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INTRODUCTION

After the planning process, projects that move forward will enter the design and (usually) the construction phase. This chapter continues the process of incorporating sustainability into major renovations and construction projects. At this point, the details of the project are beginning to take shape. By integrating sustainable design elements into the design process as early as possible, it is expected that the effectiveness of enhancing a project’s sustainability is maximized while costs due to design and construction changes are minimized. Although sustainable guidance and rating systems for buildings (vertical construction) are prevalent, the civil/infrastructure environment (horizontal construction) guidance is less common. The Design & Construction (D&C) Chapter of the Sustainable Airport Manual (SAM) joins these elements, civil/infrastructure and buildings, and applies them within the realm of an airport environment.

Implementation of sustainable design elements can reduce operational costs and increase occupant productivity. The on-site recycling and reuse of construction waste and materials, for example, reduces transportation cost and the use of regionally-obtainable materials benefits the local economy and reduces life-cycle emissions. With an appropriate level of investment in sustainable design and construction techniques, regardless of the scale and scope of a project, it is anticipated that all parties including owners, occupants, contractors, and the general public can experience environmental and economic benefits. In many cases, there is little or no impact on the project budget and schedule in the implementation of these sustainable elements.

The Design and Construction Chapter of the Sustainable Airport Manual (SAM) has been written with consideration of five general project categories that are relevant to airport design and construction projects. These project categories are defined below:

- **Civil – Airside**: Projects located inside of the Air Operations Area (AOA) that do not include normally occupied structures and consist mainly of horizontal structures such as subsurface utilities, earthwork, pavement, roadways, bridges, tunnels, and water conveyances. Projects may include but are not limited to runways, taxiways and shoulders, airside roads and perimeter roads, stormwater conveyance systems, stormwater detention facilities, electrical lighting systems, navigational aids, airport utility systems, vehicle parking facilities, and fencing.

- **Civil – Landside**: Projects located outside of the AOA that do not include normally occupied structures and consist mainly of horizontal structures such as subsurface utilities, earthwork, pavement, roadways, bridges, tunnels, and water conveyances. Projects may include but are not limited to guard post relocation, roads, tunnels and bridges, perimeter roads, stormwater conveyance systems, stormwater detention facilities, creek relocations, electrical lighting systems, airport utility systems, vehicle parking facilities and fencing, and railroad relocation.

- **Occupied Buildings**: Projects consisting of facilities and associated surroundings that, when construction is complete, will be normally occupied by employees and passengers. These facilities may include but are not limited to terminals, concourses, access guard posts, airport communications building, air rescue and firefighting facilities, cargo facilities, and air traffic control towers.
• **Unoccupied Buildings**: Projects consisting of facilities and associated surroundings that, when construction is complete, will be unoccupied. These may include but are not limited to pump stations, lighting vaults, and fuel stations.

• **Remodeling/Renovations**: Projects consisting of renovation of existing facilities or terminal areas where the focus of the work is on the exterior. This work may include but is not limited to exterior site work, building envelope modifications, roofing replacement, or combinations thereof.

**APPLICABILITY**

SAM Design & Construction (DC) certification encourages airport designers and contractors to implement sustainable practices to reduce the environmental impacts of, not only the design features of a given project, but also construction activities, and the operational aspects of the building or infrastructure project. Specifically, the rating system addresses site issues, water and energy usage, materials and resources used for building the project, waste management, and indoor/outdoor environmental quality.

The DC chapter is applicable to all construction activities requiring design services that include the categories above. Major renovations that primarily include exterior site work, building envelope modifications, roofing replacement, or combinations thereof, though not necessarily new construction, will fall under this chapter. **Major interior renovations, not related to a specific tenant, may include demolition and replacement of walls, floors, finishes, HVAC replacement, other mechanical, electrical, or plumbing work, and should be completed using the SAM Concession & Tenants – Design & Construction chapter.** It is intended that the designers and contractors of these types of projects will be evaluated throughout this process.

**DESIGN & CONSTRUCTION SECTIONS**

Projects are rated on the achievement of credits depending on the appropriate stage of the project and based on sustainable elements from the following categories:

- **AP** Administrative Procedures
- **1.0** Sustainable Site Management
- **2.0** Water Efficiency
- **3.0** Energy & Atmosphere
- **4.0** Materials & Resources
- **5.0** Indoor Environmental Quality
- **6.0** Construction Practices
- **7.0** Innovation in Design & Construction
- **8.0** Regional Priority
To determine a project’s earned points, each project is evaluated against a specific number of credits within each category. The number of earned points is then translated into a rating. There are specific weighted point thresholds (i.e. applicable credits) for each of the five project categories – civil-airside, civil-landside, occupied buildings, unoccupied buildings, and Remodeling/Renovations – so as to not inadvertently penalize a project for failing to achieve points that are not applicable. The list of credits and point thresholds applicable to each project type are summarized in Appendix DC-A – Sustainable Airport Manual Green Airplane Rating System.

**PROCESS**

Within the Manual’s main body, each sustainable design credit has five subsections: Intent, Requirements, Submittals, Technology/Strategy, and Case Studies, as described below:

- **Intent**: The primary motivations for any sustainable practice.
- **Requirements**: Specifies institutional, operational, and mechanical design or construction elements that satisfy the intent. The prerequisites must be achieved; the credits are optional, but contribute to the overall project rating.
- **Submittals**: Required and supporting documentation and/or information required to achieve applicable prerequisites or credits. This documentation may include calculations, data, short narratives, policies, documents or references to specification sections or design drawings indicating how the requirements are being met.
- **Technology/Strategy**: Highlights specific ways of meeting the recommendations within the scope for each specific credit. Case studies where available, are presented to help guide the application of sustainable credits to design and construction projects. To aid with consideration of applicable strategies and technologies, they are organized into the following three categories; “Standard Practice,” “Recommended Practice,” and “Best Available Practice.”
  - **Standard Practice**: These are requirements that may be due to standards, specifications, codes, general best management or construction practices. They are practices already in place, and in many cases SAM prerequisites, which also serve to meet sustainable goals.
  - **Recommended Practice**: These include recommendations that are expected to have insignificant impacts to cost and are therefore, encouraged to be incorporated into the design process.
  - **Best Available Practice**: These are strategies and practices that are expected to enhance the environmental design efforts of the Chicago Department of Aviation (CDA), but are anticipated to potentially have an impact on the cost and/or schedule. A simple cost benefit analysis can be conducted to determine the practicality of implementation.
- **Case Study**: Examples of credit intent “in action” at airports and/or other industry facilities.
While not all strategies will be applicable to every project category, design and construction teams are highly encouraged to think creatively and consider the intent of each issue throughout the decision process. In all cases, it is the responsibility of the design and construction teams to evaluate and review any anticipated costs or scheduled impacts with the Chicago Department of Aviation.

**SUBMITTALS**

Sustainable Airport Manual (SAM) Design & Construction Checklists

Incorporation of sustainable elements into the design and construction of a project is tracked using a checklist in order to determine the number of applicable credits described in this Manual. The SAM Design & Construction Checklist is completed by the designer with the assistance of the contractor/CM where applicable. The purpose of the SAM Design Checklist is to indicate proposed sustainable design elements during the design phase, while the purpose of the SAM Construction Checklist is to allow verification and finalization of actual data related to the project’s construction phase. The checklist is provided in Appendix DC-B – Design & Construction Checklist.

**NOTE:**

When submitting electronic files, include the name of the project and CDA project number (if applicable) in the file name for ease of processing. Submittal dates, milestones, and/or contractor names may also be included in file names. Submitting a filename such as “SAM Checklist” is not acceptable. An example of an appropriate file name is:

SAM Checklist_CT-DC_JDesignInc_TH0000.00_T3 Retail Renovation_100%_20141102.xls

SAM Checklist_[SAM Chapter]_[Contractor]_[Project Number]_[Project Name]_[Milestone]_[Submittal Date]

In order to achieve points, certain requirements outlined in each credit must be met. The design team must demonstrate how and to what extent these credits will be achieved at periodic review meetings throughout the design process. The means by which this is demonstrated will vary. In some instances, studies and calculations will be appropriate, whereas in others, this will be accomplished through product and material data or through referenced standards or specifications.

For some credits, the responsibility to meet the intent of the credit will be primarily that of the contractor. In these cases, specifications are to be developed by the designer to clearly detail the execution and submittal requirements that must be followed by the contractor. In addition to reviewing the checklist, the Sustainable Review Panel (SRP) will review any supporting documentation including calculations, specifications, and contractor submittals as needed to support the achievement of the credit(s). See Section titled Implementation and Review Process for detailed information about the SRP.
NOTE:

All design teams must have a LEED Accredited Professional. Their responsibility is to complete or oversee the completion of the SAM Checklist and their implementation.

SAM GREEN AIRPLANE RATING SYSTEM

The SAM Green Airplane Rating System for Design and Construction uses a five tier approach to rating projects based on the five project types. “Green Airplane Certification” symbols are used to designate achievement levels.

The thresholds for each project type are summarized in the table below:

<table>
<thead>
<tr>
<th>DC GREEN AIRPLANE RATING SYSTEM</th>
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<tr>
<td>Green Airplanes</td>
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<tr>
<td>Prerequisites</td>
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<tr>
<td><img src="image" alt="Green Airplane Certification Symbol" /></td>
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<tr>
<td>MAXIMUM</td>
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IMPLEMENTATION AND REVIEW PROCESS

The SAM and its supporting documentation are administered by the Sustainable Review Panel (SRP), which currently consists of representatives of the CDA Management Staff, CDA Design and Construction Staff and Representatives, OMP Project Management Office (PMO) and Master Civil Engineer (MCE), and Airport Planners actively involved in CDA projects. The composition of the SRP is intended to be dynamic depending on project needs.

The SRP is responsible for the review of submittals with respect to sustainability and provides technical support to the each project in relation appropriate to sustainable practices. The SRP
is responsible for review of every checklist and for the awarding of “Green Airplane Certification” ratings based on the extent of incorporation of sustainable practices as outlined in this Manual and as documented on the submitted SAM Checklist(s).

Other responsibilities of the SRP include preparation and review of sustainable design related specifications, technical memoranda, and miscellaneous documents, as necessary. In addition, the SRP is responsible for presentations and training to project team members with respect to the application of this Manual. The primary tasks of the SRP are to oversee the application of the Manual and review submittals for their compliance with the Manual. The review process is outlined in **Figure 1** below:
Just as any airport can easily customize the Chicago-specific guidance elements within the SAM, the composition of an SRP can also be tailored to an airport’s unique needs.

**Design Phase**

Current Requests for Proposals (RFPs) for design services include language indicating that requirements of this Manual must be incorporated as part of the design process for all projects. The designer is to incorporate language regarding all supporting specifications and requirements in the Contract Documents consistent with the requirements described in this Manual. After a project is awarded to a Design Team, SRP representatives will meet with the designers during the kick-off meeting to outline project goals for sustainability. Contract documents require that each design team include at least one LEED Accredited Professional. It is encouraged that the LEED Accredited Professional be present at all sustainability-related meetings, including the project kick-off meeting. The SAM Design Checklist is discussed in detail at the kick-off meeting, as it is one of the primary deliverables from the Design Team, as well as the supporting documents and specifications that must accompany the submittal. At this meeting, the designer is given an electronic copy of the Manual and electronic copies of all relevant specifications, checklists, calculations spreadsheets, and templates, including instructions for completion of each form. Certain credits pertain to specifications and standards that are included in every contract (e.g. 01111 – Construction Air Quality or 01524 – Waste Management). In most cases, the specification indicates the submittal requirements. The credit descriptions in this Manual describe the submittal requirements that must be satisfied in order to meet the credit.

As part of the standard design review process, the SAM Design Checklist and supporting documents are reviewed at each milestone (typically 30%, 60%, 90%, and 100% design submittals) against the goals set forth by the Manual. Review comments on the Checklist are submitted along with the design-related review comments.

At the 100% design milestone, the SRP will meet to discuss the project Checklist and collectively determine any final comments for the Design Team before completion. When the 100% design documents have been completed, the SRP meets again to determine and award the Green Airplane Certification for Sustainable Design (i.e. the number of Green Airplanes to be awarded to the project design).

**Construction Phase**

The Manual is referenced in the General Conditions of the project’s Contract Documents. The contractor is obligated to meet all the requirements of the Manual and the supporting specifications and submittals. Compliance with these requirements is verified by the Construction Manager (CM) prior to project closeout. This is verified by the Sustainable Design Compliance section of the project’s Closeout Log. As the project continues through Bid Issue and then Construction phase, the SRP will meet with the CM and contractor at the pre-construction meeting to discuss the process and the deliverables with emphasis on what is required by the contractor and the CM. At this time, additional opportunities and goals are identified for the construction phase and the contractor and CM are encouraged to raise awareness of sustainable design and construction issues with the remaining staff. The SRP works with the CM as the main point of contact. The CM is required to obtain the required
documentation from the Contractor, although in some cases, information may be received directly from the Contractor (e.g., the fuel usage logs).

For the construction phase, some up-front submittals are required (e.g., Construction Waste Plan, preconstruction estimates on regional and recycled material quantities that are reviewed at the beginning of the project). Fuel usage is tracked monthly throughout the project’s duration. The SAM Construction Checklist is reviewed and finalized when the project reaches substantial completion.

After substantial completion, the SRP will determine whether all items proposed in the Design Checklist were completed and are reflected in the SAM Construction Checklist or discuss/identify variances. At completion, the SRP will determine and award the Green Airplane Certification for Sustainable Construction.

**Commissioning**

Whenever applicable, project commissioning is encouraged. Commissioning can provide long-term benefits for the project/building owner, as well as its users and occupants. Commissioning is covered in the Energy & Atmosphere section.
airportsgoinggreen.org

For comments, case studies, lessons-learned, new technologies or for any and all project submittal forms, please email:

SAMdocs@cityofchicago.org
1.0 SUSTAINABLE SITES

1.1 Prerequisite 1 – Construction Activity Pollution Prevention

Required

INTENT

Reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust generation.

REQUIREMENTS

Create and implement an Erosion and Sedimentation Control (ESC) Plan for all construction activities. The ESC Plan shall conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit OR local erosion and sedimentation control standards and codes, whichever is more stringent. The Plan shall describe the measures implemented to accomplish the following objectives:

- Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse
- Prevent sedimentation of storm sewer or receiving streams
- Prevent pollution of the air with dust and particulate matter using BMPs

(See SAM Credit 1.2 Prerequisite 2 – Adopt CDA Best Management Practices)

The Construction General Permit (CGP) outlines the provisions necessary to comply with Phase I and Phase II of the National Pollutant Discharge Elimination System (NPDES) program. While the CGP only applies to construction sites greater than 1 acre, the requirements are applied to all projects for the purposes of this prerequisite. Information on the EPA CGP is available at: cfpub.epa.gov/npdes/stormwater/cgp.cfm.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Create an Erosion and Sedimentation Control Plan during the design phase of the project. Consider employing strategies such as temporary and permanent seeding, mulching, earth dikes, silt fencing, sediment traps and sediment basins.

Standard Practice

CDA’s current construction activities meet the basic requirements of this strategy:

- Develop an erosion and sediment control strategy plan to be implemented by stages and phases to control erosion at the source and retain sediment on the construction site
• Incorporate temporary sedimentation basins, temporary ditch checks, diversion dikes, temporary ditches, pipe slope drains into the construction plans
• For dust control: tarp truckloads, sweep streets as needed, stabilize construction entrances, spray site as necessary to minimize fugitive dust
• Establish temporary and permanent seeding plans consistent with the following CDA/OMP Specifications:
  o CDA/OMP Specification T-901 – Seeding
  o CDA/OMP Specification P-156 – Temporary Air and Water Pollution, Soil Erosion, and Sediment Control
  o CDA/OMP Specification 02905 – Sustainable Airport Landscaping
• For any proposed plant species not listed, consult an FAA certified airport biologist to ensure the plants will not attract wildlife

Recommended Practice

None

Best Available Practice

• Monitor water quality impacts before and during construction
• Develop an inventory of topsoil for potential re-use
• Develop a policy to chip or compost all vegetation for re-use on site

CASE STUDY

Construction Environmental Management Plan (CEMP)
Brisbane Airport Corporation – Brisbane, Australia

When a project involves the disturbance of soils an Erosion and Sediment Control (ESC) Management Plan must be developed in accordance with the Soil Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites, Engineers Australia (Queensland Division), or Best Practice Erosion and Sediment Control, IECA, (2009) as a minimum. A detailed site plan showing all controls to be implemented must be provided along with the CEMP, along with details on the inspection schedule for ESC onsite devices. The CEMP must also detail how roads that are used for access to and from construction sites will be protected from the movement of sediments from site.

1.0 SUSTAINABLE SITES

1.2 Prerequisite 2 – Adopt CDA Best Management Practices

Required

INTENT

Minimize the environmental impacts of facility operations.

REQUIREMENTS

- Depending on the project, the owner, tenant, or ultimate occupant must incorporate the CDA BMP Manual into their tenant or lease agreement

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

The BMP Manual defines the practices and measures used to reduce or eliminate the amount of pollution to the environment surrounding Chicago O’Hare and Midway International Airports. The BMPs are typically in the form of a procedure, activity, or structural control.

Standard Practice

- The BMP Manual has been in effect since August 2002. There are a number of practices already implemented at Chicago O’Hare and Midway via this manual. Many of these practices deal with pollution prevention for all airport entities.

Recommended Practice

None

Best Available Practice

None
1.0 SUSTAINABLE SITES

1.3 Brownfield Redevelopment

1 Point

INTENT

Rehabilitate damaged sites where development is complicated by environmental contamination, reducing pressure on undeveloped land.

REQUIREMENTS

Develop on a site documented as contaminated (by means of an ASTM E1903-97 Phase II Environmental Site Assessment or a local Voluntary Cleanup Program).

OR

Develop on a site defined as a brownfield by a local, state or federal government agency.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

During the site selection process, give preference to brownfield sites. Identify tax incentives and property cost savings. Coordinate site development plans with remediation activity, as appropriate.

Standard Practice

The following strategies are required by IEPA* for any development in a brownfield:

- Develop and implement a site remediation plan using strategies such as pump-and-treat, bioreactors, land forming and on-site remediation. Remediation would meet the standards identified in the Illinois Tiered Approach to Corrective Action (TACO).
- Opportunity to enter into the Illinois Site Remediation Program (voluntary cleanup program) that offers a No Further Remediation (NFR) Letter

*or relevant state agency

Recommended Practice

- Any recommendations are dependent upon site characteristics. Monitoring is suggested as site conditions warrant
Best Available Practice

- Cleanup requirements will be dependent on site conditions, applicable remediation standards, and timing requirements

CASE STUDY

Airport Redevelopment Site
Stapleton Airport - Denver, Colorado

Stapleton International Airport was abandoned in 1995 to allow for the commissioning of Denver International Airport. After significant contamination remediation, the site was redeveloped to allow for a master-planned community. Using strict environmental standards, contaminated soil was investigated and removed.

[Link to case study]

Pittsburgh International Airport World Trade Center
Pittsburgh International Airport – Pittsburgh, Pennsylvania

In 2014, it was announced that a public private partnership involving several state agencies will transform a 195 acre former coal mine into a center for international trade. The trade center is planned to include office space, research and development capacity and a 400 room hotel with convention space. The project is projected to generate more than $250 million in private investment and lead to the creation of 7,000 direct and indirect jobs, with the addition of more than 1,200 construction jobs. The Pennsylvania Department of Environmental Protection was awarded a $1 million federal Surface Mining Control and Reclamation Act grant for environmental remediation including shoring up former mine walls and removing acid mine drainage at the site.

[Link to case study]
1.0 SUSTAINABLE SITES

1.4.1 Alternative Transportation: Public Transportation Access

6 Points

INTENT

Reduce pollution and land development impacts from automobile use.

REQUIREMENTS

Locate project within one half-mile walking distance (measured from main building entrance) of an existing or planned and funded commuter rail, light rail, or subway station (measured from the building entrance).

OR

Locate project within one quarter-mile walking distance (measured from main building entrance) of one or more stops for two or more public, campus, or private bus lines usable by building occupants.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Perform a transportation survey of future building occupants to identify transportation needs and share results to encourage knowledge and use of mass transit. Whenever possible, co-locate buildings and mass transit and provide clear directional signage.

Standard Practice

- CDA’s current transportation plan meets the basic requirements of this strategy
- Shuttle buses and ATS transportation are currently available

Recommended Practice

Work with CDA to plan for and implement strategies aimed at the following goals:

- Improve and/or increase public transportation access from the City and suburbs
- Reduce parking needs
- Improve efficiency of access
Best Available Practice

Below are additional suggestions that could further support an inter-modal public transportation network. Teams should consider impact of future implementation.

- Provide incentives to employees to use public transportation and shuttles
- Consolidate rental car facilities and mini-bus transportation to minimize congestion on terminal roads. Consider the use of an alternate fuel mini-bus fleet to reduce vehicle emissions and carbon footprint.
- Operate satellite ‘check-in’ facilities (downtown and suburban locations) to minimize congestion on terminal access roads and encourage use of public transportation
- Construct airport to airport (O'Hare-Midway) high-speed rail connection
- Develop Airport-Downtown express connection, including satellite check-in facilities
- Develop additional train/mass transit service to/from the suburbs
- To ease in local understanding of available modes of alternative transportation, airports can include mass-transit routes on an airport area map

CASE STUDY

Electric Transit
Charles De Gaulle International Airport - Paris, France

In April 2007, Charles de Gaulle International Airport in Paris France commissioned a new automatic metro line, the Charles de Gaulle Véhicule Automatique Léger (CDGVAL). The metro line is a free driverless train that serves passengers and the nearly 85,000 airport employees. The CDGVAL links three airport terminals, TGV/RER stations, and long-term parking lots. The CDGVAL is a 100 percent electric, making it possible to save 750 tons of fuel per year and decrease 15 tons of NO\textsubscript{x} and 2,500 tons of CO\textsubscript{2} released annually by the buses. It also decreases travel time between the two furthest points on the system by more than 50 percent.

www.enviro.aero/CharlesDeGaulleAirport.aspx
1.0 SUSTAINABLE SITES

1.4.2 Alternative Transportation: Bicycle Access, Storage and Changing Rooms

1 Point

INTENT

Reduce pollution and land development impacts from automobile use.

REQUIREMENTS

For commercial or institutional buildings, provide secure bicycle racks and/or storage (within 200 yards of a building entrance) for 5% or more of all building users (measured at peak periods).

AND

Provide shower and changing facilities in the building, or within 200 yards of a building entrance, for 0.5% of Full-Time Equivalent (FTE) occupants.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

- Design the building with transportation amenities such as bicycle racks and showering/changing facilities such that employees are encouraged to use bicycles, therefore reducing parking needs
- Bicycle access may require coordination with airport security

Standard Practice

- Although bicycle access to secured areas may be limited, perimeter facilities often have bicycle access and shower rooms available

Recommended Practice

- Include bicycle storage facilities and changing rooms where possible. Locate perimeter facilities in areas that provide a continuity of safe bicycle access from the adjoining community.

Best Available Practice

- Provide safe bicycle lanes/paths
- Provide a centralized facility(s) for secure bicycle storage with convenient changing/shower areas
• Provide incentives to employees to bike to work
• Develop a bicycle-access master plan

CASE STUDY

Bike 2015 Plan
City of Chicago, Illinois

The Bike 2015 Plan is the City of Chicago’s vision to make bicycling an integral part of daily life. The plan recommends projects, programs and policies through 2015 to encourage use of bicycles as a practical, non-polluting, and affordable mode of transportation. The Bike 2015 Plan has two overall goals:

• To increase bicycle use, so that 5 percent of all trips less than five miles are by bicycle.
• To reduce the number of bicycle injuries by 50 percent from current levels.

The plan has eight chapters, each with a specific goal:

• Bikeway Network – Establish a bikeway network that serves all Chicago residents and neighborhoods.
• Bicycle-friendly Streets – Make all of Chicago’s streets safe and convenient for bicycling.
• Bike Parking – Provide convenient and secure short-term and long-term bike parking throughout Chicago.
• Transit – Provide convenient connections between bicycling and public transit.
• Education – Educate bicyclists, motorists, and the general public about bicycle safety and the benefits of bicycling.
• Marketing and Health Promotion – Increase bicycle use through targeted marketing and health promotion.
• Law Enforcement and Crash Analysis – Increase bicyclist safety through effective law enforcement and detailed crash analysis.
• Bicycle Messengers – Expand the use of bicycle messengers; improve their workplace safety and public image.

http://bike2015plan.org
1.0 SUSTAINABLE SITES

1.4.3 Alternative Transportation: Low-Emitting and Fuel-Efficient Vehicles (Non-Construction)

3 Points

INTENT

Reduce pollution and land development impacts from automobile use.

REQUIREMENTS

OPTION 1

Provide low-emitting and fuel-efficient vehicles for 3% of Full-Time Equivalent (FTE) occupants

AND

Provide preferred parking for these vehicles.

OR

OPTION 2

Provide preferred parking for low-emitting and fuel-efficient vehicles for 5% of the total vehicle parking capacity of the site. Provide discounted parking rates as an acceptable substitute for preferred parking for low-emitting/fuel efficient vehicles. In order to establish a meaningful incentive in all potential markets, the parking rate must be discounted at least 20%. This approach is acceptable as long as the discounted rate is available for all customers (not limited to the number of customers equal to 5% of the vehicle parking capacity) and publicly posted at the entrance to the parking deck.

OR

OPTION 3

Install alternative-fuel refueling stations for 3% of the total vehicle parking capacity of the site (liquid or gaseous fueling facilities must be separately ventilated or located outdoors).

OR

OPTION 4

Provide to building occupants, access to a hybrid car sharing program. The following requirements must be met:

- One low-emitting or fuel-efficient vehicle/car must be provided per 8 people
- A car sharing contract demonstrating an agreement of at least 2 years must be provided
• Documentation of the car sharing program’s customers served/car estimates and a narrative explaining the car-share program and its administration must be provided
• The low-emitting and fuel-efficient vehicle/car parking must be located in the nearest available spaces in the nearest available parking area; provide a site plan or area map clearly highlighting the walking path from the parking area to the project site and noting the distance

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Provide transportation amenities such as alternative fuel refueling stations. Consider sharing the costs and benefits of refueling stations with neighboring communities and the airport’s policy on alternative fuel options and preferences.

Standard Practice

• CDA already has programs for alternative fuel vehicles within the airport operations. Design so that these programs are enhanced and supported

Recommended Practice

• Consider local policies and preferences when considering new alternative fueling infrastructure development.

Best Available Practice

• Increase use of alternative fuel vehicles for airport operations particularly indoor cargo operations
• Provide preferred parking for staff and public alternative fuel vehicles
• Install alternative fuel refueling stations for public use
• Plan for the development of preferred parking and/or lot locations for rental fleets, which offer alternative fuel rental vehicles
• Encourage electrical receptacle in public parking garages for charging of electric vehicles

CASE STUDIES

Reduced Access Fee for Hybrid Taxis
Denver International Airport - Denver, Colorado

The environment will benefit from the reduced carbon emissions and air pollution that result from substituting hybrid taxis for conventional taxis. As a result, one of Denver International Airport’s many sustainable initiatives is to offer fee reductions for hybrid taxis which serve the airport. In addition to this incentive, Denver International Airport established a transportation
and maintenance fleet, which is 100% alternative-fueled and includes vehicles powered by compressed natural gas, hybrid technology and biodiesel.


Hydrogen Fuel Cell Vehicles
Los Angeles World Airports – Los Angeles, California

Los Angeles World Airports developed the first hydrogen fueling and generation station at Los Angeles International Airport. This facility demonstrates a comprehensive alternative fueled vehicle program that can be incorporated into daily airport operations both on and off the airfield.

1.0 SUSTAINABLE SITES

1.4.4 Alternative Transportation: Parking Capacity

2 Points

INTENT

Reduce pollution and land development impacts from single occupancy vehicle use for employees.

REQUIREMENTS

OPTION 1 — NON-RESIDENTIAL

Size parking capacity to meet, but not exceed, minimum local zoning requirements.

AND

Provide preferred parking for carpools or vanpools for 5% of the total provided parking spaces.

OR

OPTION 2 — NON-RESIDENTIAL

For projects that provide parking for less than 5% of FTE building occupants:

Provide preferred parking for carpools or vanpools, marked as such, for 5% of total provided parking spaces.

OR

OPTION 3 — ALL

Provide no new parking.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Minimize employee parking lot/garage size. Consider sharing parking facilities with adjacent buildings. Consider alternatives that will limit the use of single occupancy vehicles.

