deactivate them during closed hours. Disabling ventilation in the non- operating hours can save a substantial amount of energy, but still keeps the system running at full speed during the garage operating hours, which may include significant periods of time when it is not needed.
 - o Motion detectors and occupancy sensors can be utilized to turn ventilation on when an occupant is detected in the space, saving significant energy over scheduling by turning off ventilation during periods of garage inactivity. However, the correlation between occupancy and emissions isn’t always consistent, since an electric vehicle or pedestrian would activate the ventilation without any emissions.

The best strategy for maximizing energy efficiency and air quality is to implement demand controlled ventilation (DCV) in conjunction with Variable Frequency Drive (VFD) driven fans.

² “Codes and Standards Enhancement Initiative (case), Garage Exhaust”, 2013 California Building Energy Efficiency Standards, California Utilities Statewide Codes and Standards Team, September 2011, pages 6-15.

Options

The following options are available, with a maximum of 6 points.

- [3 Points] Demand Controlled Ventilation (DCV):** Facility uses air quality sensors mounted throughout the garage to detect undesirable levels of carbon monoxide (CO). Sensors must be configured to (1) directly control fan operation, or (2) be continuously connected to a dedicated monitoring and control instrument which controls the fans, or (3) be continuously connected to a building automation system that controls the fans.
- [2 Points] Variable Air Flow System:** Fans are configured to provide proportional ventilation (e.g., equipped with VFD or multi-fan arrays in all zones with individual fan controls).
- [1 Point] Schedule or occupancy controls:** Fan motors are directly controlled by scheduled timers, occupancy sensors or other systems that are programmed or detect human or environmental behavior in order to predict the gas levels inside of the structure, as opposed to measuring the air quality levels in real time.
- [1 Point] Calibration and Maintenance:** Ventilation system, including all sensors and motors, are inspected and calibrated at least once every 2 years.
- [6 Points] Architecture design for natural ventilation:** Facility has been designed with natural ventilation chimneys or is open air and does not have any ventilation systems installed in any of the parking decks.

Documentation Requirements

- Narrative describing the ventilation system components and operation.
- Demand Controlled Ventilation
 - Manufacturer's specifications for air quality sensors.
- Variable Air Flow Systems
 - Inventory of the variable air flow system, including model numbers, age, specifications, and average run time of all system components.
- Schedule (Timer) Controls
 - Manufacturer's specifications of timer control system components.
 - Programmed timer schedules.
 - Facility operating hours.
 - Manager's procedure for updating schedule when changes are needed (e.g., changes in operating hours, seasonal changes, daylight savings time).

- Occupancy Controls
 - Manufacturer's specifications for occupancy control system components.
- Maintenance and Calibration
 - Invoices for maintenance, inspection, and calibration services performed within 24 months of the preliminary review submission.
 - Maintenance policies/procedures describing the inspection and calibration procedures or written statement committing to inspection and calibration services at least once every 2 years.
- Designed for Natural Ventilation
 - Architectural drawings/images demonstrating natural ventilation design.
 - Written statement declaring the facility does not have any mechanical ventilation systems serving any of the parking decks.

Industry or Referenced Standards

- International Mechanical Code of IMC 2012; 404.1 and 404.2 defines acceptable CO and NO₂ levels for enclosed parking garages. Mechanical ventilation systems air change rate for enclosed parking garages may be reduced with the installation of CO detectors applied in conjunction with NO₂ detectors. The permitted range of automatic fan operation is a minimum of 0.15 CFM per square foot (0.000024 m³/s x m²) of the floor area and the system being capable of producing a ventilation rate of 0.75 CFM per square foot (0.0076 m³/s x m²) of floor area commonly regarded as 4 to 6 per hour. The lower safety limits are 25 parts per million of CO and 3 parts per million of NO₂.
- California Title 24: 2013 Building Energy Efficiency Standards

Suggested Best Practices

- Commissioning, re-commissioning or, continuous commissioning activities should be performed every 12 months. Sensors have a limited operating lifetime and this process will verify that all sensors are operational and invoking the ventilation system only when it is needed. This will also ensure that all ventilation systems, including fans and filters, are cleaned, calibrated and operating as designed.
- Any new design or retrofit to an existing garage ventilation system must be based on the codes and standards of the appropriate local jurisdiction. For example, in California Title 24-2013 Sec. 120.6(c), the regulations require a minimum ventilation rate of 0.15 CFM/ sq-ft (cubic feet per minute per square foot of surface area in the garage) in enclosed parking garages where the total design exhaust rate is greater than or equal to 10,000 CFM and no more than 20% of the vehicles expected to be stored have non-gasoline combustion engines. Note that a code requirement of constant ventilation flow rates cannot be achievable with on-and-off control unless there are multiple independently controlled fans in a zone. California regulations of this type are often adopted nationally.

- For best performance and reliability, sensors should be rated with at least +/- 5% accuracy, drift not to exceed 5% per year, and calibration to be required no more than once per year.
- Electrochemical and infrared are far superior gas sensing technologies than solid state sensors. These sensor types provide a highly effective combination of measurement accuracy, length of operating life and minimum energy consumption.³
- The rate at which these sensors age is highly dependent on the amount of CO gas exposure. To keep the demand controlled ventilation system operating efficiently, follow the sensor manufacturer's recommended maintenance schedule.
- Temperature sensors should be incorporated to adjust the ventilation level and maintain a comfortable and safe level for occupants. This is particularly important in facilities in warm climates.
- Permanent electrical metering and monitoring systems should be incorporated to provide trending gas sensor information. This will aid in the garage's ongoing use and occupancy pattern analysis and can be used to optimize control strategies while providing timely notification of sensor and motor failures.
- The quantity of sensors required depends on the type of sensors selected, spacing required between sensors, number of zones, structure layout and requirements of local building codes. Qualified ventilation engineers can determine the optimum system configuration and ensure the system is installed to meet building codes and manufacturer's specifications.
- Since the detection of CO gas has a life safety aspect, it is important to select sensors that are robust and highly reliable. UL 2075 defines the minimum requirements for quality, reliability, and accuracy of gas and vapor detectors over a wide range of environmental conditions. Sensors that have been certified to the UL2075 (commercial grade) performance standard for gas and vapor detectors, or those that meet similarly stringent requirements are recommended.

Examples

Cathedral of Christ the Light, Oakland, CA

Cathedral of Christ the Light, Oakland, CA has an enclosed parking garage that consists of two levels totaling 83,000 square feet. The garage installed DCV driven off of CO sensors. Two separate studies were performed on this system which validated a savings of 85% to 90% with the DCV system. The studies demonstrated that for the vast majority of the time, the fans were in the minimum required state and only occasionally ramped up to a high speed to extract CO from the facility. These savings were typical and demonstrated in nine other sites with consistent savings of around 85% within the same report.⁴

³ "Codes and Standards Enhancement Initiative (case), Garage Exhaust", 2013 California Building Energy Efficiency Standards, California Utilities Statewide Codes and Standards Team, September 2011, page 19.

⁴ "Codes and Standards Enhancement Initiative (case), Garage Exhaust", 2013 California Building Energy Efficiency Standards, California Utilities Statewide Codes and Standards Team, September 2011, pages 6-15.

MEASURE 8 Lighting Controls

POINT VALUE 2 – 8

Objective

Control lighting fixtures using preset programs and/or monitoring sensors to reduce the facility's energy consumption.

Description

It is most efficient and cost effective to produce light when and where it is needed. Reducing the time or intensity of parking facility illumination, or the number of fixtures illuminated, reduces the facility's energy consumption and lowers its environmental impact. A facility can incorporate sensor-based and/or programmable systems to dim lighting fixtures as desired and thus lower energy consumption.

