Sustainable Airport Construction Practices

DETAILS

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AUTHORS

AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP REPORT 42

Sustainable Airport Construction Practices

Ricondo & Associates, Inc.
Chicago, IL

Center for Transportation and the Environment
Atlanta, GA

Ardmore Associates, LLC
Chicago, IL

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AIRPORT COOPERATIVE RESEARCH PROGRAM

Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

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The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), and the Air Transport Association (ATA) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

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Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

Once selected, each ACRP project is assigned to an expert panel, appointed by the TRB. Panels include experienced practitioners and research specialists; heavy emphasis is placed on including airport professionals, the intended users of the research products. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, ACRP project panels serve voluntarily without compensation.

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CRP STAFF FOR ACRP REPORT 42

Christopher W. Jenks, *Director, Cooperative Research Programs*
Crawford F. Jencks, *Deputy Director, Cooperative Research Programs*
Michael R. Salamone, *ACRP Manager*
Marci A. Greenberger, *Senior Program Officer*
Tiana M. Barnes, *Senior Program Assistant*
Eileen P. Delaney, *Director of Publications*
Margaret B. Hagood, *Editor*

ACRP PROJECT 08-01 PANEL
Field of Construction

Shawn M. Schroeder, *Springfield-Branson National Airport, Springfield, MO* (Chair)
Janell Barrilleaux, *Denver International Airport, Denver, CO*
Michael John Clow, *City of Tallahassee/Tallahassee Regional Airport, Tallahassee, FL*
Kristin M. Lemaster, *CDM, Cambridge, MA*
Peter Matson, *Gilbane Co, Boston, MA*
Danny Perkins, *ESC Polytech Consultants, Inc., Houston, TX*
Joshua E. Polston, *Oakland International Airport, Port of Oakland, Oakland, CA*
M. Ashraf Jan, *FAA Liaison*
Frank Lanzetta, *FAA Liaison*
Jessica Steinhilber, *Airports Council International–North America Liaison*
Christine Gerencher, *TRB Liaison*

FOREWORD

By Marci A. Greenberger
Staff Officer
Transportation Research Board

ACRP Report 42: Sustainable Airport Construction Practices is a collection of sustainable practices that can be implemented during the construction phase of an airport project. This collection includes best practices, methods, procedures, and materials and is provided in a searchable, filterable spreadsheet format provided in the attached CD-ROM. This collection focuses only on those practices that are implemented during construction that will have a sustainable impact by having either a positive economic, operational, environmental, or social effect. The collection is categorized by construction phases (Pre-Construction, During Construction, and Commissioning) and by practices (Policies and Regulations, Construction Methods, Logistics, Equipment, Surface Transportation, Reuse and Recycling Materials, and Sustainable Materials), and can be filtered or searched by either construction phase or practice. The collection, supported by the Users Guide, will be useful for airport CEOs, directors, planners, environmental technicians, and airport engineers and designers during the initial planning, design, and construction phases of a given project.

Sustainability and the practice of sustainable concepts continue to be a societal focus not only in this country but worldwide. Airports are no different as they strive to be fiscally, socially, and environmentally responsible as well as good neighbors. As a result, there are many definitions as to what exactly it means to be "sustainable" even amongst the various groups that seek to help organizations be proactive in this arena.

Under ACRP Project 08-01, Ricondo & Associates, Inc. developed *ACRP Report 42: Sustainable Airport Construction Practices* by identifying sustainable practices, methods, and procedures that are currently being utilized or that have applicability during airport construction projects by conducting surveys, interviews and case studies. Although most of these practices are implemented within the actual construction phase, it may be necessary to discuss and identify some practices during the planning and design phase to take full advantage of the opportunities that are presented in the collection.

This collection does not seek to provide a definitive definition of sustainability, but rather to discuss and outline practices within a narrow initiative of sustainability; those occurring during the phase of airport construction. The construction phase alone presents many opportunities to reduce environmental and social impacts, preserve natural resources, increase efficiency, and reduce costs.

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The research team would like to express its gratitude to the members of the ACRP Project Panel for their input throughout this research project.The research team would also like to thank the following individuals for participating in surveys and interviews for this project:

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In addition, Ms. Leslie L. Riegle, Director, Regulatory Affairs, with the American Association of Airport Executives (AAAE) forwarded the online survey to AAAE's environmental contact list, for which the research team is very grateful.