Standard Practice

None
Recommended Practice
None

Best Available Practice

- Provide preferred parking for vanpools and carpools for staff
  - Preferred Parking refers to the parking spots that are closest to the main entrance of the project, exclusive of spaces designated for handicapped, or spaces designated for specific users

- Parking garages can reduce the overall footprint while providing needed capacity
1.0 SUSTAINABLE SITES

1.5.1 Stormwater Design: Quantity Control

1 Point

INTENT

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

REQUIREMENTS

CASE 1 — EXISTING IMPERVIOUSNESS IS LESS THAN OR EQUAL TO 50%
Implement a stormwater management plan that prevents the post-development peak discharge rate and quantity from exceeding the pre-development peak discharge rate and quantity for the one- and two-year, 24-hour design storms.

OR

Implement a stormwater management plan that protects receiving stream channels from excessive erosion by implementing a stream channel protection strategy and quantity control strategies.

OR

CASE 2 — EXISTING IMPERVIOUSNESS IS GREATER THAN 50%
Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the two-year, 24-hour design storm.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Design the project site to maintain natural stormwater flows by promoting infiltration. Specify vegetated roofs, pervious paving, and other measures to minimize impervious surfaces. Reuse stormwater volumes generated for non-potable uses such as landscape irrigation, toilet and urinal flushing and custodial uses.

Standard Practice

- Because many airside pavements have the potential for deicing fluid and jet fuel contamination, technologies that increase infiltration to the subsurface are not used. On landside projects, or for areas not subject to aviation-related contaminants, these methods are encouraged. A number of green vegetated roofs have already contributed toward this goal.
Recommended Practice

- Evaluate pervious pavements for roadways, shoulders, non-traffic pavements, maintenance roads, utility yards, airside and landside parking facilities, and pedestrian areas. Peak storm water runoff rates could be reduced. Storm sewer conveyance systems could be designed with reduced diameter pipes and fewer inlets.
- Install landscape to reduce runoff (See SAM Credit 3.3 Water Efficient Landscaping)
- Evaluate curb breaks and drainage ditches, and/or bioswales.

Best Available Practice

- Encourage installation of systems that are flexible to allow use of graywater
- Use of “extensive” green roof systems encourages filtration and treatment of rainwater, evaporation of rainfall to the atmosphere and storm water retention. Use plantings consistent with CDA/OMP Specification 02905 – Sustainable Airport Landscaping. For any proposed plant species not listed, consult an FAA certified airport biologist to ensure the plants will not attract wildlife.
- Use rainwater cisterns for landside irrigation during the plant growth season. Storm water runoff from the collection systems would be directed into the cisterns for storage. Collected water would be utilized for irrigation during dry periods. Cisterns would attenuate peak storm water runoff flows to the downstream storm sewer systems. Cisterns improve water quality by the removal of sediments due to the reduced velocities of flow in the system. (Sediment must be periodically removed.)
- Encourage extensive use of permeable pavement, where applicable

CASE STUDIES

North Air Traffic Control Tower
Chicago O’Hare International Airport - Chicago, Illinois

The site for the new North Air Traffic Control Tower was an existing parking lot with an impervious area of 89 percent. The new development greatly reduced the impervious area of the site to 43 percent. Because the existing site had an impervious area greater than 50 percent, in order to meet the requirement of this credit, the rate and quantity of stormwater runoff needed to be reduced by 25 percent. By reducing the impervious area of the new development by 46 percent or 47,200 square feet, the project met the requirements of this credit.

Terminal Building Cooling System Using Collected Snowfall
New Chitose Airport - Hokkaido, Japan

The New Chitose Airport terminal building in Hokkaido, Japan, utilizes a new cooling system. The transport ministry collects snow during the winter and preserves it to provide 30 percent of the building’s cooling needs during the summer. Of the snow collected throughout the winter, approximately 45 percent of the snow is preserved for the summertime through the use of heat-
insulating materials. The collected snow is used to chill the liquid of the building's cooling system. This practice could stave off 2,100 tons of carbon dioxide emissions per annum compared to using the building's existing cooling system.

www.goodcleantech.com/2008/10/new_chitose_airport_in_japan_t_1.php
1.0 SUSTAINABLE SITES

1.5.2 Stormwater Design: Quality Control

1 Point

INTENT

Limit disruption and pollution of natural water flows by managing stormwater runoff.

REQUIREMENTS

Implement a stormwater management plan that reduces impervious cover, promotes infiltration, and captures and treats the stormwater runoff from 90% of the average annual rainfall using acceptable CDA Best Management Practices (BMPs). BMPs used to treat runoff must be capable of removing 80% of the average annual post development total suspended solids (TSS) load based on existing monitoring reports. BMPs are considered to meet these criteria if (1) they are designed in accordance with standards and specifications from a state or local program that has adopted these performance standards, or (2) there exists in-field performance monitoring data demonstrating compliance with the criteria. Data must conform to accepted protocol (e.g., Technology Acceptance Reciprocity Partnership [TARP], Washington State Department of Ecology) for BMP monitoring.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Use alternative surfaces (e.g., vegetated roofs, pervious pavement or grid pavers) and non-structural techniques (e.g., rain gardens, vegetated swales, disconnection of imperviousness, rainwater recycling) to reduce imperviousness and promote infiltration thereby reducing pollutant loadings. Use sustainable design strategies (e.g., Low Impact Development, Environmentally Sensitive Design) to design integrated natural and mechanical treatment systems such as constructed wetlands, vegetated filters, and open channels to treat stormwater runoff.

Standard Practice

- Due to the potential for deicing fluid contamination, the use of these technologies must be weighed carefully to prevent larger contaminant issues, such as infiltration of ground water. Just as in SAM Credit 2.5.1 Stormwater Design: Quality Control, this credit is more applicable for landside uses or places that are not subject to aviation-related contaminants although some exceptions may be possible.
Recommended Practice

- Evaluate first flush systems including slotted edge drains connected to underground holding tanks. First flush sediment would settle in the tanks and be removed at a later date for treatment and/or disposal.
- Evaluate detention basins, detention ditches, ditch checks and other CDA BMPs for effective first flush treatment
- Evaluate bioswales along roadways and parking areas to encourage groundwater infiltration of stormwater runoff for landside areas. These strategies should be designed to discourage wildlife habitat.
- Minimize current treatment of all stormwater by reducing runoff. See SAM Credit 2.5.1 Stormwater Design: Quality Control
- Evaluate pervious pavements for roadways, shoulders, non-traffic pavements, maintenance roads, utility yards, airside and landside parking facilities. Peak storm water runoff rates could be reduced. Storm sewer conveyance systems could be designed with reduced diameter pipes.
- Install landscape to reduce runoff. See SAM Credits 3.3.1 Water Efficient Landscaping, Reduce by 50% and 3.3.2 Water Efficient Landscaping, No Potable Water Use or No Irrigation.
- Install salt-tolerant plants near roadways and parking lots
- Develop a policy for optimal road salt usage balancing environmental and safety concerns

Best Available Practice

- Develop collection systems for de-icing runoff. The proposed runway and taxiway pavements would contain first flush systems along the edge of pavements and Central Deicing Facilities for aircraft. The first flush system could consist of slotted edge drains connected to underground holding tanks. Glycol contaminated snowmelt and minor storm water runoff would be captured in the tanks and removed for treatment, disposal or recycling.
- Incorporate technologies, application techniques and/or designs to minimize glycol residual after application of deicing agents
- Central Deicing Facilities could also be utilized to capture excess glycol from aircraft deicing operations in underground storage tanks
- Use of “extensive” green roof systems encourages filtration and treatment of rainwater, evaporation of rainfall to the atmosphere and storm water retention
CASE STUDIES

Central Deicing Facilities  
Toronto International Airport - Toronto, Ontario Canada

Toronto Airport reports that in an experimental pilot project, they were able to obtain glycol fluids in a concentration of at least 50 percent from recycled spent fluids having an original concentration of 8 to 10 percent. Toronto Airport reports that glycol water quality expedience events were reduced by 62.5 percent from 2001 to 2002 by the use of central deicing facilities.

http://www.torontopearson.com/uploadedFiles/GTAA/Content/Publications/Other_Corporate_Documents/Sustainability%20report%2020020108.pdf

Fourth Runway at Washington Dulles International Airport  
Metropolitan Washington Airports Authority - Washington, D.C.

The Metropolitan Washington Airports Authority is taking an innovative approach to protecting the environment encompassing the new fourth runway. Five new biological treatment units (BTU's) constructed adjacent to the runway will provide a cleansing effect to stormwater runoff.


Bio-Retention System to Manage and Cleanse Stormwater  
John Burroughs School - Ladue, Missouri

The bio-retention system is primarily a plant- and soil-based filtration facility for parking lot stormwater runoff. Stormwater runoff flows downhill from the driveway and south parking lot into the highest cell, from which it slowly progresses into two lower cells until finally ending up in the pond. Initially, much of the water passes first through an underground vortex filter that spins under the power of the falling water. The cleaned water is then diverted from the vortex filter into the first bio-retention cell while the debris and impurities removed from the water collect at the bottom of the filter. Once a year, the collected sediment from the bottom of the vortex filter is pumped out for disposal. Water then flows into the three cells of the bio-retention basin, each of which has its own underground water holding chamber as well as above-ground plants and soil. Stands of native grasses and wildflowers in each cell help prevent evapotranspiration by shading the water, enhance soil composition, encourage biological activity, and promote the removal of pollutants before stormwater enters the pond. Another important benefit of the system is the prevention of rapid filling and flushing of the pond.

http://science.jburroughs.org/sdeken/bioretention.htm

Stormwater Quality Initiative  
Denver International Airport - Denver, Colorado

Denver International Airport was built with a dedicated system for the capture, conveyance, treatment, and discharge of stormwater contaminated with aircraft deicing fluids. The system includes seven dedicated deicing pads, five wastewater retention ponds, and an onsite deicing fluid recycling facility.

1.0 SUSTAINABLE SITES

1.6.1 Landscape and Exterior Design to Reduce Heat Islands: Non-Roof

1 Point

INTENT

Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

REQUIREMENTS

OPTION 1

Use any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots):

- Provide shade from existing tree canopy or within five years of landscape installation; landscaping (trees) must be in place at the time of certification application. Installation should be consistent with CDA/OMP Specification 02905 – Sustainable Airport Landscaping. For any proposed plant species not listed, consult an FAA certified airport biologist to ensure the plants will not attract wildlife.
- Provide shade from structures fully covered by solar photovoltaic panels
- Provide shade from architectural devices or structures that have a solar reflectance index (SRI2) of at least 29. Implement a maintenance program that ensures these surfaces are cleaned at least every two years to maintain good reflectance.
- Have paving materials with an SRI of at least 29 and implement a maintenance program that ensures these surfaces are cleaned at least every two years to maintain good reflectance.
- Have an open-grid pavement system (at least 50% pervious)

OR

OPTION 2

Place a minimum of 50% of parking spaces under cover (defined as under ground, under deck, under roof, or under a building). Any roof used to shade or cover parking must have an SRI of at least 29.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.
TECHNOLOGY/STRATEGY

Employ strategies, materials and landscaping techniques that reduce heat absorption of exterior materials. Use shade (calculated on June 21, noon solar time) from native or adapted trees and large shrubs, vegetated trellises or other exterior structures supporting vegetation (consistent with CDA/OMP Specification 02905 – Sustainable Airport Landscaping, and for any proposed plant species not listed, consult an FAA certified airport biologist to ensure the plants will not attract wildlife.) Consider the use of new coatings and integral colorants for asphalt to achieve light-colored surfaces instead of blacktop. Position photovoltaic cells to shade impervious surfaces.

Standard Practice

- Unless the reflectance is determined directly through in-situ testing, the following default SRI values are to be used:

<table>
<thead>
<tr>
<th>Material</th>
<th>SRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Conventional “gray” concrete</td>
<td>35</td>
</tr>
<tr>
<td>Old (weathered) “gray” concrete</td>
<td>19</td>
</tr>
<tr>
<td>New “white” concrete</td>
<td>86</td>
</tr>
<tr>
<td>Old (weathered) “white” concrete</td>
<td>45</td>
</tr>
<tr>
<td>New Asphalt</td>
<td>0</td>
</tr>
<tr>
<td>Old asphalt</td>
<td>6</td>
</tr>
</tbody>
</table>

Recommended Practice

- Maximize light colored/high albedo pavement, such as portland cement concrete, for roadways, parking lots, sidewalks and plaza areas. Reflectance must be a minimum of 0.3. [‘White’ portland cement – 0.7 to 0.8, typical portland cement – 0.35 to 0.5, typical asphalt pavement – 0.05 (new) to 0.15 (over 5 years)].

Best Available Practice

- For Landside projects only, install trees consistent with CDA/OMP Specification Section 02905 – Sustainable Airport Landscaping, and for any proposed plant species not listed, consult an FAA certified airport biologist to ensure the plants will not attract wildlife
- A creative combination of the above strategies to reach this goal is encouraged. For example, a task/project can provide 5% shading of dark colored impervious surfaces and 25% light colored/high albedo pavement to achieve this goal.
• Evaluate structured parking in lieu of asphalt paved surface lots. This provides additional ‘green’ areas and reduces stormwater runoff from roofs and potentially the size of storm sewer systems.
• Evaluate open grid pavement for surface lots and site pavement
• Evaluate light-colored permeable pavers and concrete
• Evaluate “green walls” for building façade
1.0 SUSTAINABLE SITES

1.6.2 Landscape and Exterior Design to Reduce Heat Islands: Roof

1 Point

INTENT

Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

REQUIREMENTS

OPTION 1

Use roofing materials having a Solar Reflectance Index (SRI) equal to or greater than the values in the table below for a minimum of 75% of the roof surface. If more than 75% of the roof area is covered with the SRI material, the SRI value may be lower than the required value if the resulting area-weighted equivalent SRI performance is at least as high as having the required value on 75% of the area.

OR

OPTION 2

Install a vegetated roof for at least 50% of the roof area.

OR

OPTION 3

Install high albedo and vegetated roof surfaces that, in combination, meet the following criteria:

\[(\text{Area of SRI Roof} / 0.75) + (\text{Area of vegetated roof} / 0.5) \geq \text{Total Roof Area}\]

<table>
<thead>
<tr>
<th>Roof Type</th>
<th>Slope</th>
<th>SRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Sloped Roof</td>
<td>\leq 2:12</td>
<td>78</td>
</tr>
<tr>
<td>Steep-Sloped Roof</td>
<td>&gt; 2:12</td>
<td>29</td>
</tr>
</tbody>
</table>

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Consider installing high-albedo and vegetated roofs to reduce heat absorption. SRI is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371. Product information is available from the Cool Roof Rating Council website, at www.coolroofs.org. Also, visit the ENERGY STAR website, www.energystar.gov, to research compliant products.
Standard Practice

- White roofs are currently the standard for new construction on airport property. These are acceptable; however, SRI decreases with the age of the roof. Unless a cleaning program is in place, the benefits of white roofs diminish over time. For this reason, along with the benefits of stormwater management, the construction of green roofs is encouraged.

Recommended Practice

- Evaluate and utilize an ENERGY STAR compliant roofing system, such as aluminum coating and light-colored coatings. Thermoplastic and white PVC roofing systems meet these standards.

Best Available Practice

- Install a “green” vegetated roof on all or portions of new and existing buildings

CASE STUDY

Green Roofs
Chicago Department of Aviation - Chicago, Illinois

The Chicago Department of Aviation (CDA) has made vegetated roofs a priority for any large roof construction at ORD or MDW. Although reducing the heat island effect is the primary goal of this credit, the CDA, with its large expanses of impervious pavement also looks to this technology for its stormwater management aspects. Where vegetated roofs are not used or if there is only partial coverage by a vegetated roof, a high reflectance roofing material in accordance with the requirements of this credit is encouraged to be used where applicable.

As of November 2012, there are a total of 13 vegetated roof projects totaling approximately 341,359 square feet at both airports. The projects include the following:

- FedEx Cargo Sort Building (ORD) – 174,442 sq. ft
- United Airlines Cargo Building (ORD) – 108,816 sq. ft.
- South Airfield Lighting Control Vault (ORD) – 14,200 sq. ft
- FedEx World Services Center (ORD) – 10,024 sq. ft
- North Air Traffic Control Tower Base Building (ORD) – 8,910 sq. ft
- Guard Post 1 Canopy (ORD) – 6,500 sq. ft
- Enterprise Rental Car Maintenance Facility (ORD) – 3,627 sq. ft

Green Roof installation atop Guard Post 1 at O’Hare
- Aircraft Rescue and Firefighting Facility #3 (ORD) – 3,440 sq. ft
- Elevated Parking Structure (MDW) – 3,179 sq. ft.
- FedEx Vehicle Maintenance Building (ORD) – 3,170 sq. ft
- Enterprise Rental Car Facility Customer Service Center (ORD) – 2,847 sq. ft
- Building #819 – Booster Pump Station (ORD) – 1,287 sq. ft
- North Air Traffic Control Tower ComEd Building (ORD) – 917 sq. ft

It should be noted that the areas above only include the vegetated roof area. In all cases a highly reflective roof (high SRI value) makes up the balance of the roof area. For example, the UAL Cargo Building has a total roof area of 229,558 sq. ft. of which 47% will is vegetated and the remaining will be a high SRI roof. In comparison, 100% of the Guard Post 1 Canopy is covered by a vegetated roof system.

In all cases, existing and proposed (thus far) vegetated roof systems are extensive, that is low profile (< 6 inches), and plants consist entirely of varieties of *Sedum sp.* to minimize wildlife attraction. Refer to CDA/OMP Specification 02905 – Sustainable Airport Landscaping, for additional details on acceptable plant species.
1.0 SUSTAINABLE SITES

1.7 Light Pollution Reduction

1 Point

INTENT

Minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction, and reduce development impact on nocturnal environments.

REQUIREMENTS

FOR INTERIOR LIGHTING

The angle of maximum candela from each interior luminaire as located in the building shall intersect opaque building interior surfaces and not exit out through the windows.

OR

All non-emergency interior lighting shall be automatically controlled to turn off during non-business hours. Provide manual override capability for after-hours use.

AND

FOR EXTERIOR LIGHTING

Only light areas as required to meet FAA Regulation, Airline and Airport operational requirements, security, safety and comfort. Lighting Power Densities shall not exceed ASHRAE/IESNA Standard 90.1-2010 Addendum "I" for the classified zone.

All projects shall be classified under one of the following zones, as defined in IESNA RP-33, and shall follow all of the requirements for that specific zone:

LZ1 — Dark (Developed areas within national parks, state parks forest land and rural areas)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.01 horizontal and vertical footcandles at the site boundary and beyond. Document that 0% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ2 — Low (Areas predominantly consisting of; Residential zoning, Neighborhood business districts, Light industrial with limited nighttime use, Residential mixed use areas)

Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value no greater than 0.10 horizontal and vertical footcandles at the site boundary and no greater than 0.01 horizontal footcandles 10 feet beyond the site boundary.
Document that no more than 2% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

LZ3 — Medium (All other areas not included in LZ1, LZ2 or LZ4 such as Commercial/Industrial, High-Density Residential)

Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value no greater than 0.20 horizontal and vertical footcandles at the site boundary and no greater than 0.01 horizontal footcandles 15 feet beyond the site. Document that no more than 5% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

LZ4 — High (High activity commercial districts in major metropolitan areas. To be LZ4 the area must be so designated by the local jurisdiction)

Design exterior lighting so that all site and building mounted luminaires produce a maximum initial illuminance value no greater than 0.60 horizontal and vertical footcandles at the site boundary and no greater than 0.01 horizontal footcandles 15 feet beyond the site. Document that no more than 10% of the total initial designed site lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For LZ2, LZ3 & LZ4 - For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary. For ALL Zones - Illuminance generated from a single luminaire placed at the intersection of a private vehicular driveway and public roadway accessing the site, is allowed to use the centerline of the public roadway as the site boundary for 2 times the driveway width.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution. Minimize site lighting where possible and model the site lighting using a computer model. Technologies to reduce light pollution include full cutoff luminaires, low-reflectance surfaces and low-angle spotlights.

Standard Practice

- Use standard cutoffs on exterior lighting, wherever possible and appropriate.

Recommended Practice

- Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution
- Minimize site lighting where possible
- The maximum candela value of all interior lighting shall fall within the building (not out
through windows) and the maximum candela value of all exterior lighting shall fall within the property

- Consider a parking lot design which allows for a reduction of the available parking areas and the associated exterior lighting during non-use or low use hours
- Evaluate smart-lighting control systems and LED light technologies

**Best Available Practice**

- Model the site lighting using a computer model
- Consider full cutoff luminaries, low-reflectance, non-specular surfaces and low-angle spotlights for roadway and building lighting

**CASE STUDY**

**Total Lighting Control System**  
**T.F. Green International Airport - Providence, Rhode Island**

The renovated terminal at T.F. Green International Airport implemented an energy-efficient and automated Total Lighting Control (TLC) system by General Electric. The system features programmable networked technology, controlling the internal and external lighting at the facility, including lights in the concourse areas, departure areas, baggage claims and outdoor parking areas.

Inlet protection

Spraying site to minimize fugitive dust

Automated People Mover System at O'Hare

Mass transit drop-off point at O'Hare
2.0 Water Efficiency

2.1 Prerequisite 1 – Water Use Reduction: 20% Reduction

Required

INTENT

Increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

REQUIREMENTS

Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation). The baseline shall meet the requirements of the Energy Policy Act of 1992 (EPAct 1992) and subsequent rulings by the Department of Energy, requirements of the Energy Policy Act of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code as to fixture performance. Calculations are based on estimated occupant usage and shall include only the following fixtures and fixture fittings (as applicable to the building): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

WaterSense™-certified fixtures and fixture fittings should be used where available. Use high-efficiency fixtures (water closets and urinals) and dry fixtures such as composting toilet systems to reduce the potable water demand. Consider the use of alternate on-site sources of water, such as rainwater, stormwater, or air conditioner condensate, and graywater for non-potable applications such as toilet and urinal flushing, as approved by the manufacturer, and for custodial uses.

Special consideration should be used to distinguish applicability of these technologies in high-volume passenger terminal areas versus office facilities, especially with respect to maintenance.

Standard Practice


Recommended Practice

- Must exceed CBC (EPAct 1992) by 20% to meet prerequisite
- Use local generation of domestic hot water, as much as possible, to eliminate long piping runs associated with recirculation piping. Unless connecting to an existing hot water recirculating system
• Domestic hot water for general plumbing fixtures should be designed for a temperature of 140°F. maximum, but not less than 120°F

Best Available Practice

• Install dry fixtures such as composting toilets and waterless urinals to reduce wastewater volumes
• Use instantaneous hot water heating systems (i.e., tankless, on-demand hot water heating)
• Use zones or sub-meters to measure and audit water consumption rates at points of use
• Use reclaimed water for cooling tower makeup
• Evaluate pulsed-power electromagnetic water treatment, ultraviolet treatment, or ozone treatment for cooling tower water
• Establish a water supply system that supports vehicle maintenance without the use of potable water by using recycled water or diverted stormwater for vehicle and aircraft washing

CASE STUDY

See SAM Credit 2.2 Water Use Reduction: 30-40% Reduction.
2.0 Water Efficiency

2.2 Water Use Reduction: 30% - 40% Reduction

2 to 4 Points

INTENT

Further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

REQUIREMENTS

Employ strategies that in aggregate use less water than the water use baseline calculated for the building (not including irrigation). The minimum water savings percentage for each point threshold is as follows:

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Water Reduction</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.1</td>
<td>30%</td>
<td>2</td>
</tr>
<tr>
<td>2.2.2</td>
<td>35%</td>
<td>3</td>
</tr>
<tr>
<td>2.2.3</td>
<td>40%</td>
<td>4</td>
</tr>
</tbody>
</table>

Calculate the baseline according to the commercial and/or residential baselines outlined below. Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves.

<table>
<thead>
<tr>
<th>Commercial Fixtures, Fittings, and Appliances</th>
<th>Current Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial toilets</td>
<td>1.6 gallons per flush (gpf)*&lt;br&gt;Except blow-out fixtures: 3.5 (gpf)</td>
</tr>
<tr>
<td>Commercial urinals</td>
<td>1.0 (gpf)</td>
</tr>
<tr>
<td>Commercial lavatory (restroom) faucets</td>
<td>2.2 gallons per minute (gpm) at 60 pounds per square inch (psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 0.5 (gpm) at 60 (psi)** all others except private applications 0.25 gallons per cycle for metering faucets</td>
</tr>
<tr>
<td>Commercial prerinse spray valves (for food service applications)</td>
<td>Flow rate ≤ 1.6 (gpm)&lt;br&gt;(no pressure specified; no performance requirement)</td>
</tr>
</tbody>
</table>

---

1 Tables adapted from information developed and summarized by the U.S. Environmental Protection Agency (EPA) Office of Water based on requirements of the Energy Policy Act (EPAct) of 1992 and subsequent rulings by the Department of Energy, requirements of the EPAct of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code pertaining to fixture performance.
SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

WaterSense™-certified fixtures and fixture fittings should be used where available. Use high-efficiency fixtures (water dispensers, water closets and urinals) and dry fixtures such as composting toilet systems to reduce the potable water demand. Consider the use of alternate on-site sources of water, such as rainwater, stormwater, or air conditioner condensate, and graywater for non-potable applications such as toilet and urinal flushing, as approved by the manufacturer, and custodial uses.

Standard Practice

None

Recommended Practice

- Use high-efficiency fixtures and valves, such as automatic sensors, aerators on lavatories and dual-flush toilets

Best Available Practice

- Dry fixtures such as composting toilets and waterless urinals to reduce wastewater volumes
- Use reclaimed water for cooling tower makeup
- Evaluate pulsed-power electromagnetic water treatment, ultraviolet treatment, or ozone treatment for cooling tower water
- Establish a water supply system that supports vehicle maintenance without the use of potable water by using recycled water or diverted stormwater for vehicle and aircraft washing

CASE STUDIES

Recommendations for Maximizing Environmental Performance: Potable Water

Fort Lauderdale Hollywood International Airport - Fort Lauderdale, Florida

Fort Lauderdale-Hollywood International Airport (FLL) was billed for over 65 million gallons of water from October 2005 through September 2006. Significant opportunities exist for reducing the consumption of potable water and the burden imposed on sewer infrastructure and treatment. FLL currently uses low-flow toilets, sinks, and faucets in its restrooms. New technology, however, now exists that would enable FLL to further improve efficiency. According to the analysis conducted, the installation of lower-flow toilets, sinks, and urinals would cost about $234,000 and further reduce potable water consumption by 43 million gallons annually. This reduced water use would save the airport $281,000 annually and provide a payback of investment in ten months. FLL works cooperatively with tenants to reduce consumption by applying best management practices to sub-metered tenants and assessing the viability of
overseeing water use through a centralized control monitoring system. An additional 142 million gallons of water was billed to 141 sub-metered airport related users during that same period of time. It appears that the sub-metered users are a combination of food service establishments (there are 27 such tenants in the airport as of October 2006), rental car companies, airlines, Federal Aviation Administration, Broward County Animal Control, Fort Lauderdale Small Boat Club and others.

http://www.docstoc.com/docs/87186095/Executive-Summary-The-Green-Airport-Initiative-at-Fort-Lauderdale-

Waterless Urinals
Los Angeles Community College District - Los Angeles, California

The Los Angeles Community College District's (LACCD) has installed 1,224 cartridge-type waterless urinals at all nine of its community colleges. The waterless urinals are designed to benefit the District in three ways:

1. Each urinal will save approximately 40,000 gallons of water per year. Combined, that's a savings of almost 50 million gallons of water a year (enough water to fill 259 Olympic-sized pools);

2. Less water consumption will result in a decrease in water bills;

3. Waterless urinals will eliminate the need to send wastewater to treatment plants, therefore reducing the sewage costs District-wide.

Installation of the new waterless urinals is currently underway, with expected completion in February 2010.

2.0 Water Efficiency

2.3.1 Water Efficient Landscaping

2 Points

INTENT

Limit or eliminate the use of potable water, or other natural surface or subsurface water resources available on or near the project site, for landscape irrigation.

REQUIREMENTS

Reduce potable water consumption for irrigation by 50% from a calculated mid-summer baseline case.

Reductions shall be attributed to any combination of the following items:

- Plant species, density and microclimate factor
- Irrigation efficiency
- Use of captured rainwater
- Use of recycled wastewater
- Use of water treated and conveyed by a public agency specifically for non-potable uses

If the percent reduction of Potable Water is equal to or greater than 50%, credit for SAM Credit 2.3.1 Water Efficient Landscaping, Reduce by 50% is earned. If the percent reduction of Potable Water is 100% AND the percent reduction of Total Water is equal to or greater than 50%, credit for SAM Credit 2.3.2 Water Efficient Landscaping, No Potable Water Use or No Irrigation is earned in addition to credit for SAM Credit 2.3.1 Water Efficient Landscaping, Reduce by 50%.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Perform a soil/climate analysis to determine appropriate plant material and design the landscape with native or adapted plants to reduce or eliminate irrigation requirements. Where irrigation is required, use high-efficiency equipment and/or climate-based controllers.