Sensor-Based Systems

Systems designed with sensors to detect changes in the facility and respond by dynamically controlling the fixtures can greatly reduce the facility's production of unneeded light. Sensors may be hard-wired to control different circuits within the parking structure, or wireless devices may be used with addressable control modules that enable fixtures to be programmed into groups for sensing activity and/or daylight. Sensor-based systems can be used in conjunction with programmable systems to increase overall lighting efficiency.

Two types of sensor systems typically employed in parking facilities are those that detect motion (occupancy sensors), and those that detect ambient light levels (daylight sensors)

Occupancy sensors incorporate devices near lighting fixtures that can detect activity in the area, such as the presence of individuals or vehicles, and turn on a light fixture. After a preset period of time without activity (typically a few minutes) the light fixture automatically shuts off (or dims). Individuals and vehicles can be detected through a variety of means, such as incorporating sensors that detect motion or audible sounds.

Daylight sensors are photosensitive devices that detect the amount of daylight entering the interior of a parking structure through perimeter walls, window openings, or skylights. These systems may also be incorporated on the facility exterior, such as on an open rooftop deck, at the entry driveway, or around the perimeter space. As the amount of daylight within a space changes, the light levels of the luminaires adjust up or down to compensate.

Programmable Systems

Programmable systems execute a sequence of predefined actions to independently turn on, turn off, or dim individual lighting fixtures or groups (zones) of lighting fixtures. This includes lighting timers, addressable lighting controls, building management systems, and other intelligent systems that turn lights on and off (or dim) to achieve energy savings. These systems are used to reduce lighting during periods where the entire facility or sections of the facility are closed.

- Simple timers are programmable devices that provide lighting control based on the time of day.
- Advanced programmable systems are more sophisticated control systems that improve energy efficiency by setting different schedules for each day of the week. These systems may adjust for seasonal requirements or special events and include:
 - Timers that support individual schedules for each day of the week.
 - Integrated building management systems (IBMS) which provide a high degree of control and flexibility. These systems allow an operator to alter the lighting schedule from a central or remote location and accommodate changes for different days, seasons, or special events.
 - Addressable fixtures are controllers that allow lighting fixtures to be individually controlled and dimmed from anywhere there is network access.

Options

Interior Lighting – Facilities meeting a requirement(s) for interior lighting controls outlined below may claim the highest of the following point levels:

[6 Points] At least 75% of the lighting fixtures are controlled by occupancy sensors.

[4 Points] At least 50% of the lighting fixtures are controlled by occupancy sensors.

[3 Points] At least 50% of the lighting fixtures are controlled by an advanced programmable system or any other system that allows the operator to vary the schedule daily, weekly or monthly according to predictable lighting demands.

[2 Points] At least 50% of the lighting fixtures are controlled by a simple timer.

[1 Point] At least 25% of the lighting fixtures are on any kind of lighting control.

Exterior Lighting – Facilities meeting a requirement(s) for exterior lighting controls outlined below may claim the highest of the following point levels:

[2 Points] At least 60% of the lighting fixtures are controlled by photocells or occupancy sensors.

[1 Point] At least 60% of the lighting fixtures are controlled by programmable timer or schedule based systems.

Documentation Requirements

- Narrative describing the lighting control scheme and components and operational plan:
 - For timer controls, provide schedules of timer control sequences and policies for updating the timer programs when changes are needed
- Table, organized by fixture location (e.g., interior or exterior), that includes the following:
 - List of the lighting control equipment (make/model)
 - List of lighting fixtures and the associated control types
 - Total quantities of each type of controlled fixture and non-controlled fixture
 - Totals of each control type, total lighting fixtures, and percentage breakdowns
- Images of each type of lighting control device.

Industry or Referenced Standards

- TM-23-11_Lighting Controls Protocol, Illuminating Engineering Society of North America, NY, NY 2011
- Occupancy Motion Sensors, Guide Publication WD 7-2000, National Electrical Manufacturers Association
- The National Electrical Code (NEC) is the relevant code pertaining to wiring and proper energy load planning.
- Illuminating Engineering Society (IES) of North America sets guidelines and recommendations for proper lighting strategy.¹
- ASHRAE Standard 90.1:2010 describes the recommended control requirements for parking facilities, specifying the standards for Daylight Transition Zones (entrances), Daylight Zones, Automatic Lighting Shutoff and Occupancy Sensors.
- Lighting Energy Efficiency in Parking Campaign
www.leepcampaign.org

Suggested Best Practices

- When dimming, reduce the power consumed by lowering the fixtures to the lowest level of illuminance needed.
- All devices should be UL/ETL (USA), CUL (Canada) or CSA (Global) listed
- International Energy Conservation Code (IECC) has established recommendations for parking structure energy consumption and illumination controls. Any energy reduction measure that is implemented should strive to improve upon the IECC recommendations by at least 40%.²

Related Measures

- A.9 Building Systems Commissioning
- C.9 Energy-efficient Lighting System

¹ www.ies.org

² Donald R. Monahan, "Lower Your Lighting Costs - Save the Planet," *Parking Today*, November 2006

MEASURE 9 Energy-efficient Lighting System

POINT VALUE 1 – 8

Objective

Utilize energy-efficient lighting technology and design to reduce energy consumption in parking garages, while ensuring patron and staff safety.

Description

Lighting is an extremely energy intensive system within a parking facility. By upgrading lighting systems to energy-efficient technologies, facilities can reduce their energy consumption and operating expenses by as much as 70% and extend lamp life by as much as 5 times when compared to traditional lighting technology.¹ Employing the most advanced technologies and operational practices can reduce the environmental impact of lighting by lowering energy consumption and the amount of raw materials used to manufacture lighting equipment.

Options

Parking facilities can earn points for both lighting efficiency (as measured by Lighting Power Density) and life-cycle impact (as measured by Average Rated Lamp Life.)

Lighting Power Density (LPD)

Lighting technology efficiency has improved considerably since the advent of incandescent lighting giving garage owners and operators a diverse array of options for illuminating their facilities. Parksmart awards points based on the amount of energy used to light a facility, without sacrificing the commonly accepted industry illumination minimums (see Industry and Referenced Standards).

Lighting Power Density (LPD) is the ratio of wattage (W) of the installed luminaires compared to the floor area (square footage) of the illuminated space. The calculation is performed with lighting at peak output and includes all components (ballast/driver/generator, lamp, fixture) of the lighting system.

¹ "What is LEEP?", retrieved May 10, 2014 from www.leepcampaign.org/

Points are allocated according to the Lighting Power Density (LPD) of the facility:

Points Awarded	LPD (W/sq. ft.)
7	< 0.04
6	0.04 to < 0.06
5	0.06 to < 0.08
4	0.08 to < 0.10
3	0.10 to < 0.12
2	0.12 to < 0.14 ²

Minimum illumination levels must be met and maintained in accordance with the standards of the Illumination Society of North America (IES) in order to qualify.

Non-operational Considerations

The lighting system's operational, or 'use phase,' is the most energy intensive phase of the system's lifecycle, accounting for approximately 90% of the system's LCA.³ However, another aspect influencing the environmental impact is the average device (e.g., lamp or LED) lifetime. Replacing a lighting device requires energy to manufacture, ship and install the new device, and the resources to transport and recycle the old device. Therefore a light source with higher Average Rated Lamp Life has a reduced environmental impact.^{4, 5}

- All lamps can be recycled by certified lighting recyclers. Facilities must ensure that proper recycling of all lighting systems has taken place in order to achieve this option.