CONTENTS

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

CHAPTER 1

Introduction

The research team was contracted to conduct research for Airport Cooperative Research Program (ACRP) Project 08-01, "Sustainable Airport Construction Practices." The research team compiled a collection of sustainable construction practices (referred to in this guide as the "Collection") available for consideration by stakeholders involved in the planning, design, and/or construction of airport development or redevelopment projects (referred to in this Guide as the "users" of the Collection). Practices identified include construction methods, procedures, and technologies that have been or are being implemented at airports in the United States and throughout the world. The Collection of sustainable airport construction practices focuses on those practices that are considered to have sustainable impact during the construction phase(s) of a project, including procurement, construction planning/logistics, construction monitoring, and implementation (actual construction).

The purpose of the Collection is to provide a resource that will enable the user to quickly identify potential sustainable airport construction practices for consideration. The Collection was developed so that it can be easily used by anyone involved in airport construction projects, regardless of the size of the airport or project scope.

This user's guide to the Collection explains:

- The key concepts of sustainability, construction, and "sustainable construction practices;"
- How the data included in the Collection was gathered;
- The organization of the Collection; and
- How to use the Collection.

The user's guide also includes case studies that illustrate some of the sustainable construction practices contained in the Collection.

CHAPTER 2

Key Concepts

To guide its efforts, the research team defined the concepts of sustainability, construction, and "sustainable construction practices" to establish the parameters of this research project. The following sections discuss how these terms were applied to this research project.

2.1 Sustainability

Sustainability has been defined differently by various organizations and individuals. Because each airport operator, government agency, and construction contractor will have different definitions or criteria for determining what they consider to be sustainable practices, the research team has taken a broader approach to identifying potential sustainable airport construction practices. Some examples of industry definitions are provided below.

- The Environmental Affairs Committee, Sustainability Working Group of ACI-NA defined airport sustainability as "a holistic approach to managing an airport so as to ensure the integrity of the economic viability, operational efficiency, natural resource conservation and social responsibility (EONS) of the airport" (ACI-NA March 2006).
- In *ACRP Synthesis 10: Airport Sustainability Practices,* an airport sustainability practice was defined as "a broad term that encompasses a wide variety of practices applicable to the management of airports" (Berry et al. 2008). The report documented practices that ensure: (1) protection of the environment; (2) social progress; and (3) the maintenance of high and stable levels of economic growth and employment. These three aspects of sustainability (environmental, social, and economic) encompass what is commonly referred to as the "triple bottom line" approach to sustainability.
- The Sustainable Aviation Guidance Alliance (SAGA) encourages each airport operator to determine its own definition of sustainability (SAGA 2009). SAGA consists of a diverse range of airport associations and aviation interests, including representatives from the Airport Consultants Council (ACC), the AAAE, the ATA, the FAA, and other airport representatives and consultants.

In the Collection, the concept of sustainability is not based on a specific definition; rather, it is focused on whether or not the application of a specific practice during construction could affect the economic, operational, natural resource/environmental, or social conditions of an airport, the surrounding community, or region. Potential sustainable construction practices were identified based on whether they could:

- Reduce energy consumption;
- Reduce impacts to water and air quality, minimize waste, reduce pollution, and/or minimize other environmental impacts;
- Improve construction operations;

- Improve construction safety;
- Reduce construction impacts on airport operations;
- Benefit surrounding communities; and
- Reduce costs associated with construction.

Each interested airport operator, trade group, construction contractor, or other stakeholder is encouraged to ascertain its organization's concept of sustainability. It is up to the users to individually determine what sustainability means to them, their organization, or their facilities. It may be possible that certain practices listed in the Collection do not match with the particular concept of sustainability established by the user or his/her organization. Additionally, the user should not expect that all sustainable practices listed in this document will satisfy the specific requirements of an airport's sustainability guidance manual, the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) rating system, or other rating systems.