Note that these landscaping strategies provide benefits for the following:

- SAM Credits 1.5.1 Stormwater Design: Quantity Control and 1.5.2 Stormwater Design: Quality Control
- SAM Credits 1.6.1 Landscape and Exterior Design to Reduce Heat Islands: Non-Roof and 1.6.2 Landscape and Exterior Design to Reduce Heat Islands: Roof
- SAM Credits 3.2 Prerequisite 2 – Minimum Energy Performance and 3.4 Optimize Energy Performance
Groundwater seepage that is pumped away from the immediate vicinity of buildings slabs and foundations can be used for landscape irrigation and meet the intent of this credit. However, it must be demonstrated that doing so does not affect site stormwater management systems.

**Standard Practice**

- Irrigation systems are not typically installed airside and the lower maintenance tall fescue is used for all projects per the following CDA/OMP Specifications:
  - CDA/OMP Specification T-901 – Seeding
  - CDA/OMP Specification 02931 – Seeding and Hydro-mulching
  - CDA/OMP Specification 02905 – Sustainable Airport Landscaping, is the airport landscaping specification that deals with other plants and landscaping requirements.

**Recommended Practice**

- Do not install an irrigation system
- Do not install plants that will require irrigation
- Utilize vegetation which may be acceptable for site use (native and/or low-maintenance), with special consideration for vegetated green roofs. Utilize vegetation to reduce or eliminate irrigation requirements for landside areas.
- Minimize the use of high maintenance lawns and annual plants
- Establish areas of high and low landscape maintenance areas. Group plants with similar water-use needs by determining which areas of the site should receive a higher level of care than others and, during drought periods, more irrigation. Coordinate these areas with the irrigation plan. Higher maintenance areas should be located around the major building entries and high traffic areas. Lower maintenance areas should be located on low traffic areas, buffer zones and service areas.

**Best Available Practice**

- Perform a soil and climate analysis to determine the appropriate landscape strategy
- Evaluate stormwater and/or graywater cisterns for capturing rainwater from all new roofs for irrigation
- If irrigation system must be installed, provide for soil moisture monitoring to reduce reliance on manual control and timed devices, as well as for detecting leaks
CASE STUDY

Sustainable Airport Landscaping Design
Chicago Department of Aviation – Chicago, Illinois

For the Chicago Department of Aviation, the key focus of the landscaping design is that it is aesthetically pleasing and at the same time, low maintenance, ecologically and financially sustainable yet does not compromise airport security and aircraft safety, as defined below:

Minimize Wildlife Hazards – The landscaping criteria are intended to minimize wildlife hazards with particular emphasis on large birds (e.g. waterfowl, gulls, raptors), small mammals that may attract raptors, and small birds that congregate into large flocks (e.g. blackbirds, starlings). In general, landscape that provides food or shelter to these types of birds and small mammals is to be avoided.

Increase Landscape Sustainability – In concert with wildlife management, Airport landscaping must be low-maintenance and environmentally sound. Plants that have little or no maintenance requirements are to be used. Plants that minimize or eliminate fertilization, mowing, pest control, and irrigation are to be used whenever possible. Wherever possible, plants native to the Midwest region of the United States are to be used.

Safety and Security – All Airport safety and security protocols related to the placement of landscape features are adhered to in all cases. This may include sight lines for security-sensitive areas (i.e. guard posts) and the line-of-sight for the air traffic control towers and runway approaches.

Example:

Turf grasses – Low maintenance, drought resistant turf grasses are to be used in place of traditional lawn/turf grass (i.e. Kentucky bluegrass) whenever possible. The list of acceptable turf grasses was based on the following criteria:

- Low or Slow Growing – Turf grass species are to grow at a rate that does not require excessive mowing, i.e. more than twice a month during the growing season or no more than six times a year or the mature height of the species does not exceed the recommended mow height.

- Drought Tolerant – Turf grass species are to require no additional irrigation except during establishment. The species must be suitable to Chicago’s climate (USDA Zone 5) and precipitation ranges. Kentucky Bluegrass (*Poa pratensis*) varieties are not acceptable.

- Non-Wildlife Attracting – Turf grass species are to be unattractive to wildlife either due to low palatability of the vegetation (e.g. endophyte toxicity) or through low seed production although the latter can be mitigated through mowing. Clover (*Trifolium* sp.) varieties are not acceptable.
Landside Landscape Uses – Areas where aesthetics will play a larger role such as the terminals, roadway approaches to the airport, landside normally-occupied buildings/facilities, and other areas of high visibility to the public must be designed using low-maintenance plants where possible. Examples of these uses include parking lot islands, roadway medians and/or roadsides, planting beds, large planter containers, building outdoor courtyards or common areas. Some allowances may be made for the use of annuals where appropriate (e.g. hanging planters, small containers, etc.). CDA/OMP Specification 02905 – Sustainable Airport Landscaping, includes a listing of approved plants and trees.

Airside Landscape Uses

Airfield Turf Areas – Areas of the airfield that are within 600’ of any active runway or taxiway are to be planted only with turf grasses. Mowing heights and frequencies are to be strictly enforced within these areas.

Trees – No trees of any kind are to be used anywhere within the AOA (Airside).

Shrubs – The basic landscaping criteria apply for selection of acceptable shrub species. In addition, mass plantings of shrubs or hedge rows are not allowed. Shrubs may be used only as ornamental specimen plants at any normally occupied airside building site or parking lot. Shrubs are not to be placed in open areas of the airfield. Shrubs must be maintained at a height no greater than 6’. Shrubs that mature at a height less than or equal to 6’ are preferable to reduce maintenance.

Green Roofs – Green roof species will typically include Sedum sp. (Stonecrop).

Ornamental Airside Landscaping – Areas where aesthetics are a higher priority, which include terminals, normally-occupied airside buildings/facilities, and the like, should include plants as indicated based on the criteria above, with some exceptions. Examples of these uses include parking lot islands, roadway medians and/or roadsides, planting beds, large planter containers, building outdoor courtyards or common areas.
2.0 Water Efficiency

2.3.2 Water Efficient Landscaping, No Potable Water Use or No Irrigation

2 Points (in addition to credit earned towards SAM Credit 2.3.1)

INTENT

Eliminate the use of potable water, or other natural surface or subsurface water resources available on or near the project site, for landscape irrigation.

REQUIREMENTS

Achieve credit towards SAM Credit 3.3.1 Water Efficient Landscaping, Reduce by 50% and:

Use only captured rainwater, recycled wastewater, recycled graywater, or water treated and conveyed by a public agency specifically for non-potable uses for irrigation.

OR

Install landscaping that does not require permanent irrigation systems. Temporary irrigation systems used for plant establishment are allowed only if removed within one year of installation.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Perform a soil/climate analysis to determine appropriate landscape types and design the landscape with indigenous plants to reduce or eliminate irrigation requirements. Consider using stormwater, graywater, and/or condensate water for irrigation.

Note that these landscaping strategies provide benefits for the following:

- SAM Credits 1.5.1 Stormwater Design: Quantity Control and 1.5.2 Stormwater Design: Quality Control
- SAM Credits 1.6.1 Landscape and Exterior Design to Reduce Heat Islands: Non-Roof and 1.6.2 Landscape and Exterior Design to Reduce Heat Islands: Roof
- SAM Credits 3.2 Prerequisite 2 – Minimum Energy Performance and 3.4 Optimize Energy Performance

Standard Practice

- Irrigation systems are not typically installed airside and the lower maintenance tall fescue is used for all projects per the following CDA/OMP Specifications:
  - CDA/OMP Specification T-901 – Seeding
  - CDA/OMP Specification 02931 – Seeding and Hydro-mulching
Recommended Practice

- Do not install an irrigation system
- Do not install plants that will require irrigation
- Utilize vegetation which may be acceptable for site use (native and/or low-maintenance), with special consideration for vegetated green roofs. Utilize vegetation to reduce or eliminate irrigation requirements for landside areas.

Best Available Practice

- Perform a soil and climate analysis to determine the appropriate landscape strategy
- Evaluate stormwater and/or graywater cisterns for capturing rainwater from all new roofs for irrigation

CASE STUDY

Water Conservation and Management Programs
Los Angeles World Airports – Los Angeles, California

Los Angeles World Airport (LAWA) recognizes that water is a precious resource in Southern California and it must be proactive in its water conservation efforts. LAWA has reduced its water consumption in its everyday operations and continues to find ways to re-use water from local treatment sources. As of 2008, Los Angeles International Airport (LAX) used reclaimed water to irrigate 35 percent of its landscaped acres. Each year 40.2 million gallons (123 acre-feet) of water has been conserved through the utilization of reclaimed water. Additionally, the airport’s car wash facilities use recycled water and the landscape irrigation systems are computer controlled. The toilets and sinks have also been converted to low flow fixtures in the terminals and buildings.

www.lawa.org/welcome_LAWA.aspx?id=1036
2.0 Water Efficiency

2.4 Innovative Wastewater Technologies

2 Points

INTENT

Reduce wastewater generation and potable water demand while increasing the local aquifer recharge.

REQUIREMENTS

OPTION 1

Reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures (water closets, urinals) or non-potable water (captured rainwater, recycled graywater, and on-site or municipally treated wastewater).

OR

OPTION 2

Treat 50% of wastewater on-site to tertiary standards. Treated water must be infiltrated or used on-site.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Specify high-efficiency fixtures and fittings and dry fixtures such as composting toilet systems and non-water using urinals to reduce wastewater volumes. Consider reusing stormwater or graywater for sewage conveyance or on-site mechanical and/or natural wastewater treatment systems. Options for on-site wastewater treatment include packaged biological nutrient removal systems and high-efficiency filtration systems.

Standard Practice

None

Recommended Practice

- Use high-efficiency fixtures and valves
- Utilize fixtures such as dual flush toilets and waterless urinals to reduce wastewater volumes
- Evaluate reusing stormwater for non-potable uses
Best Available Practice

- Capture graywater from lavatories, showers and institutional dishwashing facilities for sewage conveyance or on-site wastewater treatment systems

CASE STUDY

Port of Portland Headquarters
Portland International Airport – Portland, Oregon

In May 2010, the headquarters at Portland International Airport was unveiled, revealing cutting-edge technologies such as an innovative wastewater treatment and recycling system. The system, Living Machine, cleans wastewater through a series of holding tanks, many of which replicate the ecological processes in natural tidal wetlands. The cells alternatively fill and drain, moving the water through specially treated rocks containing microorganisms and plants. The process is so natural that 10 of the cells will appear to visitors as lush plant gardens. Six are located in the lobby at the first-floor entrance, and four are outside an adjoining wall. Based on the experiences at Living Machines installed in over a dozen other buildings around the world, it’s unlikely that visitors will ever suspect the cells are treating water from the building’s sinks, showers and toilets for reuse in toilets. The facility was recently awarded LEED platinum certification.

3.0 ENERGY & ATMOSPHERE

3.1 Prerequisite 1 – Fundamental Building Systems Commissioning

Required

INTENT

For occupied buildings, verify that the project’s energy related systems are installed, calibrated and perform according to the owner’s project requirements, basis of design, and construction documents.

REQUIREMENTS

• The following commissioning process activities shall be completed by the commissioning team. Designate an individual as the Commissioning Authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
  o The CxA shall have documented commissioning authority experience in at least two building projects.
  o The individual serving as the CxA shall be independent of the project’s design and construction management, though they may be employees of the firms providing those services. The CxA may be a qualified employee or consultant of the Owner.
  o The CxA shall report results, findings and recommendations directly to the Owner.
  o For projects smaller than 50,000 gross square feet, the CxA may include qualified persons on the design or construction teams who have the required experience.

• The Owner shall document the Owner’s Project Requirements (OPR). The design team shall develop the Basis of Design (BOD). The CxA shall review these documents for clarity and completeness. The Owner and design team shall be responsible for updates to their respective documents.

• Develop and incorporate commissioning requirements into the construction documents.

• Develop and implement a commissioning plan.

• Verify the installation and performance of the systems to be commissioned.

• Complete a summary commissioning report.

COMMISSIONED SYSTEMS

Commissioning process activities shall be completed for the following energy-related systems, at a minimum:

• Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls

• Lighting and daylighting controls
- Domestic hot water systems
- Renewable energy systems (wind, solar etc.)

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Engage a CxA as early as possible in the design process. Determine the owner's project requirements, develop and maintain a commissioning plan for use during design and construction and incorporate commissioning requirements in bid documents. Assemble the commissioning team, and prior to occupancy verify the performance of energy consuming systems. Complete the commissioning reports with recommendations prior to accepting the commissioned systems. Owners are encouraged to seek out qualified individuals to lead the commissioning process. Qualified individuals are identified as those who possess a high level of experience in the following areas:

- Energy systems design, installation and operation
- Commissioning planning and process management
- Hands-on field experience with energy systems performance, interaction, start-up, balancing, testing, troubleshooting, operation, and maintenance procedures
- Energy systems automation control knowledge

Although the commissioning process should start as early in the design process as possible, it is allowable to engage a CxA agent to execute fundamental commissioning after construction has begun.

Standard Practice

- Commissioning Agents are typically engaged to conduct fundamental commissioning for buildings.

Recommended Practice

- Review the design intent and the basis of design documentation
- Incorporate commissioning requirements into the construction documents
- Develop and utilize a commissioning plan
- Verify installation, functional performance, training, operations and maintenance documentation
- Complete a commissioning report
- Provide the owner with a single manual that contains the information required for re-commissioning systems
- Engage a commissioning team that does not include individuals directly responsible for project design or construction management to evaluate both building and site systems as part of the commissioning plan
• Priority Systems – high energy consuming systems
  o Central Building Automation system
  o All HVAC system equipment
  o Lighting controls and sensors
  o Site Lighting
  o Refrigeration systems
  o Vertical Transport
  o Building Envelope
  o Baggage handling systems (included in process loads: to promote energy savings, use the exceptional calculation method described in ANSI/ASHRAE/IESNA 90.1-2010 G2.5)
  o Information Technology Systems – IT (included in process loads: to promote energy savings, use the exceptional calculation method described in ANSI/ASHRAE/IESNA 90.1-2010 G2.5)

• Lower Priority Systems – low energy consuming system.
  o Emergency Power Generators and Automatic Transfer Switching
  o Uninterruptible Power Supply systems
  o Life Safety systems; Fire protection Fire alarm, Egress pressurization
  o Lightning Protection
  o Domestic and Process water pumping and mixing systems
  o Equipment sound control systems
  o Data and Communication systems
  o Paging systems
  o Security systems
  o Irrigation systems
  o Plumbing
  o Illuminated guidance signage

• For Runways, Civil/Stormwater and Roadways/Rail projects this scope should include the following project components.
  o For support and ancillary buildings include all of the applicable systems and assemblies noted above
  o Runway lighting and illuminated signage
  o Runway NAVAIDS
  o Site lighting systems
  o Traffic signals
  o Stations (e.g., pump stations, lift stations, drainage pumps)
  o Heating/Deicing systems
  o Oil/water separators
3.0 ENERGY & ATMOSPHERE

3.2 Prerequisite 2 – Minimum Energy Performance

Required

INTENT

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

REQUIREMENTS

The requirements for this credit will vary based on the type of project: building versus civil.

Select one of the five compliance path options described below. Options 1, 2, and 3 pertain to buildings; 4 and 5 pertain to civil/infrastructure projects.

OPTION 1 — WHOLE BUILDING ENERGY SIMULATION

Demonstrate a 10% improvement in the proposed building performance rating for new buildings, or a 5% improvement in the proposed building performance rating for major renovations to existing buildings, compared with the baseline building performance rating. Calculate the baseline building performance rating according to the building performance rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2010 (with errata but without addenda) using a computer simulation model for the whole building project.

Appendix G of Standard 90.1-2010 requires that the energy analysis done for the building performance rating method include all energy costs associated with the building project. To achieve points using this credit, the proposed design must meet the following criteria:

- Comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2010 (with errata but without addenda).
- Include all energy costs associated with the building project.
- Compare against a baseline building that complies with Appendix G of Standard 90.1-2010 (with errata but without addenda). The default process energy cost is 25% of the total energy cost for the baseline building. If the building’s process energy cost is less than 25% of the baseline building energy cost, the submittal must include documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to: office and general miscellaneous equipment, computers, elevators and escalators, kitchen

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2 Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all SAM credits.
cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g., lighting integral to medical equipment) and other (e.g., waterfall pumps).

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

Process loads must be identical for both the baseline building performance rating and the proposed building performance rating. However, project teams may follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2010) to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and the proposed design, and theoretical or empirical information supporting these assumptions.

OR

OPTION 2 — PRESCRIPTIVE COMPLIANCE PATH: ASHRAE Advanced Energy Design Guide

Comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide appropriate to the project scope, outlined below. Project teams must comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located.

The building must meet the following requirements:

- Less than 20,000 square feet
- Office occupancy

The building must meet the following requirements:

- Less than 20,000 square feet
- Retail occupancy

The building must meet the following requirements:

- Less than 50,000 square feet
- Warehouse or self-storage occupancy

OR
OPTION 3 — PRESCRIPTIVE COMPLIANCE PATH: Advanced Buildings™ Core Performance™ Guide

Comply with the prescriptive measures identified in the Advanced Buildings™ Core Performance™ Guide developed by the New Buildings Institute. The building must meet the following requirements:

- Less than 100,000 square feet
- Comply with LEED 2009 Section 1: Design Process Strategies, and Section 2: Core Performance Requirements
- Office, school, public assembly, and retail projects less than 100,000 square feet must comply with LEED 2009 Section 1 and Section 2 of the Core Performance Guide
- Other project types less than 100,000 square feet implement the basic requirements of the Core Performance Guide
- Health care, warehouse and laboratory projects are ineligible for this path

OR

OPTION 4 — CIVIL/INFRASTRUCTURE PROJECTS

Comply with the following measures based on the type of civil infrastructure project:

Exterior lighting applications (non-aviation related), such as roadways, surface parking lots, and covered parking garages, must meet the minimum illumination requirements of Tables 6-07-1 and 6-07-2 of Section 6-07 of the OMP Design and Construction Standards, Vol. II, Rev. 3 (June 1, 2006). For the purposes of establishing a baseline energy use, a conventional 400-watt lamp shall be assumed for each fixture, except for low-mast applications or covered areas where a 250-watt lamp is applicable. The benchmark standard shall assume that the lamps are run without lighting controls such as timers and motion sensors. Light sensors, however, should be taken into account.

Pumping systems not directly associated with buildings, which includes but is not limited to storm water conveyance pumps, sanitary pump stations, irrigation systems must be designed so that the operating design point (system curve intersect) shall be 60% to 120% of flow rate at the point of maximum operating efficiency. Pump motors must meet the minimum full-load efficiency requirements in ASHRAE/IESNA Standard 90.1-2010, Table 10.8, for 4-pole, enclosed motors at 1800 rpm.

The minimum standards for all aviation facilities and systems including navigation aids and runway/taxiway lighting shall be in accordance with FAA specifications and standards.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY
Design the building envelope and systems and any powered civil infrastructure systems to meet baseline requirements. Use a computer simulation model, where applicable, to assess the energy performance and identify the most cost-effective energy efficiency measures. Quantify energy performance as compared to a baseline building or civil project.

If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy (DOE) standard process for commercial energy code determination, then the results of that analysis may be used to correlate local code performance with ASHRAE 90.1-2010. Details on the DOE process for commercial energy code determination can be found at: [http://www.energycodes.gov/regulations/determinations](http://www.energycodes.gov/regulations/determinations)

**Standard Practice**


- Most exterior lighting, especially those used for roadway lighting, include the use of high pressure sodium or metal halide lamps with power ranging from 250W to 400W although pedestrian and alley applications may include lamps as low as 50W to 150 W. Induction lighting is used at the ramp areas and the South Cargo Tunnel.

- Pre-Conditioned Air (PCA), 400 Hertz power, hydrant fueling and energy-efficient mobile loading bridges should be included with any new gates or gate retrofits.

**Recommended Practice**

- Design buildings using the more current ASHRAE/IESNA 90.1-2010 standard.

**Best Available Practice**

None

**RESOURCES**


OMP Design and Construction Standards, Vol. II, Rev. 3 (June 1, 2006), §6-07 Lighting
3.0 ENERGY & ATMOSPHERE

3.3 Prerequisite 3 – Fundamental Refrigerant Management

Required

INTENT

Reduce stratospheric ozone depletion.

REQUIREMENTS

Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phase-out conversion prior to project completion. Phase-out plans extending beyond the project completion date will be considered on their merits.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

When reusing existing HVAC systems, conduct an inventory to identify equipment that uses CFC-based refrigerants and provide a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment in the base building that uses no CFC refrigerants.

Standard Practice

- Only HCFC and HFC refrigerants have been used for CDA projects where refrigerants were required (typically R-410a, which is an HFC)

Recommended Practice

None

Best Available Practice

- Although HCFCs and HFCs have ozone depletion potentials (ODP) that are nearly zero, consideration should also be given to their global warming potentials (GWP) (see SAM Credit 3.7 Enhanced Refrigerant Management). Alternative refrigerants that minimize ODP and GWP compared to HCFCs and HFCs include natural refrigerants such as carbon dioxide, ammonia, and propane. These compounds have an ODP of zero and GWPs which are three orders of magnitude less than most HCFCs and HFCs.
CASE STUDY

Central Utilities System
Toronto Pearson International Airport - Toronto, Ontario Canada

Sustainable principles were implemented in an effort to modernize Toronto Pearson International Airport and increase passenger capacity. A new central utilities plant replaced older equipment with a new HVAC system and a state-of-the-art deicing facility. The new system is supplied with chillers that use non-ozone depleting, chlorine free HFC-134a refrigerant. These chillers were customized to add extra temperature sensing capabilities to allow for closer monitoring of the chiller’s motor temperatures, while enhancing equipment safety though an effective preventative maintenance program.

3.0 ENERGY & ATMOSPHERE

3.4 Optimize Energy Performance

1 to 19 Points

INTENT

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

REQUIREMENTS

The requirements for this credit will vary based on the type of project: building versus civil.

For Occupied and Unoccupied Building projects, the requirements will follow the compliance path options as identified in LEED. There are three compliance options, Options 1 to 3, that apply to buildings as described below. Civil projects will adhere to a compliance path, Option 4, that is similar to Option 1 except that the maximum achievable points will be 6, based on the threshold limits in the table below, or the prescriptive compliance path in Option 5. It is assumed that for any project type or compliance option SAM Credit 3.2 Prerequisite 2 – Minimum Energy Performance has been met.

OPTION 1 – WHOLE BUILDING ENERGY SIMULATION (1 to 19 points)

Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2010 (with errata but without addenda) using a computer simulation model for the whole building project. The minimum energy cost savings percentage for each point threshold is as follows:

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>% Energy Reduction Over Baseline*</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4.1</td>
<td>12%</td>
<td>1</td>
</tr>
<tr>
<td>3.4.2</td>
<td>14%</td>
<td>2</td>
</tr>
<tr>
<td>3.4.3</td>
<td>16%</td>
<td>3</td>
</tr>
<tr>
<td>3.4.4</td>
<td>18%</td>
<td>4</td>
</tr>
<tr>
<td>3.4.5</td>
<td>20%</td>
<td>5</td>
</tr>
<tr>
<td>3.4.6</td>
<td>22%</td>
<td>6</td>
</tr>
<tr>
<td>3.4.7</td>
<td>24%</td>
<td>7</td>
</tr>
<tr>
<td>3.4.8</td>
<td>26%</td>
<td>8</td>
</tr>
<tr>
<td>3.4.9</td>
<td>28%</td>
<td>9</td>
</tr>
<tr>
<td>3.4.10</td>
<td>30%</td>
<td>10</td>
</tr>
<tr>
<td>3.4.11</td>
<td>32%</td>
<td>11</td>
</tr>
<tr>
<td>3.4.12</td>
<td>34%</td>
<td>12</td>
</tr>
<tr>
<td>3.4.13</td>
<td>36%</td>
<td>13</td>
</tr>
<tr>
<td>3.4.14</td>
<td>38%</td>
<td>14</td>
</tr>
<tr>
<td>3.4.15</td>
<td>40%</td>
<td>15</td>
</tr>
<tr>
<td>3.4.16</td>
<td>42%</td>
<td>16</td>
</tr>
<tr>
<td>3.4.17</td>
<td>44%</td>
<td>17</td>
</tr>
<tr>
<td>3.4.18</td>
<td>46%</td>
<td>18</td>
</tr>
<tr>
<td>3.4.19</td>
<td>48%</td>
<td>19</td>
</tr>
</tbody>
</table>

* Beyond baseline calculated in SAM Credit 3.2 Prerequisite 2 – Minimum Energy Performance

** Maximum available points for civil projects are 6. The rationale for this is that according to “2003 Commercial Buildings Energy Consumption Survey” by the Energy Information Administration approximately 36% of overall energy use is due to exterior sources, primarily exterior lighting. Therefore, the SAM makes only 6 of the 19 points available to non-building, i.e. civil projects.
Example: An energy simulation indicated that the proposed energy savings for the new air traffic control tower (new building) was 17% over the ASHRAE/IESNA 90.1-2010 standard. The project would then achieve 3 points under this credit.

Appendix G of ASHRAE Standard 90.1-2010 requires that the energy analysis done for the Building Performance Rating Method include ALL of the energy costs within and associated with the building project. To achieve points using this credit, the proposed design must meet the following criteria:

- Comply with the mandatory provisions in ASHRAE Standard 90.1-2010, Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4 (without amendments)
- Include all the energy costs within and associated with the building project
- Compare against a baseline building that complies with Appendix G to ASHRAE Standard 90.1-2010 (without amendments). The default process energy cost is 25% of the total energy cost for the baseline building. For buildings where the process energy cost is less than 25% of the baseline building energy cost, the submittal must include supporting documentation substantiating that process energy inputs are appropriate.

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

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

For this credit, process loads shall be identical for both the baseline building performance rating and for the proposed building performance rating. However, project teams may follow the Exceptional Calculation Method (ASHRAE 90.1-2010 G2.5) to document measures that reduce process loads. Documentation of process load energy savings shall include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

OR

OPTION 2 — PRESCRIPTIVE COMPLIANCE PATH: ASHRAE Advanced Energy Design Guide (1 Point)

Comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide appropriate to the project scope, outlined below. Project teams must comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located.

The building must meet the following requirements:

- Less than 20,000 square feet
- Office occupancy


The building must meet the following requirements:

- Less than 20,000 square feet
- Retail occupancy


The building must meet the following requirements:

- Less than 50,000 square feet
- Warehouse or self-storage occupancy

OR

OPTION 3 — PRESCRIPTIVE COMPLIANCE PATH: Advanced Buildings™ Core Performance™ Guide (1-3 Points)

Comply with the prescriptive measures identified in the Advanced Buildings™ Core Performance™ Guide developed by the New Buildings Institute. The building must meet the following requirements:

- Less than 100,000 square feet
- Comply with Section 1: Design Process Strategies, and Section 2: Core Performance Requirements
- Health care, warehouse or laboratory projects are ineligible for this path

Points achieved under Option 3 (1 point):

- 1 point is available for all office, school, public assembly, and retail projects less than 100,000 square feet that comply with Sections 1 and 2 of the Core Performance Guide
- Up to 2 additional points may be awarded to projects that implement performance strategies listed in Section 3, Enhanced Performance. For every three strategies implemented from this section, one point is available.
- The following strategies are not eligible for additional points under this Credit:
  - 3.1-Cool Roofs
  - 3.8-Night Venting
  - 3.13-Additional Commissioning
OR

OPTION 4 —COMPLIANCE PATH: CIVIL/INFRASTRUCTURE PROJECTS (1 – 6 Points)

Up to 6 points may be awarded to Civil/Infrastructure projects. To obtain points in this credit, the energy usage of the respective infrastructure elements must exceed the benchmark requirements in SAM Credit 3.2 Prerequisite 2 – Minimum Energy Performance, Option 4, by the levels shown below:

**Exterior Lighting (non-aviation related)**

Exterior lighting applications (non-aviation related), such as roadways, surface parking lots and covered parking garages, the benchmark standard shall be equal to the energy use if all the fixtures on a project used 400-watt or 250-watt lamps, depending on the appropriate application (see also SAM Credit 4.2). Points are awarded when the proposed design reduces the energy use over the benchmark standard by the following levels:

1 point = 8% improvement over benchmark standard
2 points = 16% improvement over benchmark standard
3 points = 24% improvement over benchmark standard
4 points = 32% improvement over benchmark standard
5 points = 40% improvement over benchmark standard
6 points = 48% improvement over benchmark standard

NOTE: For parking lots associated with buildings, the parking lighting should be considered a part of the building’s electrical usage and therefore Options 1, 2, or 3 should be used. This option is to be used only for stand-alone parking areas or structures not directly associated with a building.