Points Awarded	Average Rated Lamp Life ⁶
1	Equal to or greater than 65,000 hours

Documentation Requirements

- Lighting Power Density
 - o Calculations of Lighting Power Density (LPD) supported by the following data:
 - Fixture count
 - Specifications of each lighting type showing total peak power consumed
 - Illuminated square footage

² CA Title 24 – (proposed 2013) requires facilities to consume no greater than 0.14 w/sq-ft for new construction or major renovations, Energy Policy Act (EPACT) of 2005 provides tiered federal incentives which phase in for installations with LPD exceeding the ASHRAE 90.1 2001 standard by 25% or more.

³ www.apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2012_LED_Lifecycle_Report.pdf (pg 3)

⁴ www.ascelibrary.org/doi/abs/10.1061/%28ASCE%29IS.1943-555X.0000064

⁵ www.continuingeducation.bnppmedia.com/course.php?L=223&C=947&P=1

⁶ Average Rated Lamp Life is the mean average of the manufacturer's lamp life rating for the given application, of all of the lamps in use in the facility

- Average Rated Lamp Life
 - Calculations of average rated lamp life supported by the following data:
 - Fixture count
 - Specification sheet of each lighting type showing average rated lamp life
 - Totals and weighted average calculation for facility-wide average rated lamp life
 - Invoices or contract with lighting recycling company that handles removal of expired lamps.

Industry or Referenced Standards

The Illuminating Engineering Society of North America has established standards (RP-20-98) for recommended illumination levels in areas based on various security requirements, climate and other factors. The table below illustrates the IES Minimum Illumination Levels recommended for parking facilities (Source: IESNA Outdoor Lighting Recommendations, Darren Komengsky.)

Illumination levels are measured in foot-candles (fc) which is the amount of light (lumens) falling on a surface area (square foot).

Area	Time of Day	Minimum Horizontal Illuminance ² lux (fc)	Maximum Max-to-Min Ratio	Minimum Vertical Illuminance ³ lux (fc)
Basic ¹		10 (1.0)	10:1	5 (0.5)
Ramps ⁴	Day ⁵	20 (2.0)	10:1	10 (1.0)
	Night	10 (1.0)	10:1	5 (0.5)
Entrance Areas	Day ⁵	500 (50)		250 (25)
	Night	10 (1.0)	10:1	5 (0.5)
Stairways		20 (2.0)		10 (1.0)

¹ Typical conditions

² Measured on the parking surface without any shadowing effects

³ Measured 1.5m above parking surface at point of lowest horizontal illuminance (not including points on the boundaries facing outward.)

⁴ Applies to clearway ramps (no adjacent parking) but not to sloping floor designs.

⁵ Daylight may be considered in the design calculation.

- Additionally, IES has established more stringent criteria for locations where operators' desire increased safety on the premises, entitled Guideline for Security Lighting for People, Property and Public spaces, publication G-1-03. This sets minimum illumination levels where security is a concern.⁷
- International Energy Conservation Code (IECC) has established power density limits for parking structure illumination.
- ASHRAE 90.1 2010 has specified that the limit for the power density for a parking structure is not to exceed 0.25 watts per square foot. All efforts should be made to exceed this benchmark and reduce the power density as much as possible given the needs of the facility.

⁷ www.ies.org/store/product/guideline-on-security-lighting-for-people-property-and-public-spaces-1070.cfm

- U.S. Department of Energy, Life-cycle Assessment of Energy and Environmental Impacts of LED Lighting Products, May 2012
www.pnnl.gov/main/publications/external/technical_reports/PNNL-21443.pdf

Suggested Best Practices

- Install ENERGY STAR version 2.0 illuminated exit and directional signage as required by the congressional Energy Policy Act of 2005 (EPAct).⁸ By switching to an LED exit sign from an incandescent sign, a facility can reduce the energy consumption of exit signs by 87%. Switching from fluorescent exit signs to LED can yield savings of 68%.⁹
- Many lighting technology and design layout options can significantly improve a lighting system's performance and efficiency. The use of a professional lighting designer to determine the most appropriate and energy-efficient system for the facility is recommended.
- Practice proper lighting maintenance procedures.
 - Annual cleaning of light fixtures and lamps to maintain maximum performance
 - Annual inspection of lighting to verify luminance output. Any lamps that have had lighting output degraded 30% from their initial luminance should be replaced.¹⁰
 - Recycling of all spent lamps using proper handling procedures.¹¹
- Implement techniques to reduce the amount of electric lighting needed in the facility:
 - **Daylighting:** the use of ambient sunlight to offset the amount of powered lighting through the use of skylights, windows, light pipes, etc.
 - **Reflective surfaces:** the use of reflective paints and coatings or light colored cements and building materials to make a facility brighter. These surfaces will result in a lower lighting need because more of the illuminance will be retained.
- Lighting system design should consider:
 - **Safety:** Safety factors include reaching the minimum vertical illuminance and horizontal illuminance levels required by local safety codes, particularly during off-peak and closing hours when lights can be turned off or dimmed.
 - **Correlated Color Temperature (CCT) and Color Rendering Index (CRI):** Install lighting with the most appropriate and visible CCT and high CRI. Good color quality and color rendering properties facilitate the accurate identification of persons and objects and improves safety.
 - **Light Pollution:** Ensure that the lighting fixtures are angled or redirected so that light is concentrated on target areas and that seepage outside of the facility is minimized. Limiting light pollution, including light trespass, glare and sky glow, reduces energy waste from light in unwanted locations and can improve safety.¹²

⁸ www.energystar.gov/products/lighting_fans/exit_signs

⁹ www.energystar.gov/ia/business/small_business/led_exitsigns_techsheet.pdf

¹⁰ www.energystar.gov/products/lighting_fans/light_bulbs/learn_about_led_bulbs

¹¹ www.lamprecycle.org/

¹² www.darkskycommunity.org/handouts/LightingPlanGuidelines.pdf

Related Measures

- A.9 Building Systems Commissioning
- C.8 Lighting Controls

MEASURE 10 Stormwater Management

POINT VALUE 2 – 6

Objective

Mitigate stormwater run-off, pollution and contaminants.

Description

Stormwater is rainwater or melted snow that runs off streets, lawns and other sites. When stormwater is absorbed into soil, it is filtered and ultimately replenishes aquifers or flows into streams and rivers.

In developed areas, impervious surfaces such as pavement and roofs prevent precipitation from naturally soaking into the ground. Instead, water runs rapidly into storm drains, sewer systems and drainage ditches, and can cause:

- Downstream flooding
- Stream bank erosion
- Increased turbidity (muddiness created by stirred up sediment) from erosion
- Habitat destruction
- Combined sewer overflows
- Infrastructural damage
- Contaminated streams, rivers and coastal water¹

Various methods can mitigate stormwater effects, including structural as well as natural infiltration measures. Ideally, sites should strive for non-structural stormwater management in the form of Low Impact Development (LID).² LID utilizes natural features to increase perviousness and infiltration, including rain gardens, vegetated rooftops, rain barrels, and permeable pavements. Natural features reduce the need for, or the size of, man-made structural measures such as retention basins. These natural features, which can be existing or created, are often termed “green infrastructure.”³

The recommended strategies address erosion control during initial construction, and on-site stormwater management as defined by the U.S. EPA in the Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act.⁴

1 Environmental Protection Agency, EPA Facility Stormwater Management, retrieved August 12, 2016, www.epa.gov/greeningepa/epa-facility-stormwater-management

2 EPA, Urban Runoff: Low Impact Development: www.epa.gov/polluted-runoff-nonpoint-source-pollution/urban-runoff-low-impact-development

3 EPA: www.epa.gov/green-infrastructure

4 United States Environmental Protection Agency. (2009). Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act (EPA 841-B-09-001). Washington, DC: Author. Retrieved from www.epa.gov/sites/production/files/2015-08/documents/epa_swm_guidance.pdf

Options

The options below are cumulative for a possible total of 6 points.