2.2 Construction

The definition of construction and how it is applied was identified to determine the sustainable practices to be included in the Collection. The construction phase of a project includes all activities necessary to fulfill the requirements of a design specification, as follows:

- Policies and regulations;
- Construction methods;
- Logistics;
- Equipment;
- Surface transportation;
- Reuse and recycling materials; and
- Sustainable materials.

The research team attempted to focus the Collection on sustainable practices that take place during the construction phase of a project and have beneficial effects on sustainability during the construction phase. However, many construction practices should be considered and specified during the design process, or are impacted by design decisions, even though they are implemented during construction. This concept is discussed further in the next section.

2.3 Sustainable Construction Practices

A key element in sustainability decision making is control, i.e., the point during a project when decisions are made. Frequently, there is little control over planning and design decisions during the construction phase. Yet, construction practices are significantly influenced by design of structures and civil works as well as the materials used to build them. Construction contractors are typically limited in their ability to control decisions regarding sustainable construction techniques because the decisions that influence construction practices are typically made during the design phase.

There is a great amount of research on sustainable design and construction materials, but the research team attempted to exclude practices implemented during the planning and design phases of a project if they did not provide a sustainable benefit during construction. However, it is important to understand the influence that design and material decisions have on construction. Thus, the research team established the following definition of sustainable construction practices to guide its research:

> Sustainable construction practices are those practices that have sustainability benefits during the construction phase of a project, including those benefits that may result from decisions made during the planning or design phases of a project.

For example, choosing lightweight, carbon reinforced, prestressed, preformed concrete is a design decision that results in the use of fewer natural resources (no rebar) and increases the longevity of a building, improving its operational sustainability. This design decision also results in sustainable benefits during the construction phase because fewer trips are required to transport materials to the job site and less energy is required to install the lighter materials on the building. Incorporation of highly efficient heating, ventilating, and air conditioning (HVAC) units is also a design decision; however, the sustainability benefit is achieved during operation, not construction. Thus, the research team has included preformed concrete as a sustainable construction practice, even though control of the decision to use that material is outside the construction phase of a project. Similarly, the research team has excluded other design decisions, such as the use of efficient HVAC units, which have no sustainable benefits during construction.

As a result, the research team recommends that, in addition to airport construction contractors, airport planners and designers also review and understand the Collection to incorporate sustainable construction practices in their plans and designs.

CHAPTER 3

Data Collection

To develop the most comprehensive collection of existing and emerging sustainable airport construction practices, numerous sources were identified and consulted. The research began with a review of published literature to build the Collection and identify potential contacts. Next, online surveys were conducted to identify knowledgeable and willing participants for detailed interviews. Then, interviews were conducted to identify unpublished sustainable construction practices or practices that are in development. The interviews also were used to identify which airport operators have implemented sustainable practices included in the Collection, including any positive or negative benefits realized. Lastly, the interview participants were asked to complete an evaluation of a subset of practices from the Collection to provide the research team with input on the potential economic, operational, natural resources/environmental, and social benefits or impacts of the practices. The data collection phases and their results are discussed here.

3.1 Literature Review

The Collection was initially developed by reviewing various public documents, including:

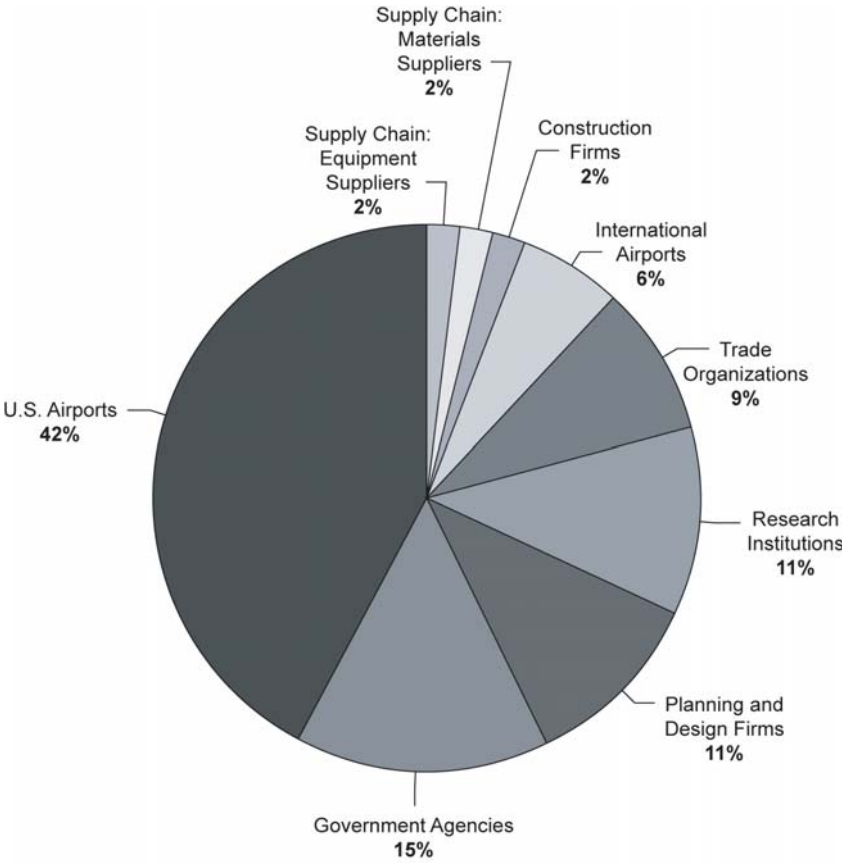
- Sustainable guidance materials;
- Information from research institutions;
- Industry publications;
- Airport sustainability reports, summaries, and initiatives; and
- Construction documents, including airport and non-airport construction projects and initiatives.

As a result of the literature review, the initial Collection consisted of 496 sustainable construction practices prior to conducting the surveys and interviews. Additional document sources pertaining to sustainable construction practices were also discovered during the interview process, reviewed by the research team, and added to the Collection as appropriate. A listing of all sources reviewed is included in the annotated bibliography located at http://www.trb.org/Main/Blurbs/164240.aspx.

3.2 Surveys

The research team identified organizations and industry contacts that have relevant experience with sustainable construction practices. Contacts were organized into the following categories to ensure that a broad spectrum of subject matter experts was sampled:

- Construction companies—equipment and material manufacturers, construction contractors.
- Government agencies—federal agencies, state departments of transportation.
- Industry organizations—trade groups associated with aviation, construction, and/or sustainability.
- Educational institutions and research laboratories.



Source: Ricondo & Associates, Inc., March 2010.
Prepared by: Ricondo & Associates, Inc., March 2010.

Figure 1. Interview participants.

- U.S. airports with sustainable initiatives.
- International airports with sustainable initiatives.

An online survey was designed and distributed via email to ascertain potential contacts' areas of expertise with respect to construction practices, identify the most appropriate contacts within an organization, and enable the research team to create a set of focused questions for each interview target.

3.3 Interviews

Interviews were conducted with 47 individuals; a breakdown by contact category is provided in Figure 1.

The objectives of the interviews were to identify additional sustainable construction practices that the research team may have been unaware of or that are still in development, and to receive input on the potential economic, operational, natural resources/environmental, and social benefits or impacts of the practices. Research institutions, trade organizations, and planning and design firms all had similar perspectives on sustainable construction practices, while the operators of U.S. and international airports provided a broader range of responses as a result of the differing sizes of airports (in terms of numbers and types of aircraft operations) and geographic location (e.g., operators of airports in warmer locations had a more negative opinion on the success of porous asphalt than those in colder locations).

CHAPTER 4

Organization of the Collection

For ease of use, the Collection is presented in two formats: Construction Practice Category and Construction Implementation Stage Category. The user should select one format to initiate their search, as the same information is presented in both presentation formats. The user may choose the appropriate presentation format based on preference and relative experience with construction and/or sustainability practices.

4.1 Construction Practice Categories

The first presentation format of the Collection is by Construction Practice Category. A construction practice category identifies common elements of any construction project, necessary to fulfill the requirements of a design specification. The Collection's sustainable construction practices are divided into seven Construction Practice categories as presented in Figure 2.