**Example:** The proposed design of a parking lot includes five high-mast light standards with two fixtures each and four lower level pedestrian lighting fixtures. The design calls for LED lighting to be used for all fixtures. The benchmark standard would be calculated such that there are 10 – 400 watt lamps for the parking lighting and 4 – 250 watt lamps for the pedestrian lighting. The benchmark standard is calculated to be 5,000 watts (10×400 + 4×250). The proposed LED lights are rated for 100 watts and 75 watts, respectively, for the parking and pedestrian lighting. Therefore, assuming no special lighting controls, the proposed energy rating for the project is 1,300 watts (10×100 + 4×75), a 74% reduction compared to the benchmark standard. This project would earn 6 points under this credit.
Pumping Systems

Pumping systems not directly associated with buildings, must exceed the minimum full-load efficiency requirements in ASHRAE/IESNA Standard 90.1-2010, Table 10.8, for 4-pole, enclosed motors at 1800 rpm by the following levels:

1 point = 8% improvement over benchmark standard
2 points = 16% improvement over benchmark standard
3 points = 24% improvement over benchmark standard
4 points = 32% improvement over benchmark standard
5 points = 40% improvement over benchmark standard
6 points = 48% improvement over benchmark standard

Airfield Lighting

For runway/taxiway lighting, exceed the minimum FAA specifications by the levels below. Note that the benchmark calculation shall assume that conventional lights are used throughout the project and that the calculation must be based on annual energy consumption and use seasonal climate data for the region, where applicable.

1 point = 8% improvement over benchmark standard
2 points = 16% improvement over benchmark standard
3 points = 24% improvement over benchmark standard
4 points = 32% improvement over benchmark standard
5 points = 40% improvement over benchmark standard
6 points = 48% improvement over benchmark standard

For projects that include multiple infrastructure elements such as those listed above, a weighted average based on the annual energy usage shall apply.

Example: A roadway project that includes a lift station realizes an annual energy savings of 65% over the benchmark standard for roadway lighting and 15% over the benchmark standard for pump systems. If the annual energy usage of the roadway lighting and the lift station is 40,000 kWh and 60,000 kWh, respectively, then the overall annual energy savings for the project is 35%. Therefore, 4 points are earned for this credit.
In some cases, there may be powered infrastructure elements that do not appear in the categories above for Option 4. In those cases, the designer may choose to demonstrate the energy savings based on an appropriate benchmark and submit for SRP review.

OR

OPTION 5 – PRESCRIPTIVE COMPLIANCE PATH: CIVIL/INFRASTRUCTURE PROJECTS (1 – 3 Points)

For civil/infrastructure projects, in lieu of performing a detailed energy usage calculation, a prescriptive compliance path is available. To earn points using this method, the project must meet SAM Credit 4.2 Prerequisite 2 – Minimum Energy Performance, Option 4, where applicable, and use any of the energy saving technologies or strategies listed in the table below.

A point is awarded for each of the following technologies up to a maximum of 3 points for this credit.

<table>
<thead>
<tr>
<th>Technology/Strategy</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED lighting for roadways, parking areas, or pedestrian areas</td>
<td>1</td>
</tr>
<tr>
<td>LED runway lights or taxiway lights</td>
<td>1</td>
</tr>
<tr>
<td>Nighttime/motion sensor or electronically-controlled ballast activation for roadway, parking, or pedestrian lighting, as applicable, with special consideration for safety.</td>
<td>1</td>
</tr>
<tr>
<td>High efficiency motors, &gt;92% at full load for all motor horsepower ratings</td>
<td>1</td>
</tr>
<tr>
<td>Variable speed drive for pump motors</td>
<td>1</td>
</tr>
<tr>
<td>Solar powered signage, lighting, or equipment</td>
<td>1</td>
</tr>
<tr>
<td>The SRP will consider other proposed strategies or technologies</td>
<td>1</td>
</tr>
<tr>
<td>NOTE: The awarding of points will be at the discretion of the SRP.</td>
<td></td>
</tr>
</tbody>
</table>

Example Calculation:

\[
\left( \frac{65\% \times (40,000 \text{ kWh}) + (15\%) \times (60,000 \text{ kWh})}{100,000 \text{ kWh}} \right) = 35\%
\]

= 35% overall energy savings for entire project; therefore 4 points earned for SAM Credit 3.4

Example: A service road that meets the requirements of SAM Credit 3.2 Prerequisite 2 – Minimum Energy Performance also uses LED fixtures for the roadway lighting (1 point) and uses light sensors to turn these lights on/off automatically depending on ambient light levels (additional 1 point). This project would earn 2 points overall for this credit using this option.
SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Design the building envelopes, infrastructure, and powered systems to maximize energy performance. Use a computer simulation models or engineering design calculations to assess the energy performance and identify the most cost-effective energy efficiency measures. Quantify energy performance compared with a baseline building or infrastructure system.

Standard Practice

- For Civil/Infrastructure: Exterior lighting is typically high pressure sodium or metal halide lamps. Larger pump systems use variable frequency drives and efficient motors. LED lights are standard practice for all taxiways. Newer pump stations have installed variable speed drives and high efficiency motors.

Recommended Practice

Consider the following for buildings and structures:

- Use a computer simulation model to assess energy performance and identify the most cost effective energy measures
- Provide high-efficiency motors and variable-speed pumping systems
- Provide energy efficient lighting systems including LED, fluorescent lighting, solar lighting and the use of lighting sensors or timers
- Organize circuiting of lighting and building systems so that individual areas may be separately controlled relative to daylight and heating/cooling zones
- Orient building to optimize passive solar and/or daylight penetration
- Optimize architectural features for daylighting and glare control. Consider light shelves, ceiling design, window placement, and window treatments
- Provide motion sensors in stairs, toilet rooms, storage rooms and equipment rooms unless life safety is compromised
- Provide “Energy Star” compliant equipment and appliances
- Control air infiltration through all exterior openings including loading docks
- Use LED lighting, wherever applicable
- Optimize lighting controls for energy savings and function
- Provide daylight harvesting control systems
• Use high performance glazing (double glazed, low-e) and window systems
• Evaluate appropriate levels of insulation and for building envelope

Consider the following for all civil and infrastructure projects:

• Use LED lighting wherever applicable and approved for:
  o Runways, as approved
  o Taxiways
  o Distance remaining signs
  o In-surface fixtures
  o Obstruction lighting
  o NAVAIDS and windsocks
  o Ramp area lighting
  o Traffic signals/Stop signs
  o Directional signs
  o Other areas, as approved
  o LED lighting for roadways, parking areas, or pedestrian areas

• Nighttime/motion sensor or electronically-controlled ballast activation for roadway, parking, or pedestrian lighting, as applicable, with special consideration for safety
• High efficiency motors, generators and pumps
• Variable speed drives for pump motors
• Solar powered signage, lighting, or equipment

Best Available Practice

Consider the following for buildings and structures:

• Evaluate cogeneration for new terminals and concourses
• Integrate lighting systems with Building Automation System
• Use spectrally selective glazing
• Evaluate underfloor air distribution systems in office-type spaces
• Evaluate thermal mass for building envelope
• Evaluate “green walls” for building façade
• Utilize premium efficiency motors where applicable
• Ground-source heat pumps for pre-heating/pre-cooling of water systems
• For in-terminal seating – integrated power stations

Consider the following for civil and infrastructure projects:

• Use induction lighting
• Comprehensive “smart” systems for lighting and signage
• Reduce energy transmission loss
• Proximity of power sources/on-site generation
• Nanotechnologies and biomimicry

CASE STUDIES

Delta Airlines Terminal A
Boston Logan International Airport - Boston, Massachusetts

Terminal A at Boston Logan International Airport has become the first airport terminal in the country to win certification for its green technology. The terminal, which opened to Delta Air Lines customers in March 2005, received the Leadership in Energy and Environmental Design certification for Environmental Sustainability from the US Green Building Council.

www.boston.com/news/local/articles/2006/08/02/logans_terminal_a_goes_green/

Moving Walkways
Boston Logan International Airport - Boston, Massachusetts

Boston Logan International Airport is undergoing tests on energy-efficient moving walkways. The walkways are equipped with EcoStart, which contains a motor efficiency controller that soft starts an electric motor, bringing it from rest to full speed. Once at full speed, the EcoStart monitors the motor and improves its efficiency when operating. Initial test efforts are estimated to conserve approximately 60,000 kilowatt-hours (kWh) per year.


Baggage Check-In Building
Reno-Tahoe International Airport - Reno, Nevada

The new airport baggage check-in building at Reno-Tahoe International Airport was designed with an efficient HVAC system, in addition to utilization of energy-efficient entryways to reduce heat/cooling loss. This helps the airport monitor and reduce overall energy use.

3.0 ENERGY & ATMOSPHERE

3.5 On-Site Renewable Energy

1 to 7 Points

INTENT

Encourage and recognize increasing levels of on-site renewable energy self-supply in order to reduce environmental and economic impacts associated with fossil fuel energy use.

REQUIREMENTS

Use on-site renewable energy systems to offset building energy cost. Calculate project performance by expressing the energy produced by the renewable systems as a percentage of the building annual energy cost and using the table below to determine the number of points achieved.

Determine the percentage of energy derived from renewable energy equipment against the proposed energy cost calculated for SAM Credit 3.4 Optimize Energy Performance. If no energy model was prepared for SAM Credit 3.4 Optimize Energy Performance, use the Department of Energy (DOE) Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use in the case of a building project. For civil projects, the portion of energy derived from renewable energy systems will be based on the fraction of the total energy replaced with on-site generated renewable energy assuming the project used conventional energy supplies (utility supplied electricity and gas).

SAM Credit 8.4 Menu Items address the use of lesser amounts renewable energy on a project, amounts that do not meet the 1% threshold in this credit.

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Percentage of Renewable Energy</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5.1</td>
<td>1%</td>
<td>1</td>
</tr>
<tr>
<td>3.5.2</td>
<td>3%</td>
<td>2</td>
</tr>
<tr>
<td>3.5.3</td>
<td>5%</td>
<td>3</td>
</tr>
<tr>
<td>3.5.4</td>
<td>7%</td>
<td>4</td>
</tr>
<tr>
<td>3.5.5</td>
<td>9%</td>
<td>5</td>
</tr>
<tr>
<td>3.5.6</td>
<td>11%</td>
<td>6</td>
</tr>
<tr>
<td>3.5.7</td>
<td>13%</td>
<td>7</td>
</tr>
</tbody>
</table>

Example: A civil project, for example a pumping station, with a proposed energy consumption calculated at 100,000 kWh per year assuming all its energy was supplied by utility electricity, installed a wind turbine that can generate 6,000 kWh per year or 6% of the total proposed energy consumption. The project would then achieve 3 points under this credit.
SUBMITTALS
Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY
Assess the project for non-polluting and renewable energy potential including solar, wind, geothermal, low-impact hydro, biomass and bio-gas strategies. When applying these strategies, take advantage of net metering with the local utility. Energy systems which are not eligible for this credit (but may be applicable under another credit) include architectural features such as daylighting and passive solar techniques, ground source heat pumps using small quantities of deep earth heat and vapor compression systems, and renewable energy from off-site sources.

Standard Practice
The following are Standard Practice:

- Solar powered signage
- Solar powered RPU for weather sensors
- Solar powered obstruction and barricade lighting
- Solar thermal water heating has been used at a number of locations, such as the ARFF Station #2, which has a system that provides hot water for up to 18 full time occupants

Recommended Practice
None

Best Available Practice
The following technologies should be considered for any applicable projects:

- Roof-mounted or building integrated photovoltaic panels
- Electricity generation using bio-fuels (untreated wood waste, agricultural crops or waste, landfill gas)
- Solar-thermal water or air heating
- Geothermal heating systems
- Geothermal electrical systems

CASE STUDIES
Wind Turbines
Boston Logan International Airport - Boston, Massachusetts

A fleet of miniature wind turbines at Boston Logan International Airport are affixed to the roof to capture the winds that gust through Boston Harbor. The 20 turbines generate about 100,000 kilowatt-hours annually, nearly 3% of the building's energy needs.

https://www.massport.com/environment/green-initiatives/
Hangar 25
Bob Hope Airport - Burbank, California

Hangar 25 at Bob Hope Airport, Burbank, California, is a $17 million structure designed to be a model of green construction and was built for what a traditional aircraft hangar would cost, according to Andy Meyers, president of Shangri-La Construction. The hangar features solar panels, skylights, artificial grass, low-flush toilets, and massive aerating fans. Situated on a former industrial lot with a cement slab, the hangar property now houses a state-of-the-art green aviation hangar minimizing the 51,000-square-foot building's carbon footprint. Avjet Corp. is the building owner. The building received a Platinum LEED® certification. In addition to providing power to run the tools and machines to maintain the planes, the energy from the solar panels on the roof powers the building's offices, copiers, computers and coffee machines. The building generates 110 percent of the energy it needs and then gives the surplus energy back to the municipal grid. Grates at the building's entrance scrape off contaminants under shoes. No toxic chemicals fill the fire suppression system. The concrete floor has no chemical polymers. In the office area, all of the cabinets are made of Plyboo®, a type of bamboo with a water-based finish.

http://www.usgbc.org/projects/hangar-25

Author: Jerry Berrios, Contra Costa Times, December 10, 2008
See Also:
www.huffingtonpost.com/paige-donner/greening-hollywood-jet-ha_b_150102.html

Solar Power System
Denver International Airport - Denver, Colorado

Denver’s second large-scale solar power system became operational in December 2009; this new 1.6 MW Sharp solar power array powers the airport’s fuel-storage and distribution facility. Just a year prior in 2008, the airport introduced the first solar power array that consisted of a two megawatt solar panel system designed to generate over three million kilowatt hours of clean electricity annually. These cost-effective energy systems were developed by a public-private partnership utilizing tax credits and incentives. This initiative shows that airports can embrace renewable energy in a financially viable way and increase the overall sustainability of their operations.

And
3.0 ENERGY & ATMOSPHERE

3.6 Enhanced Commissioning

2 Points

INTENT

Begin the commissioning process early in the design process and execute additional activities after systems performance verification is completed.

REQUIREMENTS

Implement, or have a contract in place to implement, the following additional commissioning process activities in addition to the requirements of SAM Credit 3.1 Prerequisite 1 – Fundamental Building Systems Commissioning:

- Prior to the start of the construction documents phase, designate an independent Commissioning Authority (CxA) to lead, review, and oversee the completion of all commissioning process activities.
  - The CxA shall have documented commissioning authority experience in at least two building projects.
  - The individual serving as the CxA:
    - Must be independent of the work of design and construction;
    - Must not an employee of the design firm, though they may be contracted through them;
    - Must not be an employee of, or contracted through, a contractor or construction manager holding construction contracts; and
    - May be a qualified employee or consultant of the Owner.
  - The CxA must report results, findings and recommendations directly to the Owner.
- The CxA must conduct, at a minimum, 1 commissioning design review of the Owner’s Project Requirements (OPR), Basis of Design (BOD), and design documents prior to mid-construction documents phase and back-check the review comments in the subsequent design submission.
- The CxA must review contractor submittals applicable to systems being commissioned for compliance with the OPR and BOD. This review shall be concurrent with A/E reviews and submitted to the design team and the Owner.
- The CxA or other project team members must develop a systems manual that gives future operating staff the information needed to understand and optimally operate the commissioned systems.
The CxA or other project team members must verify that the requirements for training operating personnel and building occupants are completed.

The CxA must be involved in reviewing the operation of the building with operations and maintenance (O&M) staff and occupants within 10 months after substantial completion. A plan for resolving of outstanding commissioning-related issues must be included.

SUBMITTALS
Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY
Although it is preferable that the CxA be contracted by the Owner, for the enhanced commissioning credit, the CxA may also be contracted through the design firms or construction management firms not holding construction contracts. The LEED Reference Guide provides detailed guidance on the rigor expected for following process activities:

- Commissioning design review
- Commissioning submittal review
- Systems manual

Though the commissioning process should start as early in the design process as possible, it is allowable to engage a CxA agent to conduct the design review required after construction has started, so long as the project team agrees to implement any requested changes both to the documents and to construction that may have already occurred.

Standard Practice
None

Recommended Practice
- Review the design intent and the basis of design documentation
- Incorporate commissioning requirements into the construction documents
- Develop and utilize a commissioning plan
- Verify installation, functional performance, training, operations and maintenance documentation
- Complete a commissioning report
- Provide the owner with a single manual that contains the information required for re-commissioning systems
- Engage a commissioning team that does not include individuals directly responsible for project design or construction management to evaluate both building and site systems as part of the commissioning plan
- Priority Systems - high energy consuming systems.
o Central Building Automation system
o All HVAC system equipment
o Lighting controls and sensors
o Site Lighting
o Refrigeration systems
o Vertical Transport
o Building Envelope
o Baggage handling systems (included in process loads: to promote energy savings, use the exceptional calculation method described in ANSI/ASHRAE/IESNA 90.1-2010 G2.5)
  o Information Technology Systems - IT (included in process loads: to promote energy savings, use the exceptional calculation method described in ANSI/ASHRAE/IESNA 90.1-2010 G2.5)

- Lower Priority Systems – low energy consuming system.
  o Emergency Power Generators and Automatic Transfer Switching
  o Uninterruptible Power Supply systems
  o Life Safety systems; Fire protection Fire alarm, Egress pressurization
  o Lightning Protection
  o Domestic and Process water pumping and mixing systems
  o Equipment sound control systems
  o Data and Communication systems
  o Paging systems
  o Security systems
  o Irrigation systems
  o Plumbing
  o Illuminated guidance signage

- For Runways, Civil/Stormwater and Roadways/Rail projects this scope should include the following project components.
  o For support and ancillary buildings include all of the applicable systems and assemblies noted above
  o Runway lighting and illuminated signage
  o Runway NAVAIDS
  o Site lighting systems
  o Traffic signals
  o Stations (e.g., pump stations, lift stations, drainage pumps)
  o Heating/Deicing systems
  o Oil/water separators

Best Available Practice

None
CASE STUDY

STAR Program
Metropolitan Airports Commission – Minneapolis, Minnesota

Minneapolis – St. Paul International Airport recently launched the Stewards of Tomorrow’s Airport Resources (STAR) initiative. Airport operators develop and implement sustainable solutions that address long-term environmental, operational, financial and social needs. Goals include minimizing impacts to air quality, reducing waste reduction and hazardous materials use, as well as developing alternative energy programs.

www.enviro.aero/MSPSTAR.aspx
3.0 ENERGY & ATMOSPHERE

3.7 Enhanced Refrigerant Management

2 Points

INTENT

Reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming.

REQUIREMENTS

OPTION 1

Do not use refrigerants.

OR

OPTION 2

Complete both of the following:

Select refrigerants and HVAC&R that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. The base building HVAC&R equipment shall comply with the following formula, which sets a maximum threshold for the combined contributions to ozone depletion and global warming potential:

\[ \text{LCGWP} + \text{LCODP} \times 10^5 \leq 100 \]

Where:

\[ \text{LCODP} = \left( \text{ODP}_r \times (L_r \times \text{Life} + M_r) \times R_c \right) / \text{Life} \]

\[ \text{LCGWP} = \left( \text{GWP}_r \times (L_r \times \text{Life} + M_r) \times R_c \right) / \text{Life} \]

LCODP: Lifecycle Ozone Depletion Potential (lb CFC11/Ton-Year)

LCGWP: Lifecycle Direct Global Warming Potential (lb CO₂/Ton-Year)

GWPₙ: Global Warming Potential of Refrigerant (0 to 12,000 lb CO₂/lbr)

ODPₙ: Ozone Depletion Potential of Refrigerant (0 to 0.2 lb CFC11/lbr)

L_r: Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)

M_r: End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)

R_c: Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of cooling capacity)
Life: Equipment Life (10 years; default based on equipment type, unless otherwise demonstrated)

For multiple types of equipment, a weighted average of all base building level HVAC&R equipment shall be applied using the following formula:

\[
\left[ \sum (\text{LCGWP} + \text{LCODP} \times 10^5) \times Q_{\text{unit}} \right] \div Q_{\text{total}} \leq 100
\]

Where:

- \( Q_{\text{unit}} \) = Cooling capacity of an individual HVAC or refrigeration unit (Tons)
- \( Q_{\text{total}} \) = Total cooling capacity of all HVAC or refrigeration

Small HVAC units (defined as containing less than 0.5 lbs of refrigerant), and other equipment such as standard refrigerators, small water coolers, and any other cooling equipment that contains less than 0.5 lbs of refrigerant, are not considered part of the “base building” system and are not subject to the requirements of this credit.

AND

Do not install fire suppression systems that contain ozone-depleting substances (CFCs, HCFCs or Halons).

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Design and operate the facility without mechanical cooling and refrigeration equipment. Where mechanical cooling is used, utilize base building HVAC and refrigeration systems for the refrigeration cycle that minimize direct impact on ozone depletion and global warming. Select HVAC&R equipment with reduced refrigerant charge and increased equipment life. Maintain equipment to prevent leakage of refrigerant to the atmosphere. Utilize fire suppression systems that do not contain HCFCs or Halons.

Standard Practice

None

Recommended Practice

None

Best Available Practice

- Use natural refrigerants (carbon dioxide, ammonia, propane) where possible, in order to minimize ODPs and GWPs
3.0 ENERGY & ATMOSPHERE

3.8 Measurement and Verification

3 Points

INTENT

Provide for the ongoing accountability of building energy consumption over time.

REQUIREMENTS

- The M&V period shall cover a period of no less than one year of post-construction occupancy

SUBMITTALS

Include descriptive narrative in SAM Checklist and M&V Plan.

TECHNOLOGY/STRATEGY

Develop an M&V Plan to evaluate building and/or energy system performance. Characterize the building and/or energy systems through energy simulation or engineering analysis. Install the necessary metering equipment to measure energy use. Track performance by comparing predicted performance to actual performance, broken down by component or system as appropriate. Evaluate energy efficiency by comparing actual performance to baseline performance.

While the IPMVP describes specific actions for verifying savings associated with energy conservation measures (ECMs) and strategies, this Credit expands upon typical IPMVP M&V objectives. M&V activities should not necessarily be confined to energy systems where ECMs or energy conservation strategies have been implemented. The IPMVP provides guidance on M&V strategies and their appropriate applications for various situations. These strategies should be used in conjunction with monitoring and trend logging of significant energy systems to provide for the ongoing accountability of building energy performance.
Standard Practice

None

Recommended Practice

- Install continuous metering equipment for the following end-uses:
  - Lighting systems and controls
  - Constant and variable motor loads
  - Variable frequency drive (VFD) operation
  - Chiller efficiency at variable loads (kW/ton)
  - Cooling load
  - Air and water economizer and heat recovery cycles
  - Air distribution static pressures and ventilation air volumes
  - Boiler efficiencies
  - Building-related process energy systems and equipment
  - Indoor water risers and outdoor irrigation

- Develop a Measurement and Verification plan that incorporates the monitoring information from the above end-uses and is consistent with Option B, C or D of the 2001 International Performance Measurement & Verification Protocol (IPMVP) Volume I: Concepts and Options for Determining Energy and Water Savings.

- Investigate whether these facilities will be included in the City of Chicago’s Global Building Monitoring System

- Consider the recommendations included in the Chicago Climate Action Plan

Best Available Practice

- Draft a Measurement and Verification Plan to apply during building operation that compares predicted savings to those achieved

CASE STUDY

Airport Monitoring System
San Francisco International Airport – San Francisco, California

Energy and building management systems assist in controlling and monitoring mechanical and electrical systems in airport buildings. The utilities management system at San Francisco International Airport ensures efficient energy distribution and helps to diagnose the maintenance needs for HVAC, lighting, and other electrical systems, as well as optimizes energy consumption.
3.0 ENERGY & ATMOSPHERE

3.9 Green Power

2 Points

INTENT

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

REQUIREMENTS

Engage in at least a 2-year renewable energy contract to provide at least 35% of the building’s electricity from renewable sources, as defined by the Center for Resource Solutions Green-e Energy product certification requirements. Use one of the following two options to determine the baseline electricity use:

OPTION 1 - DETERMINE THE BASELINE ELECTRICITY USE

Use the annual electricity consumption from the results of the subparts of SAM Credit 3.4 Optimize Energy Performance.

OR

OPTION 2 - ESTIMATE BASELINE ELECTRICITY USE

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

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Determine the energy needs of the building and investigate opportunities to engage in a green power contract. Green power is derived from solar, wind, geothermal, biomass or low-impact hydro sources. Visit www.green-e.org/energy for details about the Green-e program. The power product purchased to comply with credit requirements need not be Green-e certified. Other sources of green power are eligible if they satisfy the Green-e program’s technical requirements. Renewable energy certificates (RECs), tradable renewable certificates (TRCs), green tags and other forms of green power that comply with Green-e’s technical requirements can be used to document compliance with this section.
Standard Practice
None

Recommended Practice
- Determine the City of Chicago’s Green Power requirements for the task/project and investigate opportunities to engage in a green power contract with the utility
- Visit [www.green-e.org](http://www.green-e.org) for details about the Green-e program

Best Available Practice
None

CASE STUDIES

Green Power
Los Angeles World Airports - Los Angeles, California

Los Angeles World Airports (LAWA) has embraced energy efficiency for over 20 years. The efficient use of energy and the incorporation of green power are critical factors in sustainable operations at LAWA’s facilities. LAWA has retrofitted existing buildings with energy efficient lighting fixtures, ballasts and bulbs. It has upgraded 80 percent of the building air handling units with variable speed drives and soft-start controls. Additionally, 60 percent of LAWA computer servers have been upgraded to high efficiency servers. Twenty-five percent of Los Angeles International Airport’s (LAX) power comes from green sources. LAX’s Central Utilities Plant co-generates steam to heat and air condition passenger terminals and offices. When feasible, Ontario International Airport (ONT) closes one of the runways at night to save power. ONT is also installing occupancy sensors in their administration areas and encouraging employees to turn off the lights. When appropriate, inefficient fan drives are replaced with variable fan drives.


Electricity from Waste
Los Angeles World Airports - Los Angeles, California

Over 8,000 tons of food waste produced each year at Los Angeles International Airport is being used to produce methane gas which is then recycled and turned into electricity. This complex process involves food being ground up and mixed with water, creating a slurry, which is then heated up into methane gas and carbon dioxide. Eventually this is transferred offsite to an adjacent power generation plant and converted into electricity.

[http://waste360.com/mag/waste_los_angeles_airport](http://waste360.com/mag/waste_los_angeles_airport)
4.0 MATERIALS & RESOURCES

4.1 Prerequisite 1 – Storage and Collection of Recyclables

Required

INTENT
Facilitate the reduction of waste generated by building occupants and for civil/infrastructure projects within the airport environment that is hauled to and disposed of in landfills.

REQUIREMENTS
Provide an easily accessible dedicated area or areas that serve the entire building and for the airport environment for the collection and storage of materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics and metals. An area should also be dedicated to collection and storage of plant-based landscaping debris (trimmings), unless the site has no landscaping.

NOTE: For construction waste, see SAM Credits 4.3 Construction Waste Management and 6.5 Construction Waste Management.

SUBMITTALS
Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY
Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area. These areas would likely be designed and sized differently depending on the ultimate use and waste stream of the facility (e.g., terminal, airfield, office, airlines, concessionaires, cargo, hangar, etc.) Identify local waste handlers and buyers for glass, plastic, office paper, e-waste, newspaper, cardboard, metals, fluids, fixtures, and organic wastes. Instruct occupants, employees and contractors on the recycling procedures. Consider employing cardboard balers, aluminum can crushers, recycling chutes and other waste strategies to further enhance the recycling program.