[2 Points] Implement an Erosion and Sedimentation Control Plan (ESC) that meets or exceeds the most current version of the U.S. EPA Construction General Permit, or local equivalent, whichever is most stringent.

[2 Points] Manage on-site runoff from the 80% precipitation event using low-impact development (LID) and green infrastructure.

[2 Points] Manage on-site runoff from the 90% precipitation event using low-impact development (LID) and green infrastructure.

Documentation Requirements

- Erosion and Sedimentation Control (ESC) Plan
 - Provide Erosion and Sedimentation Control Plan.
- Runoff Management
 - Provide calculations for the chosen percentile storm (80% or 90%) documenting the percentile precipitation volume retained on-site.

Industry or Referenced Standards

- Low-Impact Development Design Strategies: An Integrated Design Approach
www.lowimpactdevelopment.org/pubs/LID_National_Manual.pdf
- EPA, Storm Water Best Management Practice Design Guide (EPA/600/R-04/121) September 2004.
- Center for Watershed Protection
www.cwp.org
- EPA National Pollutant Discharge Elimination System (NPDES)
- EPA, Low-Impact Development
www.epa.gov/owow/nps/lid
- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed

Related Measures

- A.15 Credentialed Management
- C.11 Rainwater harvesting
- C.12 Greywater Reuse
- C.15 Roofing Systems

MEASURE 11 Rainwater Harvesting

POINT VALUE 4

Objective

Conserve fresh water resources with a system that captures and uses rainwater use.

Description

Fresh water accounts for only 2.5% of the earth's water. Most of this supply is trapped in glaciers and ice caps, leaving only a small amount available for use.¹ Harvesting rainwater allows parking structures to maximize their use of this valuable resource. In addition, capturing rainwater reduces the discharge of stormwater and the pollutants it would typically contain into fresh water ecosystems.

Options

Rainwater can be collected from roofs, patios, paved areas and other non-permeable surfaces. Appropriate uses for rainwater at parking locations include landscape irrigation, decorative water fountains and toilet flushing. To receive credit for this measure a facility must have capacity to store 7,500 gallons of rainwater.

[4 Points] Parking structure harvests rainwater with a collection system containing a storage capacity of 7,500 gallons or more.

Documentation Requirements

- Narrative of system, including:
 - Process for collecting, storing, and utilizing rainwater.
 - Estimates for amount of fresh water it conserves.
- Images of rainwater catchment, storage, and delivery system.
- Rainwater harvesting system design plans.
- Equipment and installation invoices.

Industry or Referenced Standards

- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
- SITES
www.sustainablesites.org

¹ www.greenfacts.org/en/water-resources/index.htm

Examples

This diagram shows a simple collection system where filtered rainwater is stored underground and used for irrigation and toilet flushing.

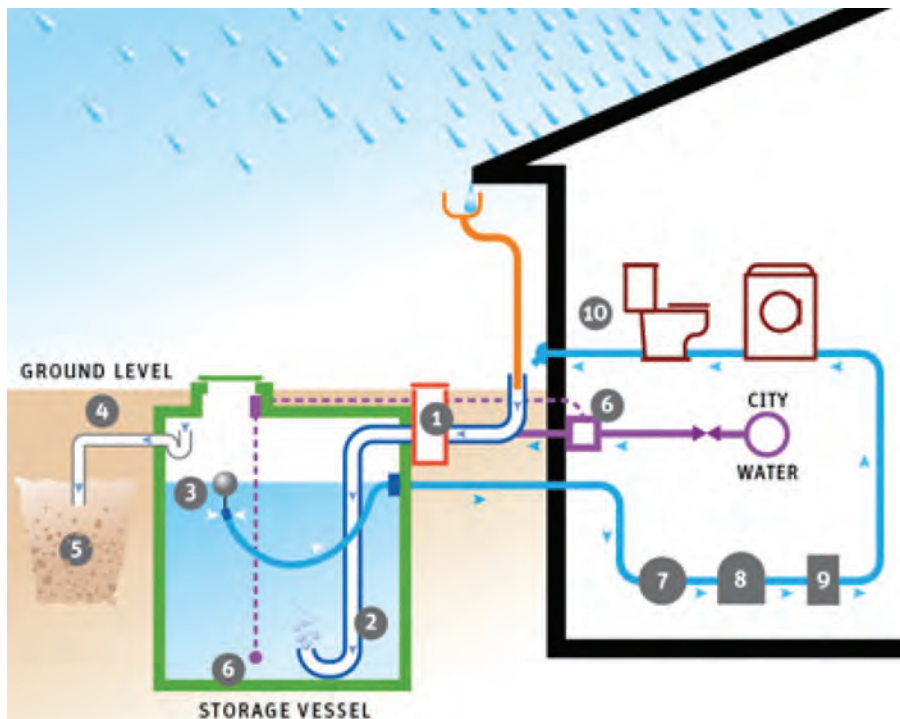


Photo courtesy of Stark Environmental:
www.starkenvironmental.com/a-0-rainwater.html

Related Measures

- C.12 Greywater Reuse
- C.13 Indoor Water-efficiency
- C.14 Water-efficient Landscaping

MEASURE 12 **Greywater Reuse**

POINT VALUE 2

Objective

Reduce fresh water consumption with a system that captures and utilizes greywater.

Description

Freshwater accounts for only 2.5% of the earth's water. Most of this supply is trapped in glaciers and ice caps, leaving only a small amount available for use.¹ Greywater is the water generated from washing machines, baths, dishwashers, sinks, showers and other plumbing systems that do not handle human waste. Parking facilities can conserve the fresh water supply by utilizing greywater for toilet flushing, irrigation, car washing, or garage cleaning.

Options

Parking structure utilizes greywater to minimize potable water consumption.

[2 Points] Parking structure has installed a system to capture and properly use greywater.

Documentation Requirements

- Narrative of the system, including:
 - Process for collecting, storing, and utilizing greywater.
 - Estimates for the amount of potable water it conserves.
- Images of the greywater system.
- Greywater system design plans.
- Equipment and installation invoices.

Industry or Referenced Standards

- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed
- SITES
www.sustainablesites.org

¹ www.greenfacts.org/en/water-resources/index.htm

Related Measures

- C.11 Rainwater Harvesting
- C.13 Indoor Water-efficiency
- C.14 Water-efficient Landscaping

MEASURE 13 Indoor Water-efficiency

POINT VALUE 2

Objective

Implement a water-efficiency plan to reduce water use within the facility.

Description

According to the U.S. EPA, while the U.S. population nearly doubled between 1950 and 2000, the public demand for water more than tripled, leading to an average personal consumption of 100 gallons of water per day.¹

By implementing water-efficiency technologies and processes in parking structures nationwide, the parking industry can reduce the use of this valuable resource.

Options

Parking structure must meet the following requirements:

- All private lavatory faucets within the parking structure are EPA WaterSense approved or have WaterSense-approved aerators (or equivalent).
- All public lavatory faucets have a maximum installed flow rate of 0.4 gallons per minute.*
- All toilets and urinals within the parking structure are EPA WaterSense approved (or equivalent) or are waterless.

**No WaterSense criteria exists for public lavatory faucets; GBCI requires that all public lavatory faucets meet the flow rate threshold defined in Compliance Path 1 of the Indoor Water Use Reduction prerequisite within the LEED v4 Reference Guide for Building Design and Construction.*

[2 Points] All faucets, toilets and urinals within the project boundary meet the criteria outlined above.

Documentation Requirements

- Provide 1 of the following:
 - All faucet and toilet receipts/invoices and a specification sheet for each fixture type.
 - Dated plumbing inspection report confirming the flush/flow rates of installed fixtures.