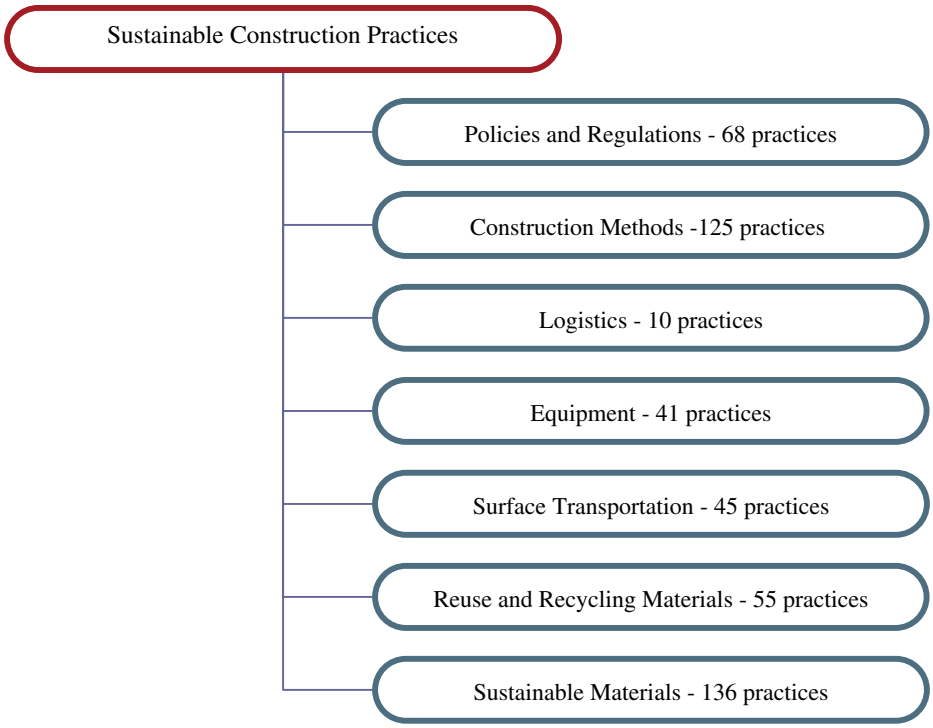
These categories were created by analyzing the compiled practices and logically determining construction practice categories based on elements common to most construction projects. Each of the seven main organizational categories listed above was further divided into subcategories, as shown in Table 1.

4.2 Construction Implementation Stage Categories

The second presentation format of the Collection is by Construction Implementation Stage Category. A construction implementation stage category identifies the typical project phase in which the practice would occur. The three construction implementation stage categories are:

- Pre-construction—129 practices;
- During construction—360 practices; and
- Commissioning/Post-construction—23 practices.

Most of the researched sustainable practices are relevant to one of the three defined construction implementation stages. However, a few practices are relevant to more than one implementation stage, such as the practice of monitoring stormwater quality pre-, during, and post-construction. These practices appear in more than one construction implementation stage category to prevent users from overlooking potentially applicable practices. Therefore, the total number of practices in the Collection appears to be larger (512 vs. 480) when organized by construction implementation stage category than by construction practice category. Each of the three construction implementation stage categories listed above was further divided into subcategories, as shown in Table 2.



Source: Ricondo & Associates, Inc., May 2010.
Prepared by: Ricondo & Associates, Inc., May 2010.

Figure 2. Construction practice categories and number of practices in Collection.

4.3 Additional Filterable Criteria

Primarily designed to be used as a Microsoft Excel-based database, as explained further in Chapter 5, the Collection can be viewed, filtered, and organized to meet particular areas of interest using the "filter" function. In addition to being able to filter based on construction practice or construction implementation stage category, the database can be filtered by the subcategories shown on Table 1 and Table 2. This functionality enables users of the Collection to conduct a filtered search on specific areas of interest in addition to, or in lieu of, filtering by construction practice category or construction implementation stage category. Practices related to multiple subcategories are listed in all categories that apply to prevent potentially applicable practices from being overlooked.

For example, the first group of filterable subcategories within the construction implementation stage presentation format, "Policies, Contracts, and Specification," includes subcategories of sustainable construction practices related to:

- Sustainability goals;
- Plans;
- Requests for proposals/requests for qualifications;
- Training and human resources;
- Meetings;
- Marketing and community outreach;
- Construction worker health and safety; and
- Compliance/performance monitoring.

Table 1. Construction practice subcategories.