Standard Practice
- These items are addressed in varying degrees utilizing appropriate strategies within an airport environment. For additional details, see CDA Best Management Practices (BMPs) Manual. Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area.
- Investigate and incorporate collection rooms for recycling streams that make sense for each facility.
Recommended Practice

- Coordinate recyclable waste collection with hauler capability
- Recycle the following waste, whenever feasible:
  - Aluminum
  - Glass
  - Paper, newspapers, magazines and cardboard
  - Carpet
  - Wood (pallets/crates, etc.)
  - Food waste/grease and compostables
  - Organic waste and compostables
  - Gas & oil filters
  - Motor oil and Anti-freeze
  - Scrap metal
  - Batteries
  - Light bulbs
  - Toner cartridges
  - Tires
  - Electrical wiring
  - Electronics including monitors
  - Deicing fluid
  - “Foreign Object Debris” (FOD)
- Instruct employees, users and occupants on recycling procedures

Best Available Practice

- Employ cardboard balers, aluminum can crushers, recycling chutes and other technologies to enhance the recycling program
- Reduce use of water bottles by enabling provisions for water dispensers for refills
- Reduce use of water bottles by providing area and collection capability on non-secured side of terminal to allow for the dumping of liquids and refill opportunity post security

CASE STUDIES

Airline Pillow Recycling
Oakland International Airport - Oakland, California

Oakland International Airport is one of the first airports in the nation to participate in a pillow recycling program. Instead of being discarded, the pillows are used as insulation or as material in making furniture.

Recycling Initiative
Seattle-Tacoma International Airport - Seattle, Washington

In addition to recycling 10 to 12 tons of coffee grounds a month, Sea-Tac also went from recycling 112 tons of material in 2003 to an estimated 1,200 tons just five years later — everything from contaminated soil to motor oil. This was projected to have a savings of $130,000 in disposal fees.

4.0 MATERIALS & RESOURCES

4.2 Building and Infrastructure Reuse

1 to 4 Points

INTENT

Extend the life cycle of existing building stock and infrastructure, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings and infrastructure as they relate to materials manufacturing and transport.

REQUIREMENTS

Maintain the existing building structure (including structural floor and roof decking) and envelope (the exterior skin and framing, excluding window assemblies and non-structural roofing material) and infrastructure components (pavement, piping, etc.). The minimum percentage building and infrastructure reuse for each point threshold is shown in the table below.

Hazardous materials that are remediated as a part of the project must be excluded from the calculation of the percentage maintained. If the project includes an addition that is more than two (2) times the square footage of the existing building, this credit is not applicable.

AND/OR

Use existing interior nonstructural elements (e.g., interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building, including additions.

If the project includes an addition with square footage more than two times the square footage of the existing building, this credit is not applicable.

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Requirement</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.1</td>
<td>Maintain 55% Existing Walls, Floors, and Roof or Infrastructure</td>
<td>1</td>
</tr>
<tr>
<td>4.2.2</td>
<td>Maintain 75% Existing Walls, Floors, and Roof or Infrastructure</td>
<td>2</td>
</tr>
<tr>
<td>4.2.3</td>
<td>Maintain 95% Existing Walls, Floors, and Roof or Infrastructure</td>
<td>3</td>
</tr>
<tr>
<td>4.2.4</td>
<td>Maintain 50% Interior Non-Structural Elements</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Only up to three points are available for infrastructure projects. For projects with both building and infrastructure elements, it is at the discretion of the designer to choose which reuse opportunity will be used to calculate the reuse percentage.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.
TECHNOLOGY/STRATEGY

Consider reuse of existing, previously occupied buildings, including structure, envelope and elements and infrastructure. Remove elements that pose contamination risk and upgrade components that would improve energy and water efficiency such as windows, mechanical systems and plumbing fixtures.

Standard Practice

- Evaluate relocation of existing structures for reuse (with special consideration of historical components)
- Consider adaptive reuse of building(s) / structure(s) and potential relocation for the same program use
- Evaluate maximizing reuse of existing runway and other infrastructure (e.g., utilities, lighting, etc.)
- Quantify the extent of reuse

Recommended Practice

- Remove elements that pose contamination risk
- Upgrade outdated components
- Seek opportunities to improve the indoor/outdoor and structure sustainability elements (e.g., increasing daylighting, energy efficiency, low VOC finishes, etc. – see other SAM credits)
- Evaluate opportunities for application of deconstruction techniques

Best Available Practice

None

CASE STUDY

Aviation Administration Building
Chicago O’Hare International Airport - Chicago, Illinois

The Aviation Administration Building, which houses the Chicago Department of Aviation and the O’Hare Modernization Program offices at O’Hare International Airport (ORD) is a former military administration building built in the 1940s and abandoned in 1999 when the military base at ORD was closed. The building was renovated in 2005 leaving nearly all of the existing exterior walls, roof, and floors in place. The building provides over 160,000 square feet of office and meeting spaces to the CDA and the OMP.
4.0 MATERIALS & RESOURCES

4.3 Construction Waste Management

1 to 3 Points

INTENT

Divert construction and demolition debris from disposal in landfills and incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials to appropriate sites.

REQUIREMENTS

Recycle and/or salvage non-hazardous construction and demolition debris. Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site. Excavated soil and land-clearing debris do contribute to this credit. Calculations must be done by weight (conversion may be necessary) and must be consistent throughout. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows:

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Recycled or Salvaged</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.1</td>
<td>50%</td>
<td>1</td>
</tr>
<tr>
<td>4.3.2</td>
<td>75%</td>
<td>2</td>
</tr>
<tr>
<td>4.3.3</td>
<td>90%</td>
<td>3</td>
</tr>
</tbody>
</table>

Section 11-4-1905 of the Chicago City Code, includes applicability requirements. For CDA purposes, all airport projects are applicable regardless of Section 11-4-1905.

SUBMITTALS

Include descriptive narrative on the SAM Checklist indicating the name of the project that will utilize the material, if other than current project or temporary storage locations, and the following:

- A design estimate using the construction waste management form in CDA/OMP Specification 01524 – Construction Waste Management, to be provided by the designer with the SAM Design Checklist.
- A Waste Management Plan as outlined in CDA/OMP Specification 01524 to be provided by the Contractor no later than 30 days prior to start of construction.
- Monthly construction waste management forms provided by the Contractor during construction.
- A final construction waste total provided by the Contractor prior to final payment.

The submittal requirements follow the City of Chicago waste ordinance (Chicago Code Section 11-4-1905) with the following exceptions:
• All airport projects, including those not subject to Section 11-4-1905 of the Chicago Code, shall be subject to the submittal requirements of this credit.
• Submit documentation to CDA for tracking purposes in addition to documentation required by the ordinance.

Note that the requirements of this credit are very similar to the Chicago construction waste ordinance and CDA/OMP Specification 01524 with the exceptions as noted above. The specification follows the City ordinance with additional provisions for submittal requirements and project applicability.

TECHNOLOGY/STRATEGY

Note that the City of Chicago waste ordinance mandates that a minimum of 50% of construction and demolition (C&D) waste produced on-site (as measured by weight) is diverted from landfill.

It is expected that these practices may lead to savings in material costs due to resource coordination and income generation from recycled/salvaged materials. Due to the large nature of the OMP construction program, for example, many opportunities exist for on-site material recycling, especially for the aggregate and paving materials.

Standard Practice

Utilize designated areas for recycling construction debris on-site, primarily concrete, asphalt, and aggregates. Other materials are typically handled on a site-and-material-specific basis.

Recommended Practice

• Thoroughly evaluate cut-and-fill needs to develop a balanced earthwork plan to reduce hauling off-site
• Establish goals for diversion from disposal in landfills and incineration facilities and adopt a construction waste management plan to achieve these goals
• Consider recycling cardboard, metal, brick, mineral fiber panel, concrete, plastic, wood, glass, gypsum wallboard, carpet and insulation
• Construction debris processed into a recycled content commodity that has an open market value (e.g., wood derived fuel [WDF], alternative daily cover material, etc.) may be applied to the construction waste calculation
• Designate a specific area(s) on the construction site for segregated collection and labeling of recyclable materials, and track recycling efforts throughout the construction process
• Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.
• Implement deconstruction planning and techniques into all demolition activities. Careful and planned deconstruction of a facility can provide sustainable benefits related to disposal, reuse of materials, etc.
• Ensure that employees are aware of waste management and recycling procedures

**Best Available Practice**

• Evaluate use, as appropriate, of pre-cast or pre-fabricated units whenever possible, to reduce on-site waste generation during construction

**CASE STUDY**

**Terminal A**
**Boston Logan International Airport - Boston, Massachusetts**

Terminal A’s redevelopment maximized the use of recyclable materials, natural lighting, energy-conservation plans and alternative-fuel utilization. Many of the building materials were recycled or manufactured locally, and more than 75 percent of construction and demolition waste was diverted from landfills.


**Terminal 5**
**Heathrow International Airport – London, England**

Consideration of waste during design, construction and into operation of Terminal 5 enabled the successful implementation of the waste hierarchy. Over 97% of waste material was recycled or recovered. Design teams adopted the principles of standardization in design, pre fabrication and modularization, dramatically reducing waste generated during construction and maximizing efficiencies in material use and delivery. BAA was committed to reusing waste materials on T5 where possible to reduce waste sent to landfill, to cut down on vehicle movements and reduce carbon emissions. Where possible designated skips were provided for general, wood, metal and cardboard waste to encourage segregation for recycling. Waste cable and plasterboard were also segregated for recycling and in the offices; paper was collected through a desktop recycling box scheme. General waste was further processed and sorted by the waste contractor, who typically recycled 87% of the waste they processed.

4.0 MATERIALS & RESOURCES

4.4 Balanced Earthwork

1 to 2 Points

INTENT

Divert soils from landfills, reduce transportation of soil to off-site locations, and maintain or make soil available for reuse on other on-airport projects.

REQUIREMENTS

Reuse or stockpile for later use, at least 75% of excavation and earthwork soils on airport property and use GPS systems during large-scale grading and earthwork operations. Please count these earthwork quantities under SAM Credit 4.3 Construction Waste Management. Calculations must be done by volume and must be consistent throughout. Hazardous or special waste soils should not be included in the calculation.

All balanced earthwork activities must be conducted in accordance with SAM Credit 1.1 Prerequisite 1 – Construction Activity Pollution Prevention.

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Managed On-Airport</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4.1</td>
<td>75%</td>
<td>1</td>
</tr>
<tr>
<td>4.4.2</td>
<td>95%</td>
<td>2</td>
</tr>
</tbody>
</table>

SUBMITTALS

Use form similar to submittal for SAM Credit 4.3 Construction Waste Management.

TECHNOLOGY/STRATEGY

Due to the large project limits of many airport infrastructure projects, earthwork can be a significant portion of the scope of work. By maintaining a balanced earthwork policy, the amount of transportation and disposal costs, both financial and environmental, can be reduced.

Standard Practice

- The OMP has so far to date managed all earthwork soils on-airport through careful planning and design
- Evaluate opportunities for on-site soil management which may include infrastructure elevation changes, development of noise berms, considerations for landscaping needs, etc.

Recommended Practice

- Use GPS systems during large-scale grading and earthwork operations
Identify stockpile areas, as well as the potential reuse on concurrent projects

**Best Available Practice**

None

**CASE STUDY**

**10C-28C Berms 5&6 and 10L Site Prep**  
**Chicago O’Hare International Airport - Chicago, Illinois**

To make way for the new Runway 10C-28C and 10L Extension, existing soil stockpiles, called Berms 5&6, were relocated to a designated area south of Irving Park Rd. A total of 1.8 million cubic yards of soil was moved and stockpiled on airport property. This constituted 100% of all the material moved from the site.

As a part of the O’Hare Modernization Program (OMP) the airport has handled more than 20 million cubic yards of soil – enough to fill the interior of the Willis Tower more than 9 times. To reduce hauling, labor, and fuel costs, and to reduce emissions and traffic congestion, the City of Chicago desired to keep as much excavated soil on-site as possible. To aid in this endeavor, the CDA initiated an Earthwork Management Plan (EMP).

An Earthwork Management Committee was also established to make every effort to effectively match available soil material resources with project earthwork needs. The committee has the responsibility of updating the EMP and coordinating future changes resulting from decisions made during the design and construction phases. The goal of the Earthwork Management Committee is to update and maintain a current EMP that allows OMP leadership to make timely and informed decisions regarding earthwork relocation costs, phasing, quality, and quantities for both individual projects and the OMP as a whole.

The CDA’s Earthwork Management Plan has kept soil on-site and out of landfills, helping the CDA achieve the triple bottom line by being economically viable, socially responsible, and environmentally sound. Soil has been reused as part of new projects or stockpiled for future use, saving over $150 million. By keeping soil on-site, the CDA has also saved more than 630,000 truck trips and more than 73,000 tons of carbon dioxide.

[http://www.flychicago.com/OHare/EN/AboutUs/Sustainability/OMP-Earthwork.aspx](http://www.flychicago.com/OHare/EN/AboutUs/Sustainability/OMP-Earthwork.aspx)
4.0 MATERIALS & RESOURCES

4.5 Aggregate Reuse

1 Point

INTENT

Promote the reuse of aggregate from on-airport property sources.

REQUIREMENTS

Reuse aggregates, including sand, gravel, crushed concrete, and recycled asphalt for at least 10% by weight of all aggregates used for permanent structures and pavement. This does not include aggregates used for temporary structures such as haul roads or check dams. The source of the aggregates must be from on-airport property demolition activities or other on-airport projects. When reusing on-site aggregates, these may not be counted under the recycled content of materials, SAM Credit 4.7 Recycled Content, and should only be counted under this credit. When recycled aggregates from off-airport sources are used, then this would count toward SAM Credit 5.7 Recycled Content.

Exemplary Performance

If a project achieves an aggregate reuse rate greater than 90% by weight of all aggregates used for permanent structures, then an additional point may be claimed under SAM Credit 7.1 Innovation in Design & Construction.

Example: To build a new sidewalk, a project used 100 tons of aggregate in total. Of this amount, 10 tons was recovered from on-airport stockpiles, 20 tons was recovered from a nearby non-airport construction project, and the remainder was virgin material purchased from a quarry. In this case, only the 10 tons recovered from the airport stockpiles would count toward this credit, which would translate to a 10% aggregate reuse rate (10 tons/100 tons total) and therefore the point is achieved. The 20 tons of recovered material from the non-airport source (but not the 10 tons from on-airport source) would be counted under SAM Credit 4.7 Recycled Content.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

None

Standard Practice

- Concrete crushing is currently employed at the airport and aggregate stockpiles are usually available. It will be important to identify the appropriate gradation(s) to maximize the reuse potential of aggregates.
Asphalt grindings are also stored on-site and reused as appropriate
To further facilitate aggregate reuse, in addition to reusing on-site aggregates, identify stockpile areas and make aggregates available to other on-airport projects

**Recommended Practice**

- Identify aggregates present on-site that can be incorporated into the final development
- Identify possible uses of recycled aggregates within each project

**Best Available Practice**

- Where approved and appropriate, consider the use of Warm Mix Asphalt (WMA) for paving, which allows for the use of higher quantities of recycled asphalt pavement (RAP, also known as asphalt grindings). Also see SAM Credit 4.7 Recycled Content.

**CASE STUDY**

**Warm mix asphalt on Runway 4R/22L**

**Boston Logan International Airport - Boston, Massachusetts**

In 2009, nearly 26,000 tons of warm mix asphalt was placed on Runway 4R/22L at Boston Logan International Airport, making it the first airport in the nation to use the environmentally friendly asphalt on a runway repaving project. The 6.3-million contract to repave Runway 4R/22L was done so in an effort to reduce greenhouse emissions and energy consumption during construction. Then Massport CEO and Executive Director Thomas J. Kinton Jr. noted that this type of asphalt took 20 percent less energy to make, produces 20 percent fewer greenhouse emissions when applied, and provides a higher percentage of recycled materials in the final product. The project provided another way for Massport to continue its environmental stewardship commitment to reduce emissions and recycle valuable resources.

[www.airportbusiness.com/publication/article.jsp?pubId=1&id=26379&pageNum=4](http://www.airportbusiness.com/publication/article.jsp?pubId=1&id=26379&pageNum=4)
4.0 MATERIALS & RESOURCES

4.6 Material Reuse

1 to 2 Points

INTENT

Reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby lessening impacts associated with the extraction and processing of virgin resources.

REQUIREMENTS

Use salvaged, refurbished or reused materials, the sum of which constitutes at least 5% or 10%, based on cost, of the total value of materials on the project. The minimum percentage materials reused for each point threshold is as follows:

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Reused Materials</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6.1</td>
<td>5%</td>
<td>1</td>
</tr>
<tr>
<td>4.6.2</td>
<td>10%</td>
<td>2</td>
</tr>
</tbody>
</table>

Only include materials in Construction Specification Institute (CSI) MasterFormat 1995 Divisions 2-10 in the calculations.

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment cannot be included in this calculation. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in SAM Credit 4.6 Materials Reuse through SAM Credit 4.10 Certified Wood.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

Indicate the name of the project that will utilize the material, if other than current project and temporary storage locations if known.

TECHNOLOGY/STRATEGY

Identify opportunities to incorporate salvaged materials into the building design, and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, masonry, fencing, metal railing, manhole frames, lids, and catch basins inlets (CSI Divisions 2 through 10, note: CSI Divisions 11 through 16 are counted in SAM Credit 4.11 Furniture and Equipment).

Use a “virtual warehouse” to maintain a current listing of materials available for reuse on other projects.
Standard Practice

- To date, many items have been reused, such as fencing, light standards, and fixtures
- Prior to the demolition and removal of existing building materials and equipment within a project area, notify the Chicago Department of Aviation to allow for the harvesting of used building materials and equipment for potential reuse

Recommended Practice
None

Best Available Practice
None

Case Study

Terminal 2
San Francisco International Airport - San Francisco, California

A number of measures were implemented to reduce the carbon footprint of Terminal 2 and San Francisco International Airport. One such strategy was to reuse a significant portion of the infrastructure system of the existing terminal. This method eliminated an estimated 12,300 tons of carbon dioxide emissions.

4.0 MATERIALS & RESOURCES

4.7 Recycled Content

1 to 2 Points

INTENT

Increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

REQUIREMENTS

Use materials with recycled content such that the sum of postconsumer recycled content plus one-half of the pre-consumer content constitutes at least 10% or 20%, based on cost, of the total value of the materials in the project. The minimum percentage materials recycled for each point threshold is as follows:

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Recycled Content</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7.1</td>
<td>10%</td>
<td>1</td>
</tr>
<tr>
<td>4.7.2</td>
<td>20%</td>
<td>2</td>
</tr>
</tbody>
</table>

The recycled content value of a material assembly is determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value. If specific material cost is not available, assume 45% of total cost (inclusive of materials, labor and equipment) is representative of the material cost.

Only include materials in CSI MasterFormat 1995 Divisions 2-10 in the calculations.

Mechanical, electrical and plumbing components and specialty items such as elevators cannot be included in this calculation. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in SAM Credit 4.6 Material Reuse through SAM Credit 4.11 Furniture and Equipment.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

The submittals include the following:

- A design estimate using the recycled content form in CDA/OMP Specification 01356 – Recycled Content – to be provided by the designer with the SAM Design Checklist
- A pre-construction estimate using the recycled content form in CDA/OMP Standard Specification 01356 – Recycled Content to be provided by the contractor
- A final construction estimate using the recycled content form in CDA/OMP Standard Specification 01356 – Recycled Content, to be provided by the contractor with the SAM Construction Checklist
TECHNOLOGY/STRATEGY

Establish a project goal for recycled content materials, and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

Standard Practice

Due to the nature of the program, the OMP uses and generates large amounts of recycled content materials particularly for the infrastructure projects which contain large amounts of paving materials and reinforcing steel. Where manufacturer information does not exist or cannot be obtained, CDA allows the use of the following recycled content percentages as a default for some of the common construction materials:

<table>
<thead>
<tr>
<th>Material</th>
<th>Post-consumer</th>
<th>Pre-consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>25%</td>
<td>-</td>
</tr>
<tr>
<td>Copper</td>
<td>65%</td>
<td>-</td>
</tr>
<tr>
<td>Aluminum</td>
<td>80%</td>
<td>-</td>
</tr>
<tr>
<td>Gypsum board (drywall)³</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>Reinforced concrete pipe</td>
<td>2%</td>
<td>-</td>
</tr>
<tr>
<td>Asphalitic paving materials, conventional</td>
<td>45%</td>
<td>45%</td>
</tr>
<tr>
<td>Asphalitic paving materials, with roof shingles</td>
<td>67%</td>
<td>45%</td>
</tr>
</tbody>
</table>

³ Default values for Post-/Pre-consumer % content based on the following manufacturers’ specs for standard gypsum drywall sourced in Midwestern states: CertainTeed (IA) – 2%/3%; American Gypsum (OK) – 5%/0%; USG (IA) – 6%/1%; USG (IN) – 5%/38%

Post-consumer Recycled Content is derived from materials that can no longer be used for their original purpose.

Pre-consumer Recycled Content consists of raw material diverted from the waste stream during the manufacturing process.

NOTE: The values in the table above are typically very conservative. For example, depending on the process used to make the steel, the recycled content can be anywhere from 25% to 35% for steel produced in a basic oxygen furnace to almost 100% in an electric arc furnace.⁴ For this reason, the designers and contractors are encouraged to determine this information directly from the manufacturers and to not rely on these default values whenever possible.

⁴ Steel Recycling Institute
Recommended Practice

- Establish a project goal for recycled content materials and identify material suppliers that can achieve this goal.
- Consider the following major building components for specifying maximum recycled content:
  - Aggregate in cast in place concrete
  - Fly-ash in cast in place concrete
  - Aggregate in pre-cast concrete including site work and infrastructure piping
  - Fly-ash in pre-cast concrete including site work and infrastructure piping
  - Bituminous concrete pavement
  - Unit pavers
  - Steel reinforcement
  - Structural steel
  - Miscellaneous steel
  - Steel fencing and furnishings
  - Unit masonry
  - Ductile iron pipe
  - Aluminum products
  - Site generated broken concrete for gabions
  - Railroad rails
  - Railroad ties
  - Railroad track base material
  - Steel doors and frames
  - Aluminum doors and windows
  - Plaster
  - Terrazzo
  - Acoustical ceilings
  - Drywall
  - Finish flooring including carpet, resilient flooring and terrazzo
  - Toilet and shower compartments
  - Special finishes

- During construction, ensure that the specified recycled content materials are installed and quantify the total percentage of recycled content materials installed.

Additionally, the following websites are provided for guidance only:
U.S. General Services Administration - Environmental Products Overview
http://www.gsa.gov/portal/content/104543

Architectural Record – Green Product Guide
www.archrecord.construction.com/products/green/
Best Available Practice

Encourage aggressive use of permeable pavement with high recycled content, where applicable, such as recycled ground tire rubber (GTR) for permeable asphalt.

CASE STUDY

Runway 10C/28C East
Chicago O’Hare International Airport - Chicago, Illinois

It is estimated that 21% of the materials (based on cost) used for the project have recycled content. These materials include approximately 115,300 cubic yards of reclaimed concrete and bituminous pavement.

Recycling asphalt grindings at O’Hare
4.0 MATERIALS & RESOURCES

4.8 Local/Regional Materials

1 to 3 Points

INTENT

Increase demand for building and all other materials and products that are extracted, harvested or recovered, as well as manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

REQUIREMENTS

Use building and all other materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10% or 20% (based on cost) of the total materials value. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value. An additional point can be achieved if 50% of the materials are extracted, harvested, or recovered, as well as manufactured, within 250 miles of the project site. The minimum percentage of local/regional materials for each point threshold is as follows:

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Local/Regional Materials</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8.1</td>
<td>10%</td>
<td>1</td>
</tr>
<tr>
<td>4.8.2</td>
<td>20%</td>
<td>2</td>
</tr>
<tr>
<td>4.8.3</td>
<td>50% within 250 miles</td>
<td>3</td>
</tr>
</tbody>
</table>

If specific material cost is not available, assume 45% of total cost (inclusive of materials, labor and equipment) is representative of the material cost.

Only include materials in CSI MasterFormat 1995 Divisions 2-10 in the calculations.

Mechanical, electrical and plumbing components and specialty items such as elevators and FAA equipment shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included if it is included consistently in SAM Credit 4.6 Materials Reuse through SAM Credit 4.11 Furniture and Equipment.

NOTE: Materials reused and salvaged that satisfy the requirements of SAM Credit 4.6 Material Reuse may also contribute to this credit.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist, as well as:

- A design estimate using the local/regional material form in CDA/OMP Specification 01355 – Regional Materials, to be provided by the designer with SAM Design Checklist
• A pre-construction estimate using the local/regional material form in CDA/OMP Specification 01355 – Regional Materials, to be provided by the contractor
• A final construction estimate using the local/regional material form in CDA/OMP Specification 01355 – Regional Materials, to be provided by the contractor with the SAM Construction Checklist

TECHNOLOGY/STRATEGY

Establish a project goal for locally sourced materials, and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

Standard Practice

• The central location of Chicago makes many materials readily available, especially for infrastructure projects
• Due to sole sourcing and limited availability, FAA equipment and specialty items sometimes cannot meet the 500 mile criterion.

Recommended Practice

• Identify and specify materials that are extracted, processed, or manufactured within 500 miles of Chicago. Materials that may contribute toward this goal include, but are not limited to: concrete, aggregate, asphaltic products, structural steel, masonry, gypsum wallboard, utility structures (manholes, conduit, catch basins, culverts, sewer piping, stormwater piping, etc.), gas and water piping, landscaping materials. NOTE: Piping used indoors for building systems should not be included. Reused and salvaged materials also qualify.

Best Available Practice

None

CASE STUDY

Business Center
San Francisco International Airport – San Francisco, California

The SFO business center was furnished with furniture purchases locally from a salvage and refurbishing company. They require that employees use a Virtual Warehouse for furniture, equipment, computers, and supplies before purchasing new supplies. SFO requires that regional materials are harvested or manufactured within 500 miles of SFO.

http://www.flysfo.com/community-environment/environmental-sustainability-reports
4.0 MATERIALS & RESOURCES

4.9 Rapidly Renewable Materials

1 Point

INTENT

Reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.

REQUIREMENTS

Use rapidly renewable building materials and products for 2.5% of the total value of all building materials and products used in the project, based on cost. Rapidly renewable building materials and products are made from plants that are typically harvested within a ten-year or shorter cycle.

Only include materials in CSI MasterFormat 1995 Divisions 2-10 in the calculations. Only permanently installed materials should be counted in this credit. Temporary construction materials are counted in SAM Credit 6.11 Sustainable Temporary Construction Materials.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Establish a project goal for rapidly renewable materials and identify products and suppliers that can support achievement of this goal. Consider materials such as bamboo, cotton insulation, agrifiber, linoleum, wheatboard, strawboard and cork. Although not a plant material, also consider wool.

Standard Practice

None

Recommended Practice

- Identify materials and suppliers that can achieve this goal
- Consider materials such as:
  - Poplar OSB
  - Straw board or “agriboard”
  - Bamboo flooring
  - Cork
  - Wool carpets and fabrics
  - Cotton-batt insulation
  - Linoleum flooring
- Sunflower seed board
- Wheat grass or Straw board cabinetry and others.
- Rice husks for concrete

**Best Available Practice**

None

**CASE STUDY**

**Leed Certified Facilities**
**Chattanooga Metropolitan Airport – Chattanooga, Tennessee**

Chattanooga Metropolitan Airport works toward LEED certification for all new construction projects. The West Side Corporate Aviation Development was completed in July 2011 and has been awarded the highest level of LEED certification – platinum. The development was built with environmental sustainability, occupant health, comfort and cost savings in mind. In regards to the use of rapidly renewable materials, the ceilings and millwork were constructed of bamboo.

4.0 MATERIALS & RESOURCES

4.10 Certified Wood

1 Point

INTENT

Encourage environmentally responsible forest management.

REQUIREMENTS

Use a minimum of 50% (based on cost) of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council’s principles and criteria, for wood building components. These components include, but are not limited to, structural framing and general dimensional framing, flooring, sub-floors, wood doors and finishes. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in activities concerning SAM Credit 4.10 Certified Wood.

Only permanently installed materials should be counted in this credit. Sustainable temporary construction materials are counted in SAM Credit 6.11 Sustainable Temporary Construction Materials. Furniture may be included if it is included consistently in SAM Credit 4.6 Materials Reuse through SAM Credit 4.11 Furniture and Equipment.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.

Standard Practice

None

Recommended Practice

- Identify suppliers that can achieve this goal during construction
- Ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed

Best Available Practice

None
4.0 MATERIALS & RESOURCES

4.11 Furniture and Equipment

1 Point

INTENT

Reduce the environmental and indoor air quality impacts of the furniture and equipment acquired for use in a building.

REQUIREMENTS

A point is awarded to projects that purchase durable goods (i.e., goods that are replaced infrequently or require capital program outlays to purchase) that meet any of the following sustainable requirements:

- Electric-Powered Equipment: Examples include, but are not limited to, office equipment (computers, monitors, copiers, faxes, scanners, and printers), appliances (refrigerators, dishwashers, and water coolers), external power adapters, and televisions and other audiovisual equipment. To achieve a point, 40% of the total purchases of electric-powered equipment (by cost) meet one of the following criteria:
  - The equipment is ENERGY STAR labeled (for product categories with developed specifications)
  - The equipment (either battery or corded) replaces conventional gas-powered equipment. Examples include, but are not limited to, maintenance equipment and vehicles, landscaping equipment and cleaning equipment.