¹ www.epa.gov/WaterSense

Industry or Referenced Standards

- EPA WaterSense
www.epa.gov/watersense
- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed
- LEED rating system
www.usgbc.org/leed
- ASHRAE
www.ashrae.org

Suggested Best Practices

- Hose bibs and other washdown equipment should be EPA WaterSense approved and limit water consumption through high-pressure nozzles or water recovery and reuse strategies.

Related Measures

- C.11 Rainwater Harvesting
- C.12 Greywater Reuse
- C.14 Water-efficient Landscaping

MEASURE 14 **Water-efficient Landscaping**

POINT VALUE 2

Objective

Landscaping exclusively uses native plantings to minimize fresh water consumption in flora maintenance.

Description

According to the U.S. EPA, studies show that average landscape water use in the commercial and institutional sector can range from 7% of total water use for hospitals, 22% for office buildings, and up to 30% for schools.¹

Parking structures can eliminate their consumption of fresh water for irrigation by selecting geographically appropriate flora that thrives with only rainfall. Eliminating fresh water use for watering and maintenance of plants, trees, shrubs, and grasses within the entire property, can conserve fresh water resources. The need for irrigation can be reduced or eliminated through the careful selection of native plantings or xeriscaping, which requires no irrigation.

This measure complements measures addressing rainwater and greywater capture. Facilities that use captured rainwater or greywater for landscape irrigation will also receive credit under this measure.

Options

Several options satisfy the criteria for this measure. (Please note that landscaping must be included within the Parksmart certification project boundary and must encompass at least 10% of the project boundary land area to receive credit for this measure.)

- Meet 1 of the following requirements:
 - Eliminate permanent irrigation systems.
 - If irrigation is required to establish new landscaping, it must be temporary and be removed within a year from planting after flora becomes established.
- Meet the full requirements of the LEED BD+C 2009 Water-efficient Landscaping credit (WE Credit 1) or LEED BD+C for New Construction v4 Outdoor Water Use Reduction credit.

¹ www3.epa.gov/watersense/commercial/docs/watersense_at_work/files/assets/common/downloads/WaterSense-at-Work_FINAL_508c3.pdf

- Meet the full requirements of Options 2 or 3 under Credit 3.4 (Reduce Outdoor Water Use) of the SITES v2 Rating System.
- Facility utilizes greywater or harvested rainwater for all landscape irrigation.

[2 Points] Parking structure has installed water-efficient landscaping to meet 1 of the criteria above and the landscaping covers at least 10% of the total project boundary.

Documentation Requirements

- Provide 1 of the following:
 - Narrative and landscaping drawings denoting planting and landscape choices that demonstrate no permanent irrigation is installed
 - Narrative explaining and documenting how the landscaping uses only rainwater or greywater and is not irrigated with fresh water sources
 - Documentation of adherence to Options 2 or 3 under Credit 3.4 (Reduce Outdoor Water Use) of the SITES v2 Rating System
 - Documentation of achievement of LEED BD+C v2009 Water-efficient Landscaping credit (WE Credit 1) or the LEED BD+C v4 Outdoor Water Use Reduction credit

Industry or Referenced Standards

- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/LEED
- SITES
www.sustainablesites.org

Suggested Best Practices

- Working with a landscape architect and the building management team to determine the best landscape choices for your facility according to local regulations, water requirements, maintenance needs, security, and aesthetics is recommended.

Related Measures

- C.11 Rainwater Harvesting
- C.12 Greywater Reuse

MEASURE 15 Roofing Systems

POINT VALUE 2 – 6

Objective

Employ roofing technology that provides environmental benefits.

Description

Advanced roofing systems can provide a number of benefits over traditional roofing designs. Depending on the type of roof and the features installed on the roof, it may provide 1 or more of these benefits:

- **Heat Island Mitigation:** Roofing that lacks reflective properties absorb the sun's warmth, increasing the roof's temperature. This heat is radiated into the parking structure and its surroundings, negatively affecting the air and water quality, the natural ecosystem, animal habitats and the human environment, particularly in urban areas.¹ Covering a roof in high Solar Reflective Index (SRI) materials will reflect this radiation and mitigate the heat island effect. Solar Photovoltaic panels not only generate renewable energy, but shade and cool the roof below by as much as 5°F, reducing the structure's heat island effect.²
- **Stormwater Mitigation:** When heavy rainfall deposits a significant volume of water onto a non-permeable surface in an urban environment, the runoff flows into cities' wastewater treatment systems, carrying pollution from surface contaminants, and negatively impacting the surrounding environment.³ A roof can be designed with materials that retain or slow down the water runoff from the roof during rain storms.
- **CO₂ Sequestration:** Roof systems with installed flora, including trees and shrubs, will capture carbon dioxide CO₂ and convert it to oxygen, improving the air quality and mitigating global warming and climate change.⁴
- **Natural Habitat or Public Green Space:** Roof systems with certain types of installed flora provide an environment for beneficial insects (such as bees and butterflies) to thrive and can provide public green space for people to enjoy.
- **Vehicle Shelter:** Carports and canopies on rooftop parking decks provide shade and protect vehicles from the elements and vehicle wear. Fuel evaporation from parked vehicles can account for up to

¹ "Heat Island Impacts", Environmental Protection Agency, www.epa.gov/heatisland/impacts/index.htm

² Anthony Dominguez, Jan Kleissl and Jeffrey C. Luvall, "Effects of solar photovoltaic panels on roof heat transfer," *Solar Energy* 85:9 (September, 2011), 2244-2255.

³ Huntsinger, Teresa, "Stormwater Solutions: Turning Oregon's Rain Back Into a Resource", Oregon Environmental Council, 2007, pages 1-6.

⁴ Climate Protection Partnership Division, U.S. Environmental Protection Agency, "Reducing Urban Heat Islands: Compendium of Strategies, Green Roofs", page 7.

20% of a vehicle's hydrocarbon emissions into the atmosphere and shaded, cooler vehicles have less evaporation than those in direct sunlight.⁵ In addition, fuel consumption related to the vehicles' air conditioning can account for as much as 30% of the fuel consumed.⁶ Additionally, the useful life of a vehicle can be extended when it is shielded from the elements such as sun, snow, or ice. For maximum environmental benefit, carports can also support solar photovoltaic (PV) panels or be coated with a high SRI material to reduce the heat island effect.

Given the numerous benefits possible, the following advanced roofing systems are recognized in this measure.

- **Green Roof:** A roof with soil beds and vegetation (intensive, extensive or native grasses) provides the greatest environmental benefit, managing stormwater, reducing heat island effect, providing natural habitat and absorbing CO₂.
- **Blue Roof:** A roofing system designed to mitigate stormwater runoff by temporarily retaining rainwater on the roof and slowly dissipating it into the storm system, easing the burden on the city stormwater management system. A blue roof also has the benefit of mitigating heat island by reducing the amount of radiated heat from the roof.
- **High Solar Reflective Index (SRI) Material:** Rooftops covered with a high SRI material, such as a sealant, coating, paint, tile, cement or surface layer reduce the heat island effect. High SRI material is defined as the top most roofing layer that has:
 - Rated SRI 78 or greater for roof area with a pitch less than or equal to 2:12
 - Rated SRI 29 or greater for roof area with a pitch greater than 2:12
- **Carports:** Carports and/or canopies with a high Solar Reflectance Index (SRI) material will keep the space underneath cooler than exposed asphalt or cement surfaces.

Options

Parking garages can earn points based on the type of roofing system installed.

- Only roofs that are directly attached to the project boundary of the parking garage are eligible. For underground facilities, the roof is the surface that is directly above the garage at grade level.
- If there is a structure above the garage and the structure is not included in the project boundary then the portion of surface area with a structure above it is not eligible for points within this measure. A minimum of 25% of the footprint of the garage must have an eligible roof area for this measure to be applicable.
- Calculations for percentages of roof area may exclude rooftop machinery, stairwells and ramps.
- If multiple roofing designs are employed, the parking garage will be awarded the highest scoring category that is in compliance.