1) Policies and Regulations	2) Construction Methods	3) Logistics	4) Equipment	5) Surface Transportation	6) Reuse and Recycling Materials	7) Sustainable Materials
A) Policies, Procedures, and Plans	A) Scheduling and Sequencing	A) Scheduling	A) Energy Conservation and Alternative Energy	A) Construction Vehicles	A) Construction Waste Management	A) Recycled Content
B) Sustainability Meetings, Teams, and Presentations	B) Planning for Deconstruction and Disassembly	B) Packaging and Delivery Methods	B) Lighting	*i. Emissions Reduction*	*i. Goals and Policies*	B) Local/Regional Materials
C) Community Outreach	C) Noise and Acoustical Quality		C) Systems Commissioning	*ii. Reduced Vehicle Idling*	*ii. Storage and Collection of Recyclables*	C) Rapidly Renewable Materials
D) Human Resources	D) Site Disturbance Minimization		D) Maintenance	*iii. Construction Traffic Control*	*iii. Materials Reuse*	D) Pavements and Building Structures
E) Health and Safety	*i. Compliance and Safety*			B) Alternative Transportation	*iv. Salvaged Materials and Resources*	E) Roofing Materials
i. Construction Worker Protection	*ii. Water Quality Protection*			*i. Public Transportation Access and Carpooling*	B) Office Waste Reduction	F) Foundations
ii. Environmental Tobacco Smoke (ETS) Control	*iii. Erosion and Sedimentation Control*			*ii. Bicycle Access/Usage*		G) Building Interiors
	iv. Tree and Plant Protection					H) Electrical Materials
	E) Indoor Air Quality					I) Polymer Concrete Surface Systems
	i. Indoor Air Quality (IAQ) Management					J) Low-Emitting Materials
	ii. Indoor Chemical and Pollutant Source Control					K) Certified Wood
	F) Dust Control					L) Wood Preservatives
	G) Water/Wastewater					
	i. Reduce Potable Water Usage					
	ii. Water Use Reduction					
	iii. Stormwater Management and Treatment					

Source: Ricondo & Associates, Inc., May 2010.
Prepared by: Ricondo & Associates, Inc., May 2010.

Table 2. Construction implementation stage subcategories.

1) Pre-Construction

A) Policies, Contracts, and Specifications
- i. *Sustainability Goals*
- ii. *Plans*
- iii. *Requests for Proposals/Request for Qualifications*
- iv. *Training and Human Resources*
- v. *Meetings*
- vi. *Marketing and Community Outreach*
- vii. *Construction Worker Health and Safety*
- viii. *Compliance/Performance Monitoring*

B) Initial Project Scheduling
- i. *General*

C) Deconstruction/Demolition
- i. *Planning for Future Use*

2) During Construction

A) Policies and Regulations
- i. *Sustainability Training and Tracking*
- ii. *Community Outreach*
- iii. *Health and Safety*
- iv. *Environmental Tobacco Smoke (ETS) Control*

B) Construction Methods
- i. *Scheduling and Sequencing*
- ii. *Deconstruction/Disassembly*

C) Site Disturbance Minimization
- i. *Compliance and Safety*
- ii. *Water Quality Protection*
- iii. *Erosion and Sedimentation Control*
- iv. *Tree and Plant Protection*

D) Indoor Air Quality
- i. *Indoor Air Quality (IAQ) Management*
- ii. *Indoor Chemical and Pollutant Source Control*

E) Dust Control
- i. *General*

F) Water/Wastewater
- i. *Reduce Potable Water Use*
- ii. *Water Use Reduction*
- iii. *Stormwater Management and Treatment*

G) Logistics
- i. *Scheduling*
- ii. *Packaging/Delivery Methods*

H) Construction Vehicles and Equipment
- i. *Noise Minimization and Monitoring*
- ii. *Vehicle Emissions Reduction*
- iii. *Reduced Vehicle Idling*
- iv. *Energy Efficiency*
- v. *Lighting*
- vi. *Maintenance*

I) Alternative Transportation
- i. *Public Transportation Access and Carpooling*
- ii. *Bicycle Access/Usage*

J) Construction Waste Management
- i. *Goals and Policies*
- ii. *Storage and Collection of Recyclables*
- iii. *Materials Reuse*
- iv. *Salvaged Materials and Resources*