- Furniture: To achieve a point, 40% of the total purchases of furniture (by cost) meet one of the following criteria:
  - Purchased furniture contains at least 10% post-consumer or 20% pre-consumer material
  - Purchased furniture contains at least 70% material salvaged from off-site sources or outside the airport boundary
  - Purchased furniture contains at least 70% material salvaged from on-site sources, such as an equipment reuse program or internal reorganization
  - Purchased furniture contains at least 50% rapidly renewable material
  - Purchased furniture contains at least 50% FSC-certified wood
  - Purchased furniture contains at least 50% material harvested and processed or extracted and processed within 500 miles of the project
Each furniture purchase can receive credit for each sustainable criterion met (i.e., a $100 purchase that contains both 10% post-consumer recycled content and 50% content harvested within 500 miles of the project counts twice in the calculation, for a total of $200 in sustainable purchasing.

To avoid double counting, furniture materials and electric equipment loads should not be counted in previous SAM categories, such as MR Credit 4.8.1 (Regional Materials) or EA Credit 3.4 (Optimize Energy).

**SUBMITTALS**

Include descriptive narrative and calculations in SAM Checklist.

**TECHNOLOGY/STRATEGY**

Designers are encouraged to specify items that help achieve the requirements of this credit whenever possible. A continuously updated list of ENERGY STAR labeled equipment can be found on [www.energystar.gov](http://www.energystar.gov). Sustainable furniture can be found from various sources. GREENGUARD Environmental Institute certifies products, including furniture. See [www.greenguard.org](http://www.greenguard.org) for a listing of GREENGUARD certified furniture.

**Standard Practice**

None

**Recommended Practice**

- Specify ENERGY STAR electric equipment and/or sustainable furniture systems, such as GREENGUARD certified furniture

**Best Available Practice**

None
4.0 MATERIALS & RESOURCES

4.12 Equipment Salvage and Reuse

1 Point

INTENT

Promote the reuse of equipment and products to reduce demand for virgin materials and reduce waste, thereby lessening impacts associated with the extraction and processing of virgin resources.

REQUIREMENTS

Use salvaged, refurbished or reused equipment and materials, in any appreciable amount on the project or make available for reuse equipment and materials for other projects.

Mechanical, electrical, and plumbing components and specialty items such as pumps and equipment (CSI Divisions 11 through 16, note: CSI Divisions 2 through 10 are counted in SAM Credit 4.6 Material Reuse) can be included. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in SAM Credit 4.6 Material Reuse through SAM Credit 4.10 Certified Wood.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist. Indicate the name of the project that will utilize the material, if other than current project or temporary storage locations.

TECHNOLOGY/STRATEGY

The purpose of this credit is to recognize the reuse of items not covered by SAM Credit 4.6 Material Reuse.

Identify opportunities to incorporate salvaged materials into the design, and research potential material suppliers. Consider salvaged materials such as cabinetry and furniture, pumps, motors, electrical panels, fixtures and tanks.

Explore and encourage the development of a virtual warehouse for salvaged and reusable items.

Standard Practice

- In the process of demolition, many projects have reused or made available for reuse old fencing and guard rails. Guard post structures and kiosks are routinely moved around the airport.
- To date, many items have been reused, such as fencing and fixtures

Recommended Practice

None
Best Available Practice
None

CASE STUDY

Airport Hangar Demolition
Ottawa International Airport - Ottawa, Ontario

The demolition of airport hangers and related facilities can result in substantial recycle and reuse opportunities. Over 90 percent of the building materials generated by the demolition of a hanger facility at the Ottawa airport were diverted from a landfill, with 65 percent being recycled and 25 percent being reused. These materials included asphalt paving, cast iron, copper, aluminum, fencing, concrete blocks, windows, restroom components and light fixtures.

5.0 INDOOR ENVIRONMENTAL QUALITY

5.1 Prerequisite 1 – Minimum Indoor Air Quality (IAQ) Performance

Required

INTENT

Establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of the occupants.

REQUIREMENTS

Meet the minimum requirements of Sections 4 through 7 of ASHRAE 62.1-2010, Ventilation for Acceptable Indoor Air Quality. Mechanical ventilation systems shall be designed using the Ventilation Rate Procedure or the applicable local code, whichever is more stringent. Naturally ventilated buildings shall comply with ASHRAE 62.1-2010, paragraph 5.1.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Ventilation systems should meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE standard. Balance the impacts of ventilation rates on energy use and indoor air quality to optimize for energy efficiency and occupant health. Use the ASHRAE 62 Users Manual for detailed guidance on meeting the referenced requirements.

Standard Practice

- Identify potential IAQ conflicts on the site and locate air intakes away from air contaminant source, which might include loading areas, exhaust fans, and cooling towers
- Locate air intakes in secure areas for protection from potential security breaches
- Chicago Building Code uses ASHRAE 62.1-2004

Recommended Practice

- Design HVAC systems to meet ventilation requirements of the referenced standard
- Evaluate carbon or electrostatic filters for use in passenger terminal buildings
- Provide a security monitoring system and restrict access to outdoor air intakes for passenger terminal buildings and any other public gathering areas
- In cases where conflicts with the City of Chicago ventilation code arise, meet the requirements of the more stringent code
Best Available Practice

None

CASE STUDY

H. Weir Cook Terminal
Indianapolis International Airport – Indianapolis, Indiana

One of the first airports in the United States to target LEED certification, the new Indianapolis International Airport terminal employs numerous sustainable measures that contribute to the indoor air quality of the building. One such feature includes an energy-efficient under floor heating/cooling system that will be used in the plaza and adjacent public spaces. Also, the high ceiling space of the terminal will have a conventional air volume HVAC system employing stratification principles to conserve energy.

www.airport-technology.com/features/feature554/
5.0 INDOOR ENVIRONMENTAL QUALITY

5.2 Prerequisite 2 – Environmental Tobacco Smoke (ETS) Control

Required

INTENT

Prevent or minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to Environmental Tobacco Smoke (ETS).

REQUIREMENTS

OPTION 1

- Prohibit smoking in the building
- Smoking must be prohibited within 25-feet of entryways, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

OR

OPTION 2

- Prohibit smoking in the building except in designated smoking areas
- Smoking must be prohibited within 25-feet from entries, outdoor air intakes and operable windows
- Locate designated smoking rooms to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room must be directly exhausted to the outdoors with no re-circulation of ETS-containing air to the non-smoking area of the building, and enclosed with impermeable deck-to-deck partitions. With the doors to the smoking room closed, operate exhaust sufficient to create a negative pressure with respect to the adjacent spaces of at least an average of 5 Pa (0.02 inches of water gauge) and with a minimum of 1 Pa (0.004 inches of water gauge).
- Performance of the smoking room differential air pressures shall be verified by conducting 15 minutes of measurement, with a minimum of one measurement every 10 seconds, of the differential pressure in the smoking room with respect to each adjacent area and in each adjacent vertical chase with the doors to the smoking room closed. The testing will be conducted with each space configured for worst case conditions of transport of air from the smoking rooms to adjacent spaces with the smoking rooms' doors closed to the adjacent spaces.

OR
OPTION 3

- Prohibit smoking in all common areas of the building
- Locate any exterior designated smoking areas including balconies where smoking is permitted, at least 25-feet away from entries, outdoor air intakes and operable windows opening to common areas
- Minimize uncontrolled pathways for ETS transfer between individual residential units by sealing penetrations in walls, ceilings and floors in the residential units, and by sealing vertical chases adjacent to the units
- All doors in the residential units leading to common hallways shall be weather-stripped to minimize air leakage into the hallway
- If the common hallways are pressurized with respect to the residential units then doors in the residential units leading to the common hallways need not be weather-stripped provided that the positive differential pressure is demonstrated as in Option 2 above, considering the residential unit as the smoking room. Acceptable sealing of residential units shall be demonstrated by a blower door test conducted in accordance with ANSI/ASTM-E779-03, Standard Test Method for Determining Air Leakage Rate By Fan Pressurization, AND use the progressive sampling methodology defined in Chapter 4 (Compliance Through Quality Construction) of the Residential Manual for Compliance with California’s 2001 Energy Efficiency Standards (http://www.energy.ca.gov/title24/archive/2001standards/index.html). Residential units must demonstrate less than 1.25 square inches leakage area per 100 square feet of enclosure area (i.e. sum of all wall, ceiling and floor areas).
- Verification of the performance of smoking rooms may be accomplished through tracer gas testing as an alternative to blower door testing

NOTE: It is acceptable to not designate any smoking areas and to provide signage to indicate the prohibition of smoking on the property to satisfy the prerequisite requirements.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Prohibit smoking in commercial buildings, or effectively control the ventilation air in smoking rooms.

Standard Practice

- Chicago Building Code prohibits smoking within 15-feet of entryways which is less stringent than this credit. The distance must be increased to 25-feet to meet this prerequisite.
Recommended Practice

- Prohibiting smoking in the public areas of buildings and locating any exterior designated smoking areas away from entries and operable windows
- Require all parts of the construction sites to be non-smoking
- Work with labor unions in privately leased tenant spaces to designate these areas as non-smoking

Best Available Practice

- Where applicable, provide a designated smoking room designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room must be directly exhausted to the outdoors with no recirculation of ETS-mixed air to the non-smoking area of the building, enclosed with impermeable deck-to-deck partitions and operated at negative pressure.
- Performance of the smoking rooms shall be verified by using tracer gas testing methods as described in the ASHRAE Standard 129-1997. Acceptable exposure in non-smoking areas is defined as less than 1% of the tracer gas concentration in the smoking room detectable in the adjoining non-smoking areas. Smoking room testing as described in ASHRAE Standard 129-1997, Section 8, is required in the contract documents and critical smoking facility systems testing results must be included in the building commissioning plan and report or as a separate document.
5.0 INDOOR ENVIRONMENTAL QUALITY

5.3 Outdoor Air Delivery Monitoring

1 Point

INTENT

Provide capacity for ventilation system monitoring to help sustain occupant comfort and wellbeing.

REQUIREMENTS

Install permanent monitoring systems to ensure that ventilation systems maintain design minimum ventilation requirements. Configure all monitoring equipment to generate an alarm when airflow values or carbon dioxide (CO₂) levels vary by 10% or more from the design values via either a building automation system alarm to the building operator or via a visual or audible alert to the building occupants.

FOR MECHANICALLY VENTILATED SPACES

- Monitor carbon dioxide concentrations within all densely occupied spaces (those with a design occupant density greater than or equal to 25 people per 1000 sq.ft.). CO₂ monitoring locations shall be between 3 feet and 6 feet above the floor
- For each mechanical ventilation system serving non-densely occupied spaces, provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor airflow rate with an accuracy of plus or minus 15% of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2010

FOR NATURALLY VENTILATED SPACES

- Monitor CO₂ concentrations within all naturally ventilated spaces. CO₂ monitoring shall be located within the room between 3 feet and 6 feet above the floor. One CO₂ sensor may be used to represent multiple spaces if the natural ventilation design uses passive stack(s) or other means to induce airflow through those spaces equally and simultaneously without intervention by building occupants.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Install carbon dioxide and airflow measurement equipment and interface with the HVAC system and/or Building Automation System (BAS) to trigger corrective action, if applicable. If such automatic controls are not feasible with the building systems, use the measurement equipment to trigger alarms that inform building operators or occupants in the event of a possible deficiency in outdoor air delivery.
Provide audible feedback to building occupants, who in turn know to inform the building’s engineer, as a satisfactory means of meeting this aspect of the credit requirement for both the densely occupied areas and the other areas with mechanical ventilation systems.

**Standard Practice**

None

**Recommended Practice**

- Design HVAC systems for passenger terminal and other public assembly and buildings with carbon dioxide monitoring sensors in each space and integrate these sensors with the building automation system (BAS)
- Provide real-time control of terminal unit (VAV box) flow rates and total outdoor air flow rates based on carbon dioxide levels

**Best Available Practice**

None

**CASE STUDY**

**Terminal Building Ventilation System Performance**

**Austin-Bergstrom International Airport – Austin, Texas**

The 550,000 square foot terminal building at Austin-Bergstrom International Airport is equipped with technology that provides monitoring and feedback on ventilation system performance to ensure the system is operating to the building’s minimum requirements. Each of the terminal’s cooling systems work for a specific application and operate within individual zones. Units provide cooling for special areas such as electrical and mechanical closets and communications areas. This building is regarded as a model for energy efficient terminal building design.

[https://www.austintexas.gov/page/environmental-initiatives](https://www.austintexas.gov/page/environmental-initiatives)
5.0 INDOOR ENVIRONMENTAL QUALITY

5.4 Increased Ventilation

1 Point

INTENT

Provide additional outdoor air ventilation to improve indoor air quality for improved occupant comfort, well-being and productivity.

REQUIREMENTS

FOR MECHANICALLY VENTILATED SPACES

- Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2010 as determined by SAM Credit 5.1 Prerequisite 1 – Storage and Collection of Recyclables

FOR NATURALLY VENTILATED SPACES

- Design natural ventilation systems for occupied spaces to meet the recommendations set forth in the Carbon Trust “Good Practice Guide 237” [1998]. Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure 1.18 of the Chartered Institution of Building Services Engineers (CIBSE) Applications Manual 10: 2005, Natural ventilation in non-domestic buildings.

AND

- Use diagrams and calculations to show that the design of the natural ventilation systems meets the recommendations set forth in the CIBSE Applications Manual 10: 2005, Natural ventilation in non-domestic buildings

OR

- Use a macroscopic, multi-zone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE 62.1-2010 Chapter 6, for at least 90% of occupied spaces

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

For mechanically ventilated spaces: Use heat recovery, where appropriate, to minimize the additional energy consumption associated with higher ventilation rates.
For naturally ventilated spaces: Follow the eight design steps described in the Carbon Trust Good Practice Guide 237 – 1) Develop design requirements, 2) Plan airflow paths, 3) Identify building uses and features that might require special attention, 4) Determine ventilation requirements, 5) Estimate external driving pressures, 6) Select types of ventilation devices, 7) Size ventilation devices, 8) Analyze the design.

Use public domain software such as NIST’s CONTAM, Multizone Modeling Software, along with LoopDA, Natural Ventilation Sizing Tool, to analytically predict room-by-room airflows.

**Standard Practice**

None

**Recommended Practice**

- Select and place air diffusers for all mechanically ventilated spaces, particularly office and passenger terminal spaces, following the recommended design approaches in the ASHRAE 2001 Fundamentals, Chapter 32, Space Air Diffusion
- Section 6 of ASHRAE 62.1-2010 outlines guidelines for determining ventilation rates for various applications of mechanical ventilation systems

**Best Available Practice**

- Increase air change effectiveness using the following strategies:
  - Displacement ventilation in passenger terminal areas
  - Underfloor air distribution in office areas
  - Operable windows and skylights in cargo buildings
- Increase air movement in cargo facilities with ceiling fans
- Install trickle ventilators in cargo facilities to provide natural winter ventilation
- Install relief vents or operable skylights in cargo facilities to provide stack effect natural ventilation

**CASE STUDY**

**Natural Ventilation Systems**
**Honolulu International Airport - Honolulu, Hawaii**

The Overseas Terminal at the Honolulu International Airport was designed with natural ventilation so that occupants and travelers could comfortably experience the natural climate. To enhance air circulation in the terminal, local wind and climate studies were compiled to evaluate the best potential practices to ensure comfortable ventilation for building occupants.

5.0 INDOOR ENVIRONMENTAL QUALITY

5.5.1 Construction IAQ Management Plan: During Construction

1 Point

INTENT

Reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

REQUIREMENTS

Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:

- During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3
- Protect stored on-site or installed absorptive materials from moisture damage

If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grille, as determined by ASHRAE 52.2-1999. Replace all filtration media immediately prior to occupancy.

SUBMITTALS

Include descriptive narrative in SAM Checklist including IAQ Management Plan and detailed photographic evidence.

TECHNOLOGY/STRATEGY

Adopt an IAQ management plan to protect the HVAC system during construction, control pollutant sources and interrupt contamination pathways. Sequence the installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile and gypsum wallboard. Coordinate SAM Credits 5.5 Construction IAQ Management Plan and 5.7 Indoor Chemical and Source Pollutant Control to determine the appropriate specifications and schedules for filtration media.

If possible, avoid using permanently installed air handlers for temporary heating/cooling during construction. Consult the LEED 2009 Green Building and Construction Reference Guide for more detailed information on how to ensure the well-being of construction workers and building occupants if permanently installed air handlers must be used during construction.

Standard Practice

None
Recommended Practice

- During construction meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3
- Protect stored on-site or installed absorptive materials from moisture damage
- Do not operate air-handling equipment during construction
- Sequence the installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile and gypsum wallboard
- Minimize the use of air handlers during construction. If air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999.

Best Available Practice

None

CASE STUDY

Construction Mitigation Program
Oakland International Airport – Oakland, California

During the airport’s Terminal Improvement Program, a number of mitigation efforts are being implemented to reduce the construction impact on contractors, tenants, and travelers. A major component of these efforts involves a comprehensive checklist enforcing compliance with these practices. This checklist includes the evaluation of existing measures, the identification of measures that may require revision, and development of recommendations for corrective action.

www.oaklandairport.com/noise/environmental_construct.shtml
5.0 INDOOR ENVIRONMENTAL QUALITY

5.5.2 Construction IAQ Management Plan: Before Occupancy

1 Point

**INTENT**

Reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

**REQUIREMENTS**

**OPTION 1 — Flush-Out**

After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

OR

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm/sq. ft. of outside air or the design minimum outside air rate determined in SAM Credit 5.1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu. ft./sq. ft. of outside air has been delivered to the space.

NOTE: All finishes must be installed prior to flush-out.

OR

**OPTION 2 — Air Testing**


- Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>MAXIMUM CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>50 parts per billion</td>
</tr>
<tr>
<td>Particulates (PM10)</td>
<td>50 micrograms per cubic meter</td>
</tr>
<tr>
<td>Total Volatile Organic Compounds (TVOC)</td>
<td>500 micrograms per cubic meter</td>
</tr>
</tbody>
</table>
CONTAMINANT MAXIMUM CONCENTRATION
4-Phenylcyclohexene (4-PCH)* 6.5 micrograms per cubic meter
Carbon Monoxide (CO) 9 part per million and no greater than 2 parts per million above outdoor levels

* This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.

- For each sampling point where the maximum concentration limits are exceeded conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.
- The air sample testing shall be conducted as follows:
  - All measurements shall be conducted prior to occupancy, but during normal occupied hours, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test;
  - All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required;
  - The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq.ft., or for each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength; and
  - Air samples must be collected between 3 feet and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

SUBMITTALS
Include descriptive narrative in SAM Checklist including IAQ Management Plan and detailed photographic evidence.

TECHNOLOGY/STRATEGY
Prior to occupancy, perform a building flush-out or test the air contaminant levels in the building. The flush-out is often used where occupancy is not required immediately upon substantial completion of construction. IAQ testing can minimize schedule impacts but may be more costly. Coordinate SAM Credits 6.5 Construction IAQ Management Plan and 6.7 Indoor Chemical and Source Pollutant Control to determine the appropriate specifications and schedules for filtration media.
The intent of this credit is to eliminate indoor air quality problems that occur as a result of construction. Architectural finishes used in tenant build-outs constitute a significant source of air pollutants, and must be addressed in order to qualify for this credit.

**Standard Practice**

None

**Recommended Practice**

- Replace all filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2-1999 for media installed at the end of construction.

**Best Available Practice**

- After construction ends and prior to occupancy, conduct a two-week building flush out with 100% fresh air
5.0 INDOOR ENVIRONMENTAL QUALITY

5.6.1 Low-Emitting Materials: Adhesives and Sealants

1 Point

INTENT

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

REQUIREMENTS

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

- Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168. VOC limits are listed in the table below and correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.

<table>
<thead>
<tr>
<th>Architectural Applications</th>
<th>VOC Limit [g/L less water]</th>
<th>Specialty Applications</th>
<th>VOC Limit [g/L less water]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Carpet Adhesives</td>
<td>50</td>
<td>PVC Welding</td>
<td>510</td>
</tr>
<tr>
<td>Carpet Pad Adhesives</td>
<td>50</td>
<td>CPVC Welding</td>
<td>490</td>
</tr>
<tr>
<td>Wood Flooring Adhesives</td>
<td>100</td>
<td>ABS Welding</td>
<td>325</td>
</tr>
<tr>
<td>Rubber Floor Adhesives</td>
<td>60</td>
<td>Plastic Cement Welding</td>
<td>250</td>
</tr>
<tr>
<td>Subfloor Adhesives</td>
<td>50</td>
<td>Adhesive Primer for Plastic</td>
<td>550</td>
</tr>
<tr>
<td>Ceramic Tile Adhesives</td>
<td>65</td>
<td>Contact Adhesives</td>
<td>80</td>
</tr>
<tr>
<td>VCT &amp; Asphalt Adhesives</td>
<td>50</td>
<td>Special Purpose Contact Adhesive</td>
<td>250</td>
</tr>
<tr>
<td>Drywall &amp; Panel Adhesives</td>
<td>50</td>
<td>Structural Wood Member Adhesive</td>
<td>140</td>
</tr>
<tr>
<td>Cove Base Adhesives</td>
<td>50</td>
<td>Sheet Applied Rubber Lining Operations</td>
<td>850</td>
</tr>
<tr>
<td>Multipurpose Construction Adhesives</td>
<td>70</td>
<td>Top &amp; Trim Adhesive</td>
<td>250</td>
</tr>
<tr>
<td>Structural Glazing Adhesives</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substrate Specific Applications</th>
<th>VOC Limit [g/L less water]</th>
<th>Sealants VOC Limit</th>
<th>VOC Limit [g/L less water]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal to Metal</td>
<td>30</td>
<td>Architectural</td>
<td>250</td>
</tr>
<tr>
<td>Plastic Foams</td>
<td>50</td>
<td>Nonmembrane Roof</td>
<td>300</td>
</tr>
<tr>
<td>Porous Material (except wood)</td>
<td>50</td>
<td>Roadway</td>
<td>250</td>
</tr>
<tr>
<td>Wood</td>
<td>30</td>
<td>Single-Ply Roof Membrane</td>
<td>450</td>
</tr>
<tr>
<td>Fiberglass</td>
<td>80</td>
<td>Other</td>
<td>420</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sealant Primers</th>
<th>VOC Limit [g/L less water]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architectural Non Porous</td>
<td>250</td>
</tr>
<tr>
<td>Architectural Porous</td>
<td>775</td>
</tr>
<tr>
<td>Other</td>
<td>750</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aerosol Adhesives:</th>
<th>VOC weight [g/L minus water]</th>
</tr>
</thead>
<tbody>
<tr>
<td>General purpose mist spray</td>
<td>65% VOCS by weight</td>
</tr>
<tr>
<td>General purpose web spray</td>
<td>55% VOCS by weight</td>
</tr>
<tr>
<td>Special purpose aerosol adhesives (all types)</td>
<td>70% VOCS by weight</td>
</tr>
</tbody>
</table>

**SUBMITTALS**

Include descriptive narrative in SAM Checklist.

**TECHNOLOGY/STRATEGY**

Specify low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where adhesives and sealants are addressed. Common products to evaluate include: general construction adhesives, flooring adhesives, fire-stopping sealants, caulking, duct sealants, plumbing adhesives, and cove base adhesives. Review product cut sheets, material safety data sheets (MSDS), signed attestations or other official literature from the manufacturer clearly identifying the VOC contents or compliance with referenced standards.

**Standard Practice**

- Low-VOC materials are becoming more common in the market place

**Recommended Practice**

- Specify Low-VOC adhesives and sealants
- Consider the use of air scrubbers during the installation and curing of adhesives and sealers when used inside the passenger terminal or other public spaces

**Best Available Practice**

- Specify that all shop finished material meet the VOC emission requirements. Materials to consider are:
  - Primed steel
  - Finished metals including aluminum
  - Finished millwork
  - Finished steel and wood doors and windows

**CASE STUDY**

Terminal A
Boston Logan International Airport - Boston, Massachusetts

In addition to the implementation of a water-efficient plumbing and irrigation system and energy-efficient electric lighting, specific measures were taken to control the amount and quality of...
construction contaminates from negatively impacting the interior of the building. Adhesives, sealants, paints and carpets were specified to have very limited or no volatile organic compounds.

5.0 INDOOR ENVIRONMENTAL QUALITY

5.6.2 Low-Emitting Materials: Paints and Coatings

1 Point

INTENT

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

REQUIREMENTS

Paints and coatings used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the project scope:

  - Flats: 50 g/L
  - Non-Flats: 150 g/L


- Clear wood finishes, floor coatings, stains, and shellacs applied to interior 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.
  - Clear wood finishes: varnish 350 g/L; lacquer 550 g/L
  - Floor coatings: 100 g/L
  - Sealers: waterproofing sealers 250 g/L; sanding sealers 275 g/L; all other sealers 200 g/L
  - Shellacs: Clear 730 g/L; pigmented 550 g/L
  - Stains: 250 g/L

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Specify low-VOC paints and coatings in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where paints and coatings are addressed. Track the VOC content of all interior paints and coatings during construction.
Standard Practice
None

Recommended Practice

- Specify Low-VOC field applied paints and coating
- Consider the use of air scrubbers during the installation and curing of paints and coatings when used inside the terminal or other public spaces

Best Available Practice

- Specify that all shop finished material meet the VOC emission requirements. Materials to consider are:
  - Primed steel
  - Finished metals including aluminum
  - Finished millwork
  - Finished steel and wood doors and windows
5.0 INDOOR ENVIRONMENTAL QUALITY

5.6.3 Low-Emitting Materials: Flooring Systems

1 Point

INTENT

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

REQUIREMENTS

All flooring must comply with the following as applicable to the project scope:

- All carpet installed in the building interior shall meet the testing and product requirements of the Carpet and Rug Institute’s Green Label Plus program
- All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program
- All carpet adhesive shall meet the requirements of SAM Credit 5.6.1 Low-Emitting Materials: Adhesives and Sealants: VOC limit of 50 g/L
- All of the hard surface flooring must be certified as compliant with the FloorScore® standard (current as of the date of this Rating System, or more stringent version) by an independent third party. Flooring products covered by FloorScore® include vinyl, linoleum, laminate flooring, wood flooring, ceramic flooring, rubber flooring, wall base, and associated sundries.
- An alternative compliance path using FloorScore® is acceptable for credit achievement according to the following stipulations. 100% of the non-carpet finished flooring must be FloorScore® certified, and it must comprise, at minimum, at least 25% of the finished floor area. Potential examples of unfinished flooring include floors in mechanical rooms, electrical rooms, and elevator service rooms.
- Concrete, wood, bamboo, and cork floor finishes such as sealer, stain and finish must meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004. VOC limits are listed below:
  - Clear wood finishes: varnish 350 g/L; lacquer 550 g/L
  - Floor coatings: 100 g/L
  - Sealers: waterproofing sealers 250 g/L; sanding sealers 275 g/L; all other sealers 200 g/L
  - Shellacs: Clear 730 g/L; pigmented 550 g/L
  - Stains: 250 g/L
• Tile setting adhesives and grout must meet South Coast Air Quality Management District (SCAQMD) Rule #1168. VOC limits are listed below and correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.
  o Ceramic tile adhesive: 65 g/L
  o Grout and mortar: 250 g/L

• All flooring products will meet the testing and product requirements of the California Department of Health Services Standard Practice for The Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

SUBMITTALS
Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY
Clearly specify requirements for product testing and/or certification in the construction documents. Select products that are either certified under the Green Label Plus program or for which testing has been done by qualified independent laboratories in accordance with the appropriate requirements.

The Green Label Plus program for carpets and its associated VOC emission criteria in micrograms per square meter per hour, along with information on testing method and sample collection developed by the Carpet & Rug Institute (CRI) in coordination with California’s Sustainable Building Task Force and the California Department of Health Services (DHS), are described in Section 9, Acceptable Emissions Testing for Carpet, DHS Standard Practice CA/DHS/EHLB/R-174, dated 07/15/04. This document is published as Section 01350 Section 9 [dated 2004] by the Collaborative for High Performance Schools [http://www.chps.net/dev/Drupal/node]).

FloorScore® is a voluntary, independent certification program that tests and certifies hard surface flooring and associated products for compliance with criteria adopted in California for indoor air emissions of Volatile Organic Compounds (VOCs) with potential health effects. The program uses a small-scale chamber test protocol and incorporates VOC emissions criteria developed by the California Department of Health Services, which are widely known as Section 1350.