5 *Arid Zone Times*, February, 1998. "Shade Trees and Parking Lots." www.fs.fed.us/psw/topics/urban_forestry/products/cufr_70_EM98_65.PDF

6 Martin F. Weilenmann, Robert Alvarez, Mario Keller. *Fuel Consumption and CO₂/Pollutant Emissions of Mobile Air Conditioning at Fleet Level - New Data and Model Comparison*. *Environmental Science & Technology*, 2010: 100608141025002 DOI: 10.1021/es903654t

[6 Points] At least 50% of the roof area is covered with at least 1 form of green roof (intensive, extensive or lawn).

[4 Points] At least 70% of the roof area is covered with at least 1 form of a blue roof.

[3 Points] At least 50% of the roof area is covered by a carport or canopy equipped with either a high SRI coating or solar PV panels.

[2 Points] At least 90% of the roof area is coated with a high SRI rated material.

[2 Points] At least 50% of the roof area is covered by roof attached solar PV panels.

Documentation Requirements

- Architectural drawing of the roof, total roof area, pitch, roof type(s).
- Images of the roof demonstrating roofing technologies.
- Breakdown of roof areas (square footage) by roofing type.
- For roof designs containing high SRI materials, include the specification sheet from the manufacturer stating the SRI rating.

Suggested Best Practices

- If the roof is being utilized for parking, solar PV carports are an excellent way to implement a roof design that retains the space for parking, provides shelter to the vehicles, reduces the heat island effect and generates renewable energy.
- For green roofs, the flora selected should be native to the region and favor low- or no-maintenance plantings that require limited or no irrigation (watering twice per week maximum, or if more frequent, the irrigation system should utilize captured rainwater).

Industry or Referenced Standards

- LEED for Building Design and Construction rating system (LEED v4 and LEED 2009)
www.usgbc.org/leed
- U.S. Environmental Protection Agency: Cool Roofs
www.epa.gov/heat-islands/using-cool-roofs-reduce-heat-islands
- New York City Environmental Protection, Blue and Green Roof Pilot Project,
www.nyc.gov/html/dep/html/stormwater/green_pilot_project_ps118.shtml

Examples

This parking structure at Post Office Square, Boston, MA installed a park as the roof of the garage.



Photo courtesy of Ed Wonsek

Sketch of green roof development plans at the Oxford Properties building at Bow Valley Square in Alberta, Canada.



Rendering courtesy of Shawn Johnston, Oxford Properties

Related Measures

- B.13 Marketing/Educational Program
- C.16 Renewable Energy Generation

MEASURE 16 Renewable Energy Generation

POINT VALUE 1 – 12

Objective

Implement on-site renewable energy generation and/or purchase Renewable Energy Credits (RECs).

Description

Renewable energy generation produces electricity that emits zero gas emissions. It includes the use of alternative energy sources such as wind turbines, solar photovoltaic (PV) panels, geothermal systems, tidal/wave energy, hydroelectric generation, fuel cell power and a host of other energy sources that do not consume fossil fuels or emit greenhouse gases (GHG). Facilities demonstrate a shift away from fossil fuels by generating renewable energy on-site or purchasing RECs to support renewable energy production in another location.

An exemplary site would produce the equivalent of 100% of the energy it consumes through on-site renewable energy generation. This is called “net zero” energy because the site effectively uses no energy from the electrical grid. The power may be stored on-site or funneled back to the utility company or power sources. In many cases, facilities can sell unused energy to the utility, providing a further environmental benefit.

Options

A parking structure can receive credit for renewable energy by installing renewable energy generation equipment, or by purchasing RECs to support off-site renewable energy generation.

Both options can be combined for a maximum of 12 points.

Renewable Energy Production

- Many renewable energy technologies are available for parking structures. The most common implementation of renewable energy generation in parking garages is the installation of solar PV arrays on roofs or carports.
- Points will be awarded based on the percentage of power generated compared to the facility's overall power consumption.

[12 Points] At least 75% of total energy used on-site is created by on-site renewable energy generation.

[10 Points] At least 50% and less than 75% of total energy used on-site is created by on-site renewable energy generation.

[8 Points] At least 25% and less than 50% of total energy used on-site is created by on-site renewable energy generation.

[6 Points] At least 5% and less than 25% of total energy used on-site is created by on-site renewable energy generation.

Renewable Energy Purchase

- RECs can be purchased from local utilities and renewable energy power-generating sites. Points will be allocated according to the percentage of power that is purchased as compared to the total amount of power used at the parking structure.
- The facility operator must commit to maintaining the same (or greater) level of REC purchases on an ongoing basis:

[4 Points] At least 75% of total energy used on-site is accompanied by the purchase of RECs.

[3 Points] At least 50% and less than 75% of total energy used on-site is accompanied by the purchase of RECs.

[2 Points] At least 25% and less than 50% of total energy used on-site is accompanied by the purchase of RECs.

[1 Point] At least 5% and less than 25% of total energy used on-site is accompanied by the purchase of RECs.

A parking structure may be awarded points from both the purchase and production of renewable energy, up to a maximum of 12 total points. For example, a garage may purchase RECs equating to 50% of its energy from wind sources through a utility (2 points), and be outfitted with photovoltaic panels that provide 30% of the facility's total energy (8 points) for a total of 10 points from this measure.

Documentation Requirements

- Renewable Energy Generation
 - Narrative describing the energy generation system.
 - Details describing the system components, including model numbers and manufacturer specification sheets.
 - Analysis of energy produced and consumed at the facility to substantiate the renewable energy production level achieved as a percentage, including:
 - Power generation reports for the 12 months prior to the preliminary review submission. If the system was installed within the past year, provide an estimate of energy production derived from an industry accepted modeling tool for any months where real data is not available
 - Utility billing history for the 12 months prior to the preliminary review submission detailing the total energy consumed at the facility (if the garage has been operational for less than 12 months, energy consumption modeling may replace utility bills)
- REC Purchases
 - Contracts/invoices showing the purchase of certified RECs over the 3 months prior to the preliminary review submission.
 - Signed commitment to continue purchasing RECs at a rate that offsets the same (or a greater) percentage of facility energy consumption.
 - Utility billing history for the 12 months prior to the preliminary review submission detailing the total energy consumed at facility (if garage has been operational for less than 12 months, energy consumption modeling may replace utility bills).

Additional Resources

- National Renewable Energy Laboratory
www.nrel.gov
- Zero Energy Buildings Database
www.buildinggreen.com/blog/zero-energy-buildings-database

Examples

Canopy Airport Parking, Commerce City, CO

In 2010, Canopy Airport Parking deployed three forms of renewable energy to power its facility: solar panels, wind turbines, and geothermal ground loop heating and cooling system.

Solar panels: An array of Sharp NU-235F1 solar panels, rated at 16.9 kW, was installed along the entry drive. The solar panel array is estimated to produce an output of 24,000 kWh/year.

Wind turbines: Eight 2,000 kWh/yr wind turbines, manufactured by Windspire, and constructed from recycled aircraft-grade aluminum (rotor blades) and recycled high-grade steel (monopole) were installed. The instantaneous power output of each turbine is 1.2 kW at a wind speed of 40 km/h (25 mph). The wind turbine mini-farm is estimated to produce an output of 7,200 kWh/year.



Photo courtesy of Canopy Airport Parking, Propark America

Geothermal loop field: The geothermal system is used to heat and cool the indoor buildings at the facility. Seven boreholes reach a depth of approximately 300 feet. A heat pump is used to extract energy from the relatively constant temperatures of the loop field (40 and 75 degrees Fahrenheit) providing heating in the winter and reversing the pump for cooling in the summer.

Federal Parking Garage, San Juan, Puerto Rico¹

The new four-level employee parking garage at the Federico Degetau Federal Building and Ruiz Nazario U.S. Courthouse in Hato Rey, Puerto Rico, will consolidate surface parking at the facility. It will also make the existing parking lot space available for the construction of a new 240,000-square-foot federal building that will help consolidate federal agency operations. A special feature of the 500-vehicle garage will be its net zero energy use. With the addition of solar panels, the parking garage is anticipated to be self-sustaining. Other environmentally sustainable features include electric vehicle charging stations for 60 cars, and a site design that is permeable to reduce storm water runoff.

Casino Reinvestment Development Authority, “The Wave” Mixed-Use Parking Structure, Atlantic City, NJ

This garage, completed in 2012, is a 1180-space mixed-use parking structure in Atlantic City that serves as a gateway to the city. It features a number of environmentally sustainable design elements, including a rooftop solar array and electric vehicle charging stations. The array supplies clean energy back to the Atlantic City Utility Agency via net metering.

¹ www.gsa.gov/portal/content/248145



Photo courtesy of RNL© Frank Ooms

Related Measures

- A.9 Building Systems Commissioning
- B.13 Marketing/Educational Program
- C.5 EV Charging Stations
- C.15 Roofing Systems



Photo courtesy of Timothy Haahs & Associates



Photo courtesy of Timothy Haahs & Associates

MEASURE 17 Design for Durability

POINT VALUE 6

Objective

Employ a precautionary design approach to increase the parking structure's lifespan and minimize the risk of premature deterioration.

Description

A parking structure that serves its users through a longer lifespan significantly reduces the environmental impact caused by demolition and construction.^{1, 2} Parking structures represent a particular challenge compared to other building types in achieving the desired lifespan, given the structure's direct exposure to the elements and the wear and tear of its users.³ As a result, quality superstructure construction and design is the most critical component in durable parking structure design.

Typical parking superstructure design types include the following forms.

- Structural Concrete
 - Precast Concrete
 - Cast-in-place Concrete
- Steel

This measure includes guidelines for each design type as applicable to the individual project or the appropriate portions of each construction form within a project boundary.

Structural Concrete

This is the most commonly used material in parking structure design. The main factor limiting the lifespan of concrete structures is the combination of concrete deterioration and the corrosion of steel reinforcements and connections. The main causes of deterioration are exposure to chlorides, freeze thaw cycles and movement/settling of the structure. Proactive design strategies can minimize the impact of environmental pressures on the structure.

¹ www.wbdg.org/resources/cwmgmt.php

² www.calrecycle.ca.gov/condemo/CaseStudies/DGSDiversion.pdf

³ "Designing and Building Durable Parking Structures" Carl A. Peterson

Cast in place post tensioned (PT) concrete structural system

Design methods that contribute to a more durable cast-in-place structure include:

- Minimize steel corrosion by keeping steel away from the immediate concrete surface.

Design rules to follow:

- o Use a 2 inch concrete cover over the top reinforcing steel and post tension tendons
 - o Use plastic seats for the placement of post tension tendons and reinforcing bars on the bottom of the formwork before pouring concrete
 - o Use high performance concrete grout product for grouting pit pockets and provide adequate water protection/sealant of all surfaces
 - o Grind and seal any cracks that appear in the concrete after curing
- Use of plastic seats for placement of rebar and PT tendons in Cast-in-Place concrete construction



Photo courtesy of DESMAN

- Design drainage to avoid ponding by ensuring that all drains are located at low elevation. Emphasis should be put on the importance of proper finishing of the concrete.
- Specify epoxy coated or galvanized rebar to delay steel corrosion. Inspect coatings on reinforcement before pouring concrete and repair damaged coatings.
- Implement PT design to reduce cracking in slabs and beams.
- Include the following elements to achieve a concrete mix appropriate to the specific project requirements:
 - o Include appropriate amounts of fly ash, silica fume and slag cement in concrete mix design. These components are industrial by-products that reduce permeability in concrete.
 - o Minimize chloride content in concrete mix by limiting water soluble chloride content to 0.06% in concrete mix. Include concrete additives that protect against chloride ion corrosion.
 - o Add air entraining admixtures to concrete mixture to help reduce concrete micro cracking.
 - o Specify periodic testing of each batch of concrete to ensure desired quality.

- Install steel embeds to connect finishes or secondary structures to the superstructure.
- Locate expansion joints no more than 300 feet apart.
- Limit the depth of decorative reveals to three quarters of an inch.



Photo courtesy of DESMAN

Precast (PC) concrete structural system

Design methods that contribute to a more durable precast concrete structure are:

- Design drainage to avoid ponding by ensuring that all drains are located at low elevation. Emphasis should be put on the importance of proper finishing of the concrete.
- Specify epoxy coated or galvanized rebar to delay corrosion.
- Require that precast manufacturer is a member of the Precast/Prestressed Concrete Institute (PCI).
- Include the following to achieve a concrete mix appropriate to the specific project requirements:
 - Include appropriate amounts of fly ash, silica fume and slag cement in concrete mix design. These components are industrial by-products that reduce permeability in concrete.
 - Minimize chloride content in concrete mix by limiting water soluble chloride content to 0.06% in concrete mix. Include concrete additives that protect against chloride-ion corrosion.
 - Add air entraining admixtures to the concrete mixture to help reduce concrete micro cracking.
- Use the following materials for metal connections:
 - Hot dipped galvanized metal for non-welded connections exposed to the elements
 - Zinc rich cold metal for welded connections exposed to the elements
 - Electroplated rods and bolts
 - Stainless steel flange-to-flange shear connections
- Installation of metal embeds connect finishes or secondary structures to the superstructure.
- Locate structural expansion joints no more than 300 feet apart.

SECTION C Technology & Structure Design

- Limit the depth of decorative reveals to three quarters of an inch.
- Specify any penetrations through the PC concrete components, which may be required for piping and conduits, during the design phase to avoid any coring of the concrete after installation is completed.

Precast concrete during construction phase



Steel Structural System

Steel structural systems are often used in combination with concrete, where steel is used for framing and concrete is used for decking. Concrete slabs may be precast or cast-in-place.

Steel is subject to corrosion, making it crucial to protect the steel members from corrosive elements when designing for prolonged durability.

- Specify a high quality coating system consisting of either a high performance paint system or hot-dip galvanizing.

- If paint finish is used, specify a high quality SSPC-SP10 Near White Metal Blast Cleaning.

For concrete deck construction ensure techniques comply with the appropriate sections above for pre-cast concrete or cast-in-place concrete, as applicable.



Photo courtesy of DESMAN

Options

[6 Points] Facility complies with options above for the applicable design form(s) in use within the project boundary.

Documentation Requirements

- Documentation confirming compliance to a durability design plan for the applicable superstructure design type(s). If more than 1 design type is employed, provide all of the applicable durability design plans.
- Written statement by a licensed professional endorsing the project's adherence to the applicable design options.

Industry or Referenced Standards

- American Concrete Institute, ACI 362.1rR-12 "Guide for the Design and Construction of Durable Concrete Parking Structures" Reported by ACI Committee 362
- Post-Tensioning Institute (PTI), Post-Tensioning Manual, 6th edition
- Precast/Prestressed Concrete Institute, "PCI Design Handbook: Precast and Prestressed Concrete", 6th Edition
- American Institute of Steel Construction, "Design Guide 18: Steel-Framed Open-Deck Parking Structures"
- The Coatings Society
www.SSPC.org

Suggested Best Practices

- Coat slabs with a traffic bearing membrane throughout the structure or at a minimum coat the top level slab and any slab areas above occupied space.