Standard Practice
None

Recommended Practice
• Specify Low-VOC carpet systems. Ensure that VOC limits are clearly stated where carpet systems are addressed. Be attentive to carpet installation requirements.
- Consider the use of air scrubbers during the installation and curing of carpet or hard surface floor system adhesives and sealers when used inside the terminal or other public spaces

**Best Available Practice**

- Specify that all shop finished material meet the VOC emission requirements. Materials to consider are:
  - Primed steel
  - Finished metals including aluminum
  - Finished millwork
5.0 INDOOR ENVIRONMENTAL QUALITY

5.6.4 Low-Emitting Materials: Composite Wood and Agrifiber Products

1 Point

INTENT

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

REQUIREMENTS

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

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

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Specify wood and agrifiber products that contain no added urea-formaldehyde resins. Specify laminating adhesives for field and shop applied assemblies that contain no added urea/formaldehyde resins. Review product cut sheets, MSD sheets, signed attestations or other official literature from the manufacturer.

Standard Practice

None

Recommended Practice

- Specify wood and agrifiber products with no added urea-formaldehyde resins.

Best Available Practice

- Specify that all shop finished material meet the VOC emission requirements. Materials to consider are:
  o Finished millwork
  o Finished steel and wood doors and windows
CASE STUDY

Terminal A – Composite Wood
Boston Logan International Airport – Boston, Massachusetts

During construction of the new terminal, special measures were taken to utilize composite wood materials. These materials helped reduce any adverse effects of the construction and preserve indoor air quality. In addition to wood composite, adhesives, sealants and very low or no Volatile Compounds (VOCs) were built into the specifications of the new terminal.

5.0 INDOOR ENVIRONMENTAL QUALITY

5.7 Indoor Chemical and Pollutant Source Control

1 Point

INTENT

Minimize exposure of building occupants to potentially hazardous particulates and chemical pollutants.

REQUIREMENTS

Design to minimize and control pollutant entry into buildings and later cross-contamination of regularly occupied areas:

- Employ permanent entryway systems at least 10-feet long in the primary direction of travel to capture dirt and particulates from entering the building at all entryways that are directly connected to the outdoors. Acceptable entryway systems include permanently installed grates, grilles, or slotted systems that allow for cleaning underneath. Roll-out mats are only acceptable when maintained on a weekly basis by a contracted service organization.

- Sufficiently exhaust each space where hazardous gases or chemicals may be present or used (including garages, housekeeping/laundry areas and copying/printing rooms) to create negative pressure with respect to adjacent spaces with the doors to the room closed. For each of these spaces, provide self-closing doors and deck to deck partitions or a hard lid ceiling. The exhaust rate shall be at least 0.50 cfm/sq.ft., with no air recirculation. The pressure differential with the surrounding spaces shall be at least 5 Pa (0.02 inches of water gauge) on average and 1 Pa (0.004 inches of water) at a minimum when the doors to the rooms are closed.

- In mechanically ventilated buildings, provide regularly occupied areas of the building with new air filtration media prior to occupancy that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better. Filtration should be applied to process both return and outside air that is to be delivered as supply air.

- Provide containment drains plumbed for appropriate disposal of hazardous liquid wastes in places where water and chemical concentrate mixing occurs for laboratory purposes.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Design facility cleaning and maintenance areas with isolated exhaust systems for contaminants. Maintain physical isolation from the rest of the regularly occupied areas of the building. Install permanent architectural entryway systems such as grills or grates to prevent occupant-borne
contaminants from entering the building. Install high-level filtration systems in air handling units processing both return air and outside supply air. Ensure that air handling units can accommodate required filter sizes and pressure drops.

**Standard Practice**

None

**Recommended Practice**

- Employ permanent entryway systems (e.g., grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways
- Where chemical use occurs (including housekeeping areas and copying/printing rooms), provide segregated areas with deck to deck partitions with separate outside exhaust at a rate of at least 0.50 cubic feet per minute per square foot, no air recirculation and maintaining a negative pressure
- Provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs
- Select finish materials and assemblies that resist mold growth
- Designate central locations in terminal and office buildings for storage of concentrated cleaning chemicals and other pollutant sources
- Install permanent architectural entryway systems such as grills or grates to prevent occupant-borne contaminants from entering the building

**Best Available Practice**

- Design separate exhaust and plumbing systems for rooms or areas with contaminants to achieve physical isolation from the rest of the building
- Encourage the use of electric vehicle uses in indoor cargo facilities
5.0 INDOOR ENVIRONMENTAL QUALITY

5.8.1 Controllability of Systems: Lighting

1 Point

INTENT

Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (e.g., classrooms and conference areas) to promote productivity, comfort and well-being.

REQUIREMENTS

Provide individual lighting controls for 90% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences.

AND

Provide lighting system controls for all shared multi-occupant spaces to enable lighting adjustment that meets group needs and preferences.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Design the building with occupant controls for lighting. Strategies to consider include lighting controls and task lighting. Integrate lighting systems controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the building.

Standard Practice

None

Recommended Practice

- Tie lighting in public areas of passenger terminals to flight schedules or use motion-activated lighting
- Design lighting control systems to take advantage of daylight harvesting to reduce artificial lighting when adequate daylight is available
- Design terminal areas to provide a variety of levels of light and sound in different areas simultaneously
- Provide operable windows in areas that are not noise-sensitive, such as cargo buildings
- Provide task lighting or more light switching zones in office areas
Best Available Practice
None

CASE STUDY

Jeppesen Landside Terminal – Lighting
Denver International Airport – Denver, Colorado

The Jeppesen Terminal at Denver International Airport was designed with energy efficient lighting throughout the building that will contain multi-level lighting, monitoring, and controls, integrated with energy efficient mechanical systems.

5.0 INDOOR ENVIRONMENTAL QUALITY

5.8.2 Controllability of Systems: Thermal Comfort

1 Point

INTENT

Provide a high level of thermal comfort system control by individual occupants or by specific groups in multi-occupant spaces (i.e., classrooms or conference areas) to promote the productivity, comfort and well-being of building occupants.

REQUIREMENTS

Provide individual comfort controls for 50% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences. Operable windows can be used in lieu of comfort controls for occupants of areas that are 20-feet inside of and 10-feet to either side of the operable part of the window. The areas of operable window must meet the requirements of ASHRAE 62.1-2010 paragraph 5.1 Natural Ventilation.

AND

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

Conditions for thermal comfort are described in ASHRAE Standard 55-2004 to include the primary factors of air temperature, radiant temperature, air speed and humidity.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Design the building and systems with comfort controls to allow adjustments to suit individual needs or those of groups in shared spaces. ASHRAE Standard 55-2004 identifies the factors of thermal comfort and a process for developing comfort criteria for building spaces that suit the needs of the occupants involved in their daily activities. Control strategies can be developed to expand on the comfort criteria to allow adjustments to suit individual needs and preferences.

These strategies may involve system designs incorporating operable windows, hybrid systems integrating operable windows and mechanical systems, or mechanical systems alone. Individual adjustments may involve individual thermostat controls, local diffusers at floor, desk or overhead levels, or control of individual radiant panels, or other means integrated into the overall building, thermal comfort systems, and energy systems design. In addition, designers should evaluate the closely tied interactions between thermal comfort (as required by ASHRAE Standard 55-2004) and acceptable indoor air quality (as required by ASHRAE Standard 62.1-2010, whether natural or mechanical ventilation).
Standard Practice

None

Recommended Practice

None

Best Available Practice

- Provide under floor air distribution systems with individual diffusers for office spaces
5.0 INDOOR ENVIRONMENTAL QUALITY

5.9.1 Thermal Comfort: Design

1 Point

INTENT

Provide a comfortable thermal environment that supports the productivity and well-being of building occupants.

REQUIREMENTS

Design HVAC systems and the building envelope to meet the requirements of ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy. Demonstrate design compliance in accordance with Section 6.1.1 Documentation.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

Establish comfort criteria per ASHRAE Standard 55-2004 that support the desired quality and occupant satisfaction with building performance. Design building envelope and systems with the capability to deliver performance to the comfort criteria under expected environmental and use conditions. Evaluate air temperature, radiant temperature, air speed, and relative humidity in an integrated fashion and coordinate these criteria with SAM Credits 5.1 Minimum Indoor Air Quality Performance, 5.3 Outdoor Air Delivery Monitoring and 5.4 Increase Ventilation.

Standard Practice

None

Recommended Practice

None

Best Available Practice

- Provide ceiling fans or natural ventilation to increase air movement in cargo spaces
- Provide humidification in HVAC systems serving office and terminal areas
- For spaces with humidification, install humidistats in addition to thermostats
CASE STUDY

Terminal 2
San Francisco International Airport - San Francisco, California

Terminal 2’s design at San Francisco International Airport incorporates a number of measures to reduce the carbon footprint of the facility. The LEED certified building is designed to improve indoor air quality and reduce energy consumption. The design features a waste reduction program and a reclaimed water reuse program.

www.flysfo.com/web/page/about/T2/sustainability/
5.0 INDOOR ENVIRONMENTAL QUALITY

5.9.2 Thermal Comfort: Verification

1 Point (awarded only if credit is earned toward SAM Credit 5.9.1)

INTENT

Provide for the assessment of building thermal comfort over time.

REQUIREMENTS

Provide a permanent monitoring system to ensure building performance to the desired comfort criteria as determined by SAM Credit 5.9.1 Thermal Comfort: Design.

Agree to implement a thermal comfort survey of building occupants within a period of six to 18 months after occupancy. This survey should collect anonymous responses about thermal comfort in the building including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. This plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55-2004.

Thermal Comfort: Verification, is contingent on the successful completion and award of the credit - Thermal Comfort: Design.

SUBMITTALS

Include descriptive narrative in SAM Checklist.

TECHNOLOGY/STRATEGY

ASHRAE Standard 55-2004 provides guidance for establishing thermal comfort criteria and the documentation and validation of building performance to the criteria. While the standard is not intended for purposes of continuous monitoring and maintenance of the thermal environment, the principles expressed in the standard provide a basis for design of monitoring and corrective action systems.

Standard Practice

None

Recommended Practice

None

Best Available Practice

None
CASE STUDY

Harvard Green Campus Initiative
Harvard University – Cambridge, Massachusetts

Harvard Real-Estate Services (HRES) facilities team plans to administer occupant surveys and adjust HVAC parameters to respond to comfort issues. The HRES survey is based on requirements of the LEED New Construction version 2.2 Reference Guide. The operations team will view survey results for each residence unit. If greater than 20% of the survey respondents are not comfortable, then the team will identify problem areas within the building. The team will identify the cause of discomfort in each situation and choose from a variety of options to correct the discomfort.

http://www.green.harvard.edu/theresource/
5.0 INDOOR ENVIRONMENTAL QUALITY

5.10.1 Daylight and Views: Views for 75% of Spaces

1 Point

INTENT

Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

REQUIREMENTS

OPTION 1 — CALCULATION

Achieve a minimum glazing factor of 2% in a minimum of 75% of all regularly occupied areas.

The glazing factor is calculated as follows:

\[
\text{Glazing Factor} = \frac{\text{Window Area (SF)}}{\text{Floor Area (SF)}} \times \frac{\text{Window Geometry Factor}}{\text{Actual } T_{\text{vis}} \times \text{Minimum } T_{\text{vis}}} \times \text{Window Height Factor}
\]

OR

OPTION 2 — SIMULATION

Demonstrate, through computer simulation, that a minimum daylight illumination level of 25 footcandles has been achieved in a minimum of 75% of all regularly occupied areas. Modeling must demonstrate 25 horizontal footcandles under clear sky conditions, at noon, on the equinox, at 30 inches above the floor.

OR

OPTION 3 — MEASUREMENT

Demonstrate, through records of indoor light measurements, that a minimum daylight illumination level of 25 footcandles has been achieved in at least 75% of all regularly occupied areas. Measurements must be taken on a 10-foot grid for all occupied spaces and must be recorded on building floor plans. Measurements must be taken under clear sky conditions, at 30" above the floor, on or about solar noon on the equinox.

OR

OPTION 4

Any of the above calculation methods may be combined to document the minimum daylight illumination in at least 75% of all regularly occupied spaces. The different methods used in each space must be clearly recorded on at minimum a 10-foot grid on all building plans.
In all cases, only the square footage associated with the portions of rooms or spaces meeting the minimum illumination requirements can be applied towards the 75% of total area calculation required to qualify for this credit. In all cases, provide daylight redirection and/or glare control devices to avoid high-contrast situations that could impede visual tasks. Exceptions for areas where tasks would be hindered by the use of daylight will be considered on their merits.

**SUBMITTALS**

Include descriptive narrative and calculations in SAM Checklist.

**TECHNOLOGY/STRATEGY**

Design the building to maximize interior daylighting. Strategies to consider include building orientation, shallow floor plates, increased building perimeter, exterior and interior permanent shading devices, high performance glazing and automatic photocell-based controls. Predict daylight factors via manual calculations or model daylighting strategies with a physical or computer model to assess footcandle levels and daylight factors achieved.

Modeling must demonstrate 25 horizontal footcandles under clear sky conditions, at noon, on the equinox, at 30 in. above the floor. Any portion of a room achieving the requirements can qualify for this credit.

**Standard Practice**

- Evaluate building design to maximize interior daylight. Consider:
  - Building orientation
  - Shallow floor plates
  - Increased building perimeter
  - Floor-to-ceiling heights
  - Ceiling configurations
- Design the building to maximize view opportunities.

**Recommended Practice**

- Provide sky or clerestory lighting as appropriate in cargo and passenger terminal facilities
- Coordinate daylight strategy with BAS and lighting control system

**Best Available Practice**

- Provide exterior and interior permanent shading devices
- Provide spectrally selective glazing to maximize daylight while minimizing heat gain
- Provide photo-integrated light sensors to dim artificial lights
- Predict daylighting via calculations or model daylighting strategies to assess footcandle levels and daylight factors achieved
CASE STUDY

Humphrey Terminal Design
Metropolitan Airports Commission - Minneapolis, Minnesota

Metropolitan Airports Commission, the governing authority for Minneapolis – St. Paul International Airport, has implemented various sustainable strategies for the development of green buildings at the airport. The new Humphrey Terminal optimizes HVAC efficiency, maximizes day-lighting and uses low-flow & automatic fixtures in all restrooms. Construction materials were also recycled and reused.

5.0 INDOOR ENVIRONMENTAL QUALITY

5.10.2 Daylight and Views: Views for 90% of Spaces

1 Point

INTENT

Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

REQUIREMENTS

Achieve direct line of sight to the outdoor environment via vision glazing between 30-inches and 90-inches above finish floor for building occupants in 90% of all regularly occupied areas. Determine the area with direct line of sight by totaling the regularly occupied square footage that meets the following criteria:

- In plan view, the area is within sight lines drawn from perimeter vision glazing
- In section view, a direct sight line can be drawn from the area to perimeter vision glazing

The line of sight may be drawn through interior glazing. For private offices, the entire square footage of the office can be counted if 75% or more of the area has direct line of sight to perimeter vision glazing. For multi-occupant spaces, the actual square footage with direct line of sight to perimeter vision glazing is counted.

SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist.

TECHNOLOGY/STRATEGY

Design the space to maximize daylighting and view opportunities. Strategies to consider include lower partition heights, interior shading devices, interior glazing, and automatic photocell-based controls.

Standard Practice

- Evaluate building design to maximize interior daylight. Consider:
  - Building orientation
  - Shallow floor plates
  - Increased building perimeter
  - Floor-to-ceiling heights
  - Ceiling configurations
- Design the building to maximize view opportunities
Recommended Practice

- Provide sky or clerestory lighting as appropriate in cargo and passengers terminal facilities
- Coordinate daylight strategy with BAS and lighting control system

Best Available Practice

- None

CASE STUDY

H. Weir Cook Terminal
Indianapolis International Airport - Indianapolis, Indiana

The new terminal building at Indianapolis International Airport contains high glass walls and a sweeping roof, where very little heat is transferred from the sun to the inside of the building. During the daylight hours, very little artificial light is required to light the terminal, all leading to energy conservation and cost reduction. The terminal’s high ceiling and high-performance curtain walls minimize solar loads, and a radiantly chilled/heated granite floor help maintain temperature by cooling from the ground up and allowing the warm air to naturally gather at the top of the structure.

5.0 INDOOR ENVIRONMENTAL QUALITY

5.11 Noise Transmission

1 Point

INTENT

Limit noise levels in noise-sensitive, occupied spaces such as passenger terminals and offices to increase employee productivity and passenger comfort.

REQUIREMENTS

Maintain predicted noise levels in all passenger terminal areas to a Noise Criteria (NC) below 40 and offices and conference rooms below NC30.

OR

Specify exterior glazing with a Sound Transmission Class (STC) of 35 or better per ASTM E413 and ASTM E1332 for all regularly occupied spaces.

SUBMITTALS

Include descriptive narrative in SAM Checklist and show calculations indicating that NC levels are met in all critical areas or submit product data sheets for exterior glazing meeting the STC requirements.

TECHNOLOGY/STRATEGY

There are a number of design techniques that can influence the acoustical quality of indoor spaces. Generally, these can include improved glazing and partitions or less costly design practices such as building and furniture orientation.

Standard Practice

- Design spaces in such a way as to orient noise sensitive areas away from major noise sources
- Use sound dampening glazing and wall partitions
- Locate copy machines and printers in separate rooms

Recommended Practice

- For office environments, specify acoustical ceiling with an appropriate noise reduction coefficient to meet the requirements of this credit
- Choose cubicle partitions that are at least 5 feet tall to provide a sound barrier to workstation occupants
- Insulate wall cavities for noise sensitive spaces and extension of partition walls to the structural deck
Best Available Practice

- Specify laminated glazing to reduce noise transmission for normally occupied spaces

RESOURCES


www.wbdg.org/resources/acoustic.php
6.0 CONSTRUCTION PRACTICES

6.1 Prerequisite 1 – Clean Fuel Construction Vehicles

Required

NOTE

Due to advancements in available fuels and technologies, as well as changes in regulation, including the City of Chicago Clean Diesel Ordinance for Construction Sites, this section is currently applicable, but under revision.

INTENT

Minimize air quality impacts during construction.

REQUIREMENTS

All projects must comply with CDA/OMP Specification 01111 – Construction Air Quality. The requirements are summarized below. For additional detail, refer to the CDA/OMP Specification.

The requirements for all off-road vehicles that are on the project site for more than 14 consecutive days are:

- All off-road construction vehicles over 50 hp must use ultra-low sulfur diesel (ULSD) fuel conforming to ASTM D975, D5453, D6078, and D613.
- All off-road diesel-powered vehicles and equipment (both mobile and stationary) over 50 hp must install and/or retrofit with emissions control devices that will reduce emissions prior to utilization of said equipment on the project. The Retrofit Emission Control Devices must consist of diesel oxidation catalysts, diesel particulate filters or similar retrofit equipment control technology that:
  - Is included on the EPA Verified Retrofit Technology List (http://epa.gov/cleandiesel/verification/verif-list.htm) or verified by the California Air Resources Board (CARB) (www.arb.ca.gov/diesel/verdev/verdev.htm) or
  - Is verified by EPA or represented by the manufacturer in writing, to provide a minimum emissions reduction of 20% PM, 20% CO, and 40% HC when used with Ultra Low Sulfur Diesel fuel.
  - This requirement applies unless the vehicle or equipment is either EPA Tier 2 Rule compliant or meets the horsepower/model year defined in the table below:

<table>
<thead>
<tr>
<th>Horsepower Range</th>
<th>Model Year (or newer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-99</td>
<td>2004</td>
</tr>
<tr>
<td>100-299</td>
<td>2003</td>
</tr>
<tr>
<td>300-599</td>
<td>2001</td>
</tr>
<tr>
<td>600-749</td>
<td>2002</td>
</tr>
<tr>
<td>750 and up</td>
<td>2006</td>
</tr>
</tbody>
</table>
The requirements for all on-road vehicles that access the project site more than 5 calendar days per month.

- All on-road construction vehicles over 50 hp must use ultra-low sulfur diesel (ULSD) fuel conforming to ASTM D975, D5453, D6078, and D613

All diesel powered vehicles meet the idling restrictions described in the specification section. Specifically, vehicles must not idle for more than five consecutive minutes in a 60-minute period when the equipment is not in use except for certain situations, such as traffic conditions or during equipment repairs.

**SUBMITTALS**

The submittal requirements for compliance with CDA/OMP Specification 01111 – Construction Air Quality and to meet this prerequisite are summarized in the table below:

<table>
<thead>
<tr>
<th>Submittal</th>
<th>Specification Paragraph Reference</th>
<th>Description</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor/Subcontractor Equipment Verification Report</td>
<td>3.01.B</td>
<td>Contractor certifies that vehicles listed on Contractor Equipment Listing are true and accurate and is in compliance with EPA rules.</td>
<td>Prior to start of construction.</td>
</tr>
<tr>
<td>Contractor Equipment Listing</td>
<td>3.01.B</td>
<td>Gives a list of all vehicles to be used by Contractor that will be on the Project site and subject to the Fuel Use Requirements in 2.01.</td>
<td>Prior to start of construction.</td>
</tr>
<tr>
<td>Equipment Tracking Form</td>
<td>3.01.B</td>
<td>Used when new equipment is brought to the project site or old equipment is replaced. Track changes to the Contractor Equipment Listing with this form.</td>
<td>As needed</td>
</tr>
</tbody>
</table>
TECHNOLOGY/STRATEGY

Standard Practice

- The OMP currently requires that all off-road construction vehicles over 50 hp use ultra-low sulfur diesel (ULSD) fuel and restrict idling times. In addition, all contractors are required to report fuel usage on a monthly basis. All projects are required to include CDA/OMP Specification 01111 – Construction Air Quality in their contract documents.

Recommended Practice

- Contractors are encouraged to identify and incorporate any other measures that may assist in reducing air quality emissions as a result of construction. For example, many cleaner vehicle options now exist for employee shuttle buses and Light Duty Vehicles (LDVs) including compressed natural gas (CNG), hybrid (fuel/electric), flex fuel, and demand on displacement. The availability of cleaner vehicle options is anticipated to expand over time and over the course of the Project. Contractors working on the Project are strongly encouraged to consider these options when making purchase decisions.

Best Available Practice

None

CASE STUDY

Ultra Low Sulfur Diesel Fuel Mandate
Chicago O’Hare Modernization Program - Chicago, Illinois

When the O’Hare Modernization Program (OMP) construction began in September 2005, several years before the EPA was mandating the use of ULSD fuel, the OMP made it a priority to minimize the air quality impacts of such a large construction project. At the time, the availability and cost of the specialized fuel and emissions control equipment caused concern to program officials and contractors alike. However, because of the size and duration of the construction activities, in addition to the need to meet EPA standards by 2010, the program may have bolstered the market for ULSD and the newer, cleaner burning construction.

As of September 2011, approximately 90% of all equipment met Tier 2 emission standards or better. The tier compliance is an emission based standard set by EPA. The higher the tier level the more stringent the emissions will be from the equipment.
6.0 CONSTRUCTION PRACTICES

6.2 Prerequisite 2 – Construction Equipment Maintenance

Required

INTENT

Minimize the environmental impact of construction equipment maintenance activities.

REQUIREMENTS

Follow the requirements of the CDA BMP Manual.

SUBMITTALS

- For the SAM Design Checklist, indicate the required location in the contract documents
- For the SAM Construction Checklist, the contractor must indicate relevant BMPs applied

TECHNOLOGY/STRATEGY

By requiring contractors to comply with the CDA BMP Manual, it is anticipated that the impacts due to construction equipment maintenance activities will be reduced. The BMPs include procedures for vehicle washing, maintenance, fueling, chemical storage, and spill control.

Standard Practice

Relevant BMPs (from CDA BMP Manual):

- 001 – Equipment Vehicle Washing Restrictions
- 002 – Equipment Vehicle Fueling Controls
- 003 – Equipment Vehicle Maintenance Requirements
- 011 – Above Ground Storage Tank Equipment Requirements/Spills
- 012 – Mobile Tank Trucks (petroleum) Requirements
- 013 – Chemical Handling/Storage Requirements
- 014 – Drum Storage Procedures
- 015 – Battery Storage Procedures
- 017 – Truck Loading/Unloading Procedures/Spill Control
- 018 – Spill Control Kits and Spill Response
- 019 – Good Housekeeping Procedures/Waste Storage
- 020 – Storm Drain Protection/Identification

Recommended Practice

None

Best Available Practice

None
6.0 CONSTRUCTION PRACTICES

6.3 Construction Activity Pollution Prevention

Identical to SAM Credit 1.1 Prerequisite 1 – Construction Activity Pollutant Prevention

Required

INTENT

This credit is identical to SAM Credit 1.1 Prerequisite 1 – Construction Activity Pollutant Prevention and is referenced under this section to emphasize that it is a sustainable construction prerequisite. Points will not be awarded under this credit and the credit is only shown as a reference. Requirements for this credit will be tracked under SAM Credit 1.1 Prerequisite 1 – Construction Activity Pollutant Prevention only.

6.4 Systems Commissioning

Identical to SAM Credit 3.1 Prerequisite 1 – Fundamental Building Systems Commissioning

Required

INTENT

This credit is identical to SAM Credit 3.1 Prerequisite 1 – Fundamental Building Systems Commissioning and is referenced under this section to emphasize that it is a sustainable construction prerequisite. Points will not be awarded under this credit and the credit is only shown as a reference. Requirements for this credit will be tracked under SAM Credit 3.1 Prerequisite 1 – Fundamental Building Systems Commissioning only.

6.5 Construction Waste Management

Identical to SAM Credit 4.3 Construction Waste Management

No Points – Points awarded under SAM Credit 4.3 Construction Waste Management

INTENT

This credit is identical to SAM Credit 4.3 Construction Waste Management and is referenced under this section to emphasize that it is a sustainable construction credit. Points will not be awarded under this credit and the credit is only shown as a reference. Requirements for this credit will be tracked under SAM Credit 4.3 Construction Waste Management only.
6.6 Construction IAQ Management Plan

Identical to SAM Credit 5.5 Construction IAQ Management Plan

No Points – Points awarded under SAM Credit 5.5 Construction IAQ Management Plan

INTENT

This credit is identical to SAM Credit 5.5 Construction IAQ Management Plan and is referenced under this section to emphasize that it is a sustainable construction credit. Points will not be awarded under this credit and the credit is only shown as a reference. Requirements for this credit will be tracked under SAM Credit 5.5 Construction IAQ Management Plan only.
6.0 CONSTRUCTION PRACTICES

6.7 Low-Emission Construction Vehicles

1 Point

INTENT

Minimize air quality impacts during construction.

REQUIREMENTS

In addition to complying with the prerequisite SAM Credit 6.1 Prerequisite 1 – Clean Fuel Construction Vehicles, a point is earned if 50% of all off-road vehicles over 50 hp on the project site for more than 14 consecutive days are EPA Tier 3 compliant or better.

Exemplary Performance

An additional point may be claimed under 8.1 Innovation in Design & Construction if 25% of the off-road vehicles over 50 hp that are on the project site for more than 14 consecutive days are EPA Tier 4a compliant.

SUBMITTALS

Submittal requirements are per CDA/OMP Specification 01111 – Construction Air Quality.

TECHNOLOGY/STRATEGY

Standard Practice

- See Standard Practice under SAM Credit 6.1 Prerequisite 1 – Clean Fuel Construction Vehicles

Recommended Practice

- In addition to the recommendations in SAM Credit 6.1 Prerequisite 1 – Clean Fuel Construction Vehicles, the contractor is encouraged to use equipment in its existing fleet that meets these guidelines

Best Available Practice

- In addition to the recommendations in SAM Credit 6.1 Prerequisite 1 – Clean Fuel Construction Vehicles, the contractor is encouraged to purchase new equipment or retrofit existing equipment to meet these guidelines. Consider use of:
  - Biodiesel (use regionally derived biofuels)
  - Other regionally preferred alternative fuels
  - Diesel-electric hybrid vehicles
o Where approved and appropriate, consider the use of Warm Mix Asphalt (WMA) for paving, which reduces energy usage and emissions. Also see SAM Credit 5.5 Aggregate Reuse.

o GPS for optimizing haul routes and work activities.

o Stricter idling controls, including use of idling restrictors.

o Newest technology equipment and retrofits.
6.0 CONSTRUCTION PRACTICES

6.8.1 Alternative Transportation during Construction: Staging Area

1 Point

INTENT

Reduce emissions due to construction vehicles by minimizing the amount of traffic to the construction site.

REQUIREMENTS

To meet this credit each project must have a staging area where employees congregate prior to entering the project site.