Related Measures

- A.6 Proactive Operational Maintenance
- A.11 Regional Materials for New Construction, Rehabilitation, or Retrofit
- A.12 Regional Labor for New Construction, Rehabilitation, or Retrofit
- A.13 Reused, Repurposed, or Recycled Materials
- C.3 No/Low VOC Coatings, Paints and Sealants

MEASURE 18 **Energy Resiliency – Storage**

POINT VALUE 2 – 4

Objective

Enhance energy resiliency through implementation of an energy storage solution.

Description

Energy resilience is the ability to adapt to the consequences of on-site and local electric grid change, and in extreme cases catastrophic failure. The Electric Power Research Institute and Department of Energy have examined and are working to enhance grid resilience. Energy consumers can contribute to the ‘hardening’ of the grid and improve the electric distribution system’s ability to meet today’s 24/7 service reliability expectations. Storage solutions can be structured to enable emergency backup power, load shifting, peak demand reduction and enhance power quality.

Options

Several energy storage solutions will enhance energy resilience, including, but not limited to, batteries, flywheels, and pumped storage. The garage operator may own the energy storage solution directly or indirectly through a third-party agreement.

[2 Points] A grid interactive energy storage solution has been integrated into the garage’s electric infrastructure.

[4 Points] A grid interactive energy storage solution has been integrated into the garage’s electric infrastructure and on-site renewable energy source.

Documentation Requirements

- Grid Interactive Energy Storage
 - Electrical single line drawing demonstrating the design of the grid interactive energy storage solution.
 - Images of the installed energy storage solution.
- Grid Interactive Energy Storage with On-site Renewable Energy Generation
 - Narrative describing renewable energy integration to the energy storage system.

- o Electrical single line drawing demonstrating the design of the grid interactive energy storage solution and renewable energy source(s).
- o Images of the installed energy storage solution and renewable energy source(s).

Industry or Referenced Standards

- DOE/EPRI 2013 Electricity Storage Handbook
www.sandia.gov/ess/publications/SAND2013-5131.pdf
- Grid Energy Storage: U.S. Department of Energy
www.energy.gov/sites/prod/files/2013/12/f5/Grid%20Energy%20Storage%20December%202013.pdf
- www.energy.gov/downloads/economic-benefits-increasing-electric-grid-resilience-weather-outages
- www.epri.com/Pages/Grid-Resiliency.aspx

Examples

Konterra Realty Group Corporate Headquarters, Laurel, MD



Photo courtesy of Solaire Generation

Standard Solar, Solar Grid Storage, and Solaire Generation collaborated to install Maryland’s first corporate microgrid for the Konterra Realty Group in Laurel, MD. The system includes 402 kW of solar canopies combined with a battery storage system and Electric Vehicle (EV) charging stations. The lithium ion batteries provide frequency regulation services that help stabilize the grid and serve as a source of emergency backup power if needed. The project, which was awarded the Maryland Energy Administration “Game Changer” grant, was unveiled at a ribbon cutting on October 15, 2013 attended by Maryland Governor Mike O’Malley and FERC Chairman Jon Wellinghoff. The installation set the standard for solar projects that promote energy resiliency and independence.

Related Measures

- C.16 Renewable Energy Generation



SECTION D

Innovation

MEASURE 1 **Innovative Approach**



MEASURE 1 Innovative Approach

POINT VALUE 1 – 6

Objective

Recognize facilities that deploy environmental sustainability initiatives beyond the scope of the measures in the Parksmart Certification Standard.

Description

Projects that surpass the performance levels of specific Parksmart measures or deploy environmental sustainability initiatives not yet addressed in the Parksmart Certification Standard are encouraged to seek recognition through this measure.

Options

Facility demonstrates a unique approach to environmental sustainability or exceeds the benchmark for an existing Parksmart certification measure. Innovation must be shown to produce either a significant improvement in the construction of the facility or expectation of continuing results on an ongoing basis through the duration of the certification.

Innovative Approach

Facility achieves an identifiable environmental sustainability benefit by deploying a design, technology or practice that does not fall under any existing Parksmart certification measure.

Exemplary Performance

Facility demonstrates achievement beyond the maximum metric outlined in a Parksmart certification measure. To be considered for exemplary performance a facility must exceed a measure's maximum metric by at least 50%.

[1-6 Points] Points will be awarded based on the environmental and community benefit demonstrated. Most innovative approaches will be awarded between 1 to 3 points, but multiple innovations can be recognized for a total of up to 6 points.

Documentation Requirements

- Innovative Approach
 - Narrative detailing innovative approach and strategies used to achieve environmental sustainability benefit.
 - Supporting documentation for the metrics used to verify compliance, demonstrating quantitative performance improvements for environmental benefit (establishing a baseline of standard performance for comparison).
- Exemplary Performance
 - Documentation demonstrating innovation has exceeded the maximum metric within an existing Parksmart measure by at least 50%.
 - The assumptions made to determine an acceptable baseline and the justifications for claimed improvements over the baseline.

Industry or Referenced Standards

- LEED 2009/LEED v4 green building certification program

Examples

Below is a list of examples which may merit credit under this measure.

Innovative Approach

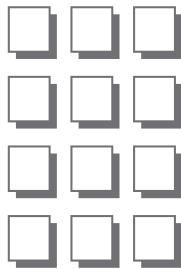
- Demonstrate that the project has been built on a previously disturbed, infill, or brownfield site (surface parking lots are considered previously disturbed).
- Use 50% of the site acreage to restore or create wetlands or environmentally sensitive habitats.
- Incorporate a wildlife friendly design (e.g., glazing to reduce bird collisions, avian nesting platforms, culverts for animal migration).
- Utilize a biologically safe and/or organic formwork release agent in garage construction.
- Employ the recarbonation process discovered by Pade and Guimaraes as reduction of the structure's carbon footprint ($\text{Ca}(\text{OH})_2 + \text{CO}_2 = \text{CaCO}_3 + \text{H}_2\text{O}$).¹
- Utilize a significantly light cement mix (e.g., 50% of the weight of standard concrete) that reduces hauling fuel and improves the thermodynamic properties of the structure.
- Integrate an innovative new technology which produces renewable electricity (equivalent to >5% of the garage's use) from the motion of people walking up stairs or from the weight changes of vehicles through the facility.
- Utilize co-generation to produce electricity from HVAC systems, equating to at least 5% of the structure's energy use.

¹ Pade, Claus and Guimaraes, Maria, "The CO₂ uptake of concrete in a 100 year perspective", *Cement and Concrete Research* 37 (2007), pages 1348-1356, June 2007

- Sponsor or organize competitive recycling programs pitting one building against another, with results demonstrating significantly improved (e.g., 50% increase) recycling participation.
- Provide permanent space in a quarter of the roof top and funding to support academic research and development of an energy or environmental innovation (e.g., fund and provide location for a student projects to test a new wind turbine design).
- Design the garage with reuse in mind in order to extend the potential life of the structure. For example, design with level decks that are spaced far enough apart to accommodate conversion to occupied spaces.
- Incorporate fuel-efficient motor scooter and/or motor cycle programs to encourage the use of more efficient two wheeled vehicles.
- Incentivize smaller vehicle choices by having a tiered pricing scheme for passenger cars versus SUVs.

Exemplary Performance

- Dramatically exceed the renewable energy production measure by producing over 150% of the energy used in the parking facility.
- Incorporate ongoing recycling programs that offer collection of an extensive array of waste, such as collecting and locally recycling electronics, hazardous materials, clothing, batteries, lamps, etc.
- Cover nearly 100% of the roof with an intensive green roof design and provide community vegetable gardens.
- Install EV charging stations in 20% of the parking spaces.



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