AND

Use multiple occupancy vehicles to access the project site from the centralized staging area.

SUBMITTALS

Although not required for the SAM Design Checklist, a staging area, with contractor trailer, should be included in the design drawings.

For the SAM Construction Checklist, the contractor must state that the staging area, with contractor trailer, was present and list or describe how employees accessed the project site (e.g., pooled in trucks or shuttle bus).

TECHNOLOGY/STRATEGY

Standard Practice

- Most projects typically use heavier duty vehicles such as pick-up trucks or SUVs to provide workers with access to the project site. In some cases, for larger projects, buses are used

Recommended Practice

- Establish procedures and make vehicles available for employee car pooling to the project site. For maximum benefit, shuttle buses or vans are preferred over lower occupancy vehicles such as pick-up trucks.

Best Available Practice

- Use fuel-efficient vehicles for car-pooling employees to the project site
6.0 CONSTRUCTION PRACTICES

6.8.2 Alternative Transportation during Construction: Low-Emitting and Fuel-Efficient Vehicles, 10%

1 Point

INTENT

Reduce emissions from on-road construction vehicles (e.g., foreman pickups or shuttle buses).

REQUIREMENTS

The contractor must use fuel efficient and low-emitting vehicles for at least 10% of all on-road, contractor-owned construction vehicles that access the project site more than five calendar days per month. To meet this requirement, the vehicles must be listed as SmartWay certified vehicles according to the EPA Green Vehicle Guide. The listing of SmartWay certified vehicles can be found at: http://www.epa.gov/greenvehicles/you/smartway.htm

SUBMITTALS

For the sustainable construction checklist, the contractor must submit a list of its on-road vehicles and identify those which meet the EPA’s SmartWay certification as described above.

TECHNOLOGY/STRATEGY

Each model year, EPA rates every new car, truck, and SUV for greenhouse gas and smog-forming emissions on scales of 1-10. To earn the SmartWay designation, a vehicle must receive a combined score from both scales that is much better than the average vehicle. SmartWay Elite certification is given to only those vehicles that attain the highest scores on both scales. The thresholds for the combined scores needed to achieve a SmartWay certification vary by vehicle model year. The Air Pollution (or Smog) Score is based on the government emission standards for which the vehicle was certified to comply with and reflects vehicle tailpipe emissions that contribute to local and regional air pollution, creating problems such as haze, and health issues. The Greenhouse Gas score reflects fuel lifecycle emissions of carbon dioxide (CO2) and other greenhouse gases. A partial list of heavier duty vehicles (pick-ups and SUVs) that meet these requirements are shown below for reference:

<table>
<thead>
<tr>
<th>Year/Vehicle Make/Model (Type)</th>
<th>Engine/Transmission/Fuel</th>
<th>Air Pollution Score</th>
<th>Greenhouse Gas Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 GMC Canyon Crew Cab (Pick-Up)</td>
<td>5.3L/Auto 2WD/Gasoline</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2007 Chevrolet Silverado K15 (Pick-Up)</td>
<td>5.3L/Auto 4WD/ E85-Gasoline</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2008 Chevrolet Colorado (Pick-Up)</td>
<td>2.9L/Auto 2WD/Gasoline</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2010 Ford Ranger (Pick-Up)</td>
<td>2.3L/Auto 2WD/Gasoline</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2014 Toyota Highlander Hybrid (SUV)</td>
<td>3.5L/Auto 4WD/Gasoline</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2014 Chevrolet Equinox (SUV)</td>
<td>2.4L/Auto 2WD/E85-Gasoline</td>
<td>6 (E85)</td>
<td>7 (E85)</td>
</tr>
<tr>
<td>2014 GMC Terrain (SUV)</td>
<td>2.4L/Auto 2WD/Gasoline</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2012 Azure Dynamics Transit Connect Electric (Van)</td>
<td>Electric/Auto/Electricity</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>
Standard Practice

- Utilize hybrid and flex fuel vehicles

Recommended Practice

- Promote the use of vehicles that meet the requirements above for EPA SmartWay certified vehicles.

Best Available Practice

- Operate compressed natural gas (CNG), electric, fuel cell, biodiesel vehicles
6.0 CONSTRUCTION PRACTICES

6.8.3 Alternative Transportation During Construction: Low-Emitting and Fuel-Efficient Vehicles, 50%

1 Point

INTENT

Reduce emissions from on-road construction vehicles.

REQUIREMENTS

The contractor must use fuel efficient and low-emitting vehicles for at least 50% of all on-road, contractor-owned construction vehicles that access the project site more than five calendar days per month. To meet this requirement, the vehicles must be listed as SmartWay certified vehicles according to the EPA Green Vehicle Guide. The listing of SmartWay certified vehicles can be found at: http://www.epa.gov/greenvehicles/you/smartway.htm

SUBMITTALS

For the sustainable construction checklist, the contractor must submit a list of its on-road vehicles and identify those which meet the EPA’s SmartWay certification as described above.

TECHNOLOGY/STRATEGY

Each model year, EPA rates every new car, truck, and SUV for greenhouse gas and smog-forming emissions on scales of 1-10. To earn the SmartWay designation, a vehicle must receive a combined score from both scales that is much better than the average vehicle. SmartWay Elite certification is given to only those vehicles that attain the highest scores on both scales. The thresholds for the combined scores needed to achieve a SmartWay certification vary by vehicle model year. The Air Pollution (or Smog) Score is based on the government emission standards for which the vehicle was certified to comply with and reflects vehicle tailpipe emissions that contribute to local and regional air pollution, creating problems such as haze, and health issues. The Greenhouse Gas score reflects fuel lifecycle emissions of carbon dioxide (CO2) and other greenhouse gases. A partial list of heavier duty vehicles (pick-ups and SUVs) that meet these requirements are shown below for reference:

<table>
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<tr>
<th>Year/Vehicle Make/Model (Type)</th>
<th>Engine/Transmission/Fuel</th>
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<th>Greenhouse Gas Score</th>
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<tr>
<td>2008 Chevrolet Colorado (Pick-Up)</td>
<td>2.9L/Auto 2WD/Gasoline</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2010 Ford Ranger (Pick-Up)</td>
<td>2.3L/Auto 2WD/Gasoline</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2014 Toyota Highlander Hybrid (SUV)</td>
<td>3.5L/Auto 4WD/Gasoline</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2014 Chevrolet Equinox (SUV)</td>
<td>2.4L/Auto 2WD/E85-Gasoline</td>
<td>6 (E85)</td>
<td>7 (E85)</td>
</tr>
<tr>
<td>2014 GMC Terrain (SUV)</td>
<td>2.4L/Auto 2WD/Gasoline</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2012 Azure Dynamics Transit Connect Electric (Van)</td>
<td>Electric/Auto/Electricity</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>
**Standard Practice**

- Utilize hybrid and flex fuel vehicles

**Recommended Practice**

- Promote the use of vehicles that meet the requirements above for EPA SmartWay certified vehicles.

**Best Available Practice**

- Operate compressed natural gas (CNG), electric, fuel cell, biodiesel vehicles
6.0 CONSTRUCTION PRACTICES

6.9 Construction Materials Conveyance

1 Point

INTENT

Reduce emissions from construction activities by minimizing the amount of on-road and off-road vehicle traffic traveling to/from the construction site.

REQUIREMENTS

Use an automatic materials conveyance system as a method for transporting materials to or from a construction site.

SUBMITTALS

For the sustainable construction checklist, the contractor must describe the conveyance system in the narrative.

TECHNOLOGY/STRATEGY

The use of a materials conveyance system not only reduces site traffic but can also aid in logistics, noise reduction, and increased security. The primary focus of a conveyance system will obviously be in those projects in which there is a large area requiring significant grading changes. While it is encouraged that soil be maintained on-site as much as possible, for those case where it is not feasible, a conveyance system would be a potential solution for transport to off-site, on- or near-airport locations.

Standard Practice

- Due to the configuration of the airfield and the proximity of the earth stockpiles and sources, there has so far not been a need to use an automatic conveyor system. However, a railroad relocation project was awarded a point under this credit as a result of using the rail line itself to deliver materials for this project.

Recommended Practice

- Construct Batch Plants as needed on- or near-site or utilize rail transport where available or appropriate.

Best Available Practice

None
CASE STUDIES

Recycling and Waste Management Conveyor
Hartsfield-Jackson Atlanta International Airport - Atlanta, Georgia

Hartsfield-Jackson International Airport in Atlanta has developed innovative programs to handle and process demolition waste for reuse in airport construction projects. The airport utilized an overland belt conveyor system that transported 93 percent of the 21.5 million cubic yards of fill necessary for a new runway's construction, resulting in reduced truck trips, emission elimination, and diversion of construction material waste from landfills.


Materials Management Program
Oakland International Airport - Oakland, California

As capital improvement and infrastructure programs increase over the next few years, Oakland International Airport, has implemented a comprehensive construction materials management program to reduce the amount of transport and disposal of construction materials and increase recycling and re-use of these materials.

www.oaklandairport.com/noise/environmental_construct.shtml
6.0 CONSTRUCTION PRACTICES

6.10 Construction Noise and Acoustical Quality

1 Point

INTENT

Improve the exterior noise quality during construction affecting residential areas or other noise sensitive areas.

REQUIREMENTS

Although the City of Chicago has an environmental noise ordinance (Article XXI – Environmental Noise and Vibration Control), it does not apply to construction or demolition work on public improvements authorized by a government body or agency (City Ordinance 11-4-2835).

The requirements of this credit will only apply to noise disturbances that are adjacent to noise sensitive areas, such as residential or institutional (hospitals, schools, libraries, nursing homes) areas. Noise disturbances are defined as any sound which is audible at a distance of 600 feet from its source or any sound which generates a sound pressure level in the public way exceeding 70 dB(A) when measured 10-feet from the source (City Ordinance 11-4-2710).

To achieve a point under this credit, the following requirements must be met during construction for those sites that are near noise sensitive areas as defined by the Chicago City Ordinance:

Meet the noise restrictions listed in the Chicago City Ordinance (Article XXI, Part B) which include, but are not limited to, noise from mechanical stationary sources (11-4-2810), loading and unloading operations (11-4-2830), and construction equipment (11-4-2835) during nighttime hours.

OR

Implement a noise abatement or noise mitigation plan that identifies site specific, mechanical, structural or operational measures to reduce noise disturbances in noise sensitive areas adjacent to the project site.

SUBMITTALS

Although not required for the sustainable design checklist, indicate noise sensitive areas on plans to aid contractor in determining the best noise mitigation strategies.

For the sustainable construction checklist, the contractor must indicate that the requirements of the Chicago Environmental Noise Ordinance have been met or submit a noise mitigation plan identifying the measures taken to reduce noise disturbances in the affected areas.
TECHNOLOGY/STRATEGY

The primary paragraph related to construction activities is Chicago City Ordinance 11-4-2835 which basically states that no fuel or electric powered mechanical equipment may be used during the hours of 8:00 p.m. and 8:00 a.m. within 600 feet of any residential areas or hospitals. The ordinance further states that public improvements authorized by a government agency, like the OMP, are not subject to this ordinance, however, a point will be given under this credit for those projects that choose to comply with the ordinance.

There are numerous noise mitigation methods that can be employed some of which are site or equipment specific. The easiest method of noise mitigation is to locate the noise source in an area that is not noise sensitive and to conduct that work during daytime hours, 8:00am to 8:00pm. Where this is not possible, temporary barriers can be erected to mitigate the noise emanating from a source.

Standard Practice

None

Recommended Practice

None

Best Available Practice

None

CASE STUDY

Noise Abatement and Mitigation Procedures
Federal Highway Administration

The Federal Highway Administration has identified a number of measures and provisions which help to mitigate construction noise. One such strategy is the utilization of natural and artificial barriers such as ground elevation changes, existing buildings, noise walls, and other structures.

Also, many construction vehicle engine compressors are contained or have baffles to help abate noise levels. Electric compressors are significantly quieter than diesel or gasoline engine powered compressors.

www.fhwa.dot.gov/environment/noise/handbook/07.htm
6.0 CONSTRUCTION PRACTICES

6.11 Sustainable Temporary Construction Materials

1 Point

INTENT

Reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with high recycled content, rapidly renewable materials and FSC certified wood products for temporary uses during construction.

REQUIREMENTS

Temporary construction materials include, but are not limited to, any materials that are used for construction that are not incorporated into the final development such as, erosion control materials, temporary haul roads, shoring materials, formwork, temporary carpentry, and traffic control devices and signage. For the purposes of this calculation, only the material cost, excluding labor and equipment, shall be used. In order to meet the requirements of this credit, one of the following requirements must be met:

Using a recycled content calculation similar to SAM Credit 4.7 Recycled Content, determine the percentage of recycled content in the temporary construction materials based on overall temporary construction material cost. To achieve a point in this credit, the overall recycled content of the temporary construction materials must be 30% or greater by cost.

OR

Using a rapidly renewable content calculation similar to SAM Credit 4.9 Rapidly Renewable Materials, determine the percentage of the rapidly renewable materials based on overall temporary construction material cost. To achieve a point in this credit, the overall recycled content of the temporary construction materials must be 10% or greater by cost.

OR

Using a certified wood calculation similar to SAM Credit 4.10 Certified Wood, determine the percentage of certified wood materials based on the total wood-based material cost. To achieve a point in this credit, the overall recycled content of the temporary construction materials must be 60% or greater by cost.

Do not count temporary construction materials under any of the credits in Section 4.0 - Materials & Resources. Materials such as aggregates may be counted either under SAM Credit 4.5 Aggregate Reuse or this credit, but should only be counted once.

SUBMITTALS

The submittals include the following:

- A pre-construction estimate using the form in CDA/OMP Standard Specification 01360 – Sustainable Temporary Construction Materials, to be provided by the contractor
A final construction estimate using the form in CDA/OMP Standard Specification 01360 – Sustainable Temporary Construction Materials, to be provided by the contractor

TECHNOLOGY/STRATEGY

Many temporary construction materials can help achieve the requirements of this credit. Although not tracked by LEED, CDA has added this credit in order to promote the use of such materials during construction, as well as for final development stages of a project.

Standard Practice

- Although many temporary construction materials meet the requirements of this credit, their use is typically not tracked or promoted. The designer is encouraged to specify sustainable materials in construction wherever possible. The contractor is further encouraged to use these types of materials in the cases where they may not be explicitly specified.

Recommended Practice

Materials that may have high recycled content include, but are not limited to:

- Temporary steel structures or materials
- Fencing or metal barricades
- Plastic traffic control devices (barricades, cones)
- Temporary piping (HDPE, ductile iron)
- Steel formwork
- Plastic erosion control materials (e.g. silt fence)

Materials that have rapidly renewable materials include, but are not limited to:

- Poplar oriented strand board (OSB) for formwork or temporary carpentry
- Coir or jute fabric erosion control blankets and meshes
- Plant-based cladding and insulation materials
- Contractor trailer materials such as flooring and finishes

FSC certified wood products for temporary construction materials may include:

- Wood formwork
- Temporary wood structures or scaffolding

Best Available Practice

None
CASE STUDY

Sustainable Scaffolding Materials
Seattle, Washington

When Seattle enacted a Sustainable Building Policy in 2000, all new city-funded renovations and construction projects were required to obtain LEED Silver rating. In response to this initiative, contractors are expected to begin utilizing sustainable materials for construction project scaffolding structures. Most of these types of scaffolding structures are made of bamboo or hybrid-bamboo material, which is regarded as highly sustainable.

www.scaffoldingusa.com/scaffold/seattle-scaffolding.html
Clean fuel construction vehicles

On-site Batch Plant

Designated material recycling area

Balanced Earthwork Plan, in action
7.0 INNOVATION IN DESIGN & CONSTRUCTION

7.1 – 7.3 Innovation in Design & Construction

1 to 3 Points

INTENT

Provide design teams and projects the opportunity to achieve exceptional performance above the requirements set by the Sustainable Airport Manual Green Airplane Rating System and/or innovative performance not specifically addressed by the Sustainable Airport Manual.

REQUIREMENTS

In writing, identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the approach (strategies) that might be used to meet the requirements.

Up to 3 points may be awarded for this credit:

<table>
<thead>
<tr>
<th>SAM Credit</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>1</td>
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<tr>
<td>7.2</td>
<td>1</td>
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<tr>
<td>7.3</td>
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</tbody>
</table>

SUBMITTALS

Include descriptive narrative in the SAM Checklist following the criteria in the Requirements section above.

TECHNOLOGY/STRATEGY

Substantially exceed a SAM performance credit such as energy performance or water efficiency and/or apply strategies or measures that demonstrate a comprehensive approach and quantifiable environment and/or health benefits.

Refer to LEED Credit Interpretation Results (CIRs) or the Innovation in the LEED Design Credit Catalog5 for potential strategies that may be considered for innovation. Most will pertain to building related innovations; however the SRP will review proposed innovations by the designer or contractor on a case by case basis. Some examples include green cleaning programs for buildings, educational programs for building occupants related to sustainability, and innovative construction practices that reduce waste such as travelling formwork.

5 Available at www.usgbc.org.
CASE STUDY

DFW Sustainability Initiative
Dallas / Fort Worth International Airport - Dallas, Texas

In August 2008, DFW Airport initiated an airport-wide Sustainability Policy and Program, which is a key element in the Airport’s Strategic Plan designed to positively impact the environment, the surrounding community, the Airport and its employees. This comprehensive approach encourages project submittals for airport-related facilities to demonstrate compliance to LEED-related policies and the strategies used to meet the requirements.


7.0 INNOVATION IN DESIGN & CONSTRUCTION

7.4 Menu Items (Construction Equipment Retrofit, Photovoltaics, Geothermal Heating/Cooling, Wind Power, Rainwater Harvesting, Permeable Pavement, Trombe or Solar Walls, Green Walls, Warm-Mix Asphalt or Alternative Water Heating)

1 to 5 Points

INTENT

Promote specific technologies and additional strategies considered to be important to the sustainability of the airport environment.

REQUIREMENTS

A point will be awarded for each of the technologies or strategies listed below that are used on a project up to a maximum of 3 points:

- Construction Equipment Retrofit – Retrofit all construction equipment over 50 hp and on site for more than 14 calendar days per month to EPA Tier 3 emission standards
- Photovoltaics – Use photovoltaic systems to generate electricity. System must generate 0.5 kW or greater
- Geothermal Heating/Cooling – Any geothermal system to provide heating and cooling is acceptable
- Wind Power – Generate on-site electricity using wind turbines, horizontal or vertical. System must generate 0.5 kW or greater
- Rainwater Harvesting – Use cisterns, rain barrels, or other vessels to store rain water for other uses including, but not limited to, irrigation, vehicle washing, and other general, non-potable uses. The harvested rainwater must have an intended use. Minimum storage capacity is 200 gallons.
- Permeable Pavement – Use permeable pavement such as concrete, asphalt, or pavers, for at least 5% of the total pavement area of the project not subject to aircraft traffic or 1,000 sq. ft, whichever is greater
- Trombe or Solar Walls – Use passive solar preheating of intake air for space heating using wall systems or other building surfaces
- Green Walls – Use green, vegetated wall systems on exterior of building envelope for at least 25% of the vertical wall surfaces or the entirety of south and/or west facing walls, whichever is greater
- Warm-Mix Asphalt – Use warm-mix asphalt for at least 5% of the total pavement area of the project or 1,000 sq. ft, whichever is greater
- Alternative Hot Water Heating – Use solar thermal for 25% or demand (tankless) hot water heating systems for 100% of the project’s hot water demand. Excludes process water demand.
SUBMITTALS

Include descriptive narrative and calculations in SAM Checklist. Indicate in the narrative which of the above technologies and strategies are being included in the project and, where applicable, indicate where these items are shown in the drawings or specifications.

TECHNOLOGY/STRATEGY

Choose any of the following:

- Construction equipment retrofit – The use of particulate traps and catalysts to meet more stringent EPA emissions standards for older construction equipment.
- Photovoltaics – Photovoltaic or solar-electric systems may be ground-mounted, roof-mounted, or built into the roof or walls of a building, known as building integrated photovoltaic (BIPV).
- Geothermal heating/cooling systems – Any geothermal system to provide heating and cooling is an acceptable strategy.
- Wind power – Generate on-site electricity using wind turbines, horizontal or vertical.
- Rainwater harvesting – Collecting rainwater from the many roofs at an airport would provide a large source of clean non-potable water. Although the supply would far exceed the demand, the use of harvested rainwater should be taken on a site-specific case by case basis. Although airport irrigation is limited to ornamental planters, other uses such as vehicle washing may be amenable to this technology.
- Permeable pavement – The amount of pavement at an airport makes permeable pavement an attractive application for the management of stormwater. Although major pavement areas such as runways, taxiways, and apron areas cannot include permeable pavement, there is a significant amount of non-aviation related pavement areas. Using permeable pavement, unit pavers or permeable asphalt or concrete, may also further contribute to the sustainability of a project because these materials can contain high recycled content materials that are locally available, and may reduce heat island effects for non-roof areas, in addition to their stormwater management aspects. All three of these types of pavements have been demonstrated and are being used by the City of Chicago in its Green Alley Program under the direction of Chicago Department of Transportation (CDOT).
- Trombe or Solar walls – These systems use solar energy to heat a thermal mass, usually a concrete wall or an air gap between an interior wall and a dark-colored exterior surface, as means to preheat intake air. On very cold days, the heating system can condition preheated air rather than putting the additional energy in heating cold outside air, thereby realizing an energy savings. In some cases, the wall may also have a photovoltaic component that generates electricity.
- Green Walls – Vegetated green wall systems on exterior of building envelope can reduce wall surface temperatures by as much as 18°F (depending on which direction it is
facing), which also results in significant air conditioning savings, while reducing the heat island effect

- **Warm-Mix Asphalt** - Warm-mix asphalt allows the producers of hot-mix asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road. Reductions of 50°F to 100°F have been documented. Such drastic reductions have the obvious benefits of cutting fuel consumption and decreasing the production of greenhouse gases. In addition, engineering benefits include better compaction on the road, the ability to haul paving mix for longer distances, and extending the paving season by being able to pave at lower temperatures.

- **Water heating – Solar thermal** hot water heating technology uses a solar collector which is simply a heat exchanger designed to convert the sun’s radiant light energy into thermal energy to be stored for later use. This collector uses optics and parabolic concentration technology to heat the fluid media passing through the selectively coated tubing manifold. The fluid media is circulated, via a pump, through the collector and into a storage tank located within the home/building. Other water heating technologies that are encouraged include demand, instantaneous, or tankless water heaters. Demand water heaters heat water directly without the use of a storage tank thus avoiding the standby heat losses associated with conventional storage tank water heaters. When a hot water tap is turned on, cold water travels through a pipe into the unit. Either a gas burner or an electric element heats the water as it passes through coiled piping within the unit. As a result, demand water heaters deliver a constant supply of hot water not limited by the volume of a storage tank.

**CASE STUDY**

**What about Green Walls?**
**Tokyo, Japan**

During summer, hot walls cause temperatures to rise inside buildings, increasing demand on cooling systems and consuming more energy. A Green Wall surface temperature is reduced by up to 10°C when covered with plants and moist soil. In 1979, Green Wall research by Akira Hoyano (Professor, Tokyo Institute of Technology), a pioneer in passive and low-energy architecture, revealed that the heat energy that passed through a Green Wall was significantly lower than a concrete wall (see below graph).

The Tokyo City Government recently undertook a study to measure the effects of Green Walls on the Heat Island effect, and in essence, to confirm Professor Hoyano’s earlier findings. They not only confirmed the findings, but they were able to derive the significance of Green Walls in cooling buildings and combating the Heat Island Effect.
With the Green Wall tests shown here, it was discovered that Green Wall panels reduce the wall temperature by 10°C (see the below graph). It was also concluded that Green Wall panel reduce energy transfer into a building by ~0.24kWh/m². This is approximately 60% less than that of a Green Roof. The above calculations can be used in the same manner, however, Green Wall energy savings calculations depend greatly on the direction the wall is facing, the sun's angle in your local region, and many other factors that make calculating Green Wall energy savings complex.

http://gsky.com/green-walls/benefits/energy-savings/
7.0 INNOVATION IN DESIGN & CONSTRUCTION

7.5 LEED Accredited Professional

1 Point

INTENT

Support and encourage the design integration required by LEED to streamline the application and certification process.

AND

Facilitate the incorporation of sustainable design and construction elements.

REQUIREMENTS

At least one principal participant of the project team shall be LEED accredited (i.e., LEED Green Associate; LEED Accredited Professional).

SUBMITTALS

Identify the LEED accredited individual(s) in the SAM Checklist and submit proof of their LEED certification.

TECHNOLOGY/STRATEGY

Educate the project team members about green building design and construction, the LEED requirements and application process early in the life of the project. Consider assigning integrated design and construction process facilitation to the LEED accredited individual.

Standard Practice

- The OMP requires that each design consultant and/or design management team include a LEED accredited individual on its staff to oversee the design and assist with construction administration

CASE STUDY

Sustainable Airport Planning, Design and Construction Guidelines
Los Angeles World Airports - Los Angeles, California

Los Angeles World Airports, with aggressive support from Los Angeles Mayor Antonio Villaraigosa, has begun implementation of the “Sustainable Airport Planning, Design and Construction Guidelines” for all projects at its facilities. The vision encourages every project to include LEED-accredited professionals and follow the “triple bottom line” approach for sustainability.
7.0 INNOVATION IN DESIGN & CONSTRUCTION

7.6 LEED Certified Project

1 Point

INTENT

Promote the incorporation of environmentally sustainable design in building and infrastructure improvements by registering and certifying a project through the LEED certification process and rating system.

REQUIREMENTS

Achieve certification via the LEED process – Certified, Silver, Gold, or Platinum.

SUBMITTALS

Include descriptive narrative in SAM Checklist demonstrating that the project has been registered under LEED during the design process. Provide the LEED submittal documentation and final determination. Indicate what level of LEED certification has been achieved after construction.

TECHNOLOGY/STRATEGY

Educate the project team members about green building design & construction and application of the LEED Rating System early in the life of the project. Consider pursuing LEED for any occupied building project.

Standard Practice

- Projects are encouraged to seek LEED certification, where applicable

Recommended Practice

- Encourage LEED Silver or better rating for occupied buildings

Best Available Practice

None

CASE STUDY

O'Hare Modernization Program
Chicago O'Hare International Airport - Chicago, Illinois

The O'Hare Modernization Program has encouraged several projects to pursue LEED certification, including the North Air Traffic Control Tower and FedEx World Services Center.

http://www.airportbusiness.com/print/Airport-Business-Magazine/A-Model-for-Sustainability/1$30978
8.0 REGIONAL PRIORITY

8.1 Regional Priority

1 to 4 Points

INTENT

Provide an incentive for the achievement of credits that address geographically-specific environmental priorities.

REQUIREMENTS

Earning one to four of the 6 Regional Priority credits identified by the USGBC regional councils and chapters as having environmental importance for a project’s region. A database of Regional Priority credits and their geographic applicability is available on the USGBC website, www.usgbc.org.

The credits are specific to a project’s ZIP code. Use the following link to determine which credits are applicable for a given project based on zip code location:


One point is awarded for each Regional Priority credit achieved; no more than four credits identified as Regional Priority credits may be earned. Projects outside the US are not eligible for Regional Priority credits.

For example, the majority of ORD lies within the 60666 zip code. The following credits are identified as Regional Priority credits for ORD zip code 60666:

- SAM Credit 1.4.1 – Alternative Transportation: Public Transportation Access
- SAM Credit 1.4.3 – Alternative Transportation: Low-Emitting Vehicles
- SAM Credit 1.4.4 – Alternative Transportation: Parking Capacity
- SAM Credit 1.5.2 – Stormwater Design: Quality Control
- LEED 2009 SScl – Site Selection
- LEED 2009 SScl2 – Development Density and Community Connectivity

NOTE: Two LEED credits listed above are applicable for this zip code, but are not SAM Credits outlined in this Manual. Meeting any of the four of the SAM Credits would earn one point for each. However, if the project is pursuing LEED certification, all of the credits would be applicable, but the maximum points allowed is still four.

NOTE: Zip Codes present at ORD in order of decreasing area size include 60666 (Cook Co.), 60106 (DuPage Co.), 60018 (NE boundaries, Rosemont), 60007 (NW boundaries, Des Plaines), 60176 (SE boundaries, Schiller Park). The Zip Code at MDW is 60638.
SUBMITTALS

The submittals for this Credit are the same as for constituent credits; no additional submittals are required.

TECHNOLOGY/STRATEGY

See applicable credits determined by location.
airportsgoinggreen.org

For comments, case studies, lessons-learned, new technologies or for any and all project submittal forms, please email:

SAMdocs@cityofchicago.org