K) Sustainable Materials
- i. *Recycled Content*
- ii. *Local/Regional Materials*
- iii. *Rapidly Renewable Materials*
- iv. *Pavements and Building Structures*
- v. *Roofing Materials*
- vi. *Foundations*
- vii. *Building Interiors*
- viii. *Electrical Materials*
- ix. *Polymer Concrete Surface Systems*
- x. *Low-Emitting Materials*
- xi. *Wood*

3) Commissioning / Post-Construction

A) Systems Commissioning

B) Indoor Air Quality

C) Community Outreach and Sustainability Accomplishments

Source: Ricondo & Associates, Inc., May 2010.
Prepared by: Ricondo & Associates, Inc., May 2010.

"Potential LEED Applicability" is also included as a filterable criterion so that users can conduct a search for sustainable construction practices related to LEED credits (U.S. Green Building Council 2009). The criterion does not guarantee that performance of the sustainable construction practice will achieve LEED credits; rather, the criterion indicates practices related to the LEED rating system so that users who may be pursuing LEED certification would be able to locate practices that are relevant to the LEED process or could assist in achieving LEED credits. More specifically, Applicable LEED Credit is also included as a filterable criterion so that users can search for sustainable construction practices related to particular LEED credits.

4.4 Additional Nonfilterable Information

Provided with each sustainable construction practice included in the Collection is information about the source of the sustainable construction practice, whether it be from a particular document included in the literature review or one of the interviews conducted as part of the research process. Some sustainable construction practices may appear in more than one document considered in the literature review; however, the source most frequently used by practitioners in the field was included in the Collection.

If data was available, sustainable construction practices in the Collection also include the airport(s) where the practice has been implemented. Provided with each sustainable construction practice included in the Collection is a brief assessment (where applicable) of the economic, operational, natural resource/environmental, and/or social considerations that should be understood prior to implementation.

CHAPTER 5

How to Use the Collection

As discussed in Chapter 1, the introduction to this User's Guide, the Collection was created with the dual objectives of ease of use and applicability to all potential users involved in airport construction projects, regardless of airport size or project scope. The steps set forth below for using the Collection should be followed to ensure effective and efficient use of the Collection.

5.1 General Process to Follow When Using the Collection

A user interested in implementing sustainable airport construction practices should first select the appropriate database presentation format from which to conduct their search of the Collection. Hard copies of the Collection sorted by Construction Practice category and Construction Implementation Stage category are provided in Appendix A and Appendix B, respectively. An Excel version of the Collection, found on the accompany CD, can also be used.

The search of the Collection can be as broad or as specific as needed. The main methods to search the Collection are (1) with no filter (either using the hard copy provided in Appendix A and Appendix B or using the Excel version of the Collection); or (2) by filterable criteria (using the Excel version of the Collection only). A list of potential sustainable construction practices can be extracted from this search and shared with other selected stakeholders that will participate in, or be affected by, a particular airport construction project.

After a search of the Collection has yielded potential sustainable construction practices for implementation, these practices should be further evaluated by the user and by selected stakeholders for their suitability at a given airport. An assessment of suitability implies predetermination of criteria that defines what practices would be considered appropriate and what would not; this may include an economic cost/benefit analysis, environmental impact study, social impact study, or operational change management analysis.

Each practice on the list should be considered in light of policies, requirements, conditions, and constraints that are unique to the particular airport. As part of this process, the user should review the information in the Collection pertaining to the applicable economic, operational, natural resource/environmental, and/or social considerations potentially resulting from implementation of a specific practice. Information in the Collection can also be used to identify locations (e.g., airports where a particular practice has been implemented) and sources (e.g., documents that may yield further information about the suitability of a particular practice) for additional research.

Once an assessment of the suitability of each practice has been performed, the practices identified for implementation should ideally be incorporated into a comprehensive, top-down effort

to implement and monitor sustainable construction practices at the airport. Los Angeles World Airports' *Sustainable Airport Planning, Design and Construction Guidelines* (Los Angeles World Airports 2009) and the City of Chicago's *Sustainable Airport Manual* (City of Chicago 2009) are examples of this type of comprehensive effort.

5.2 How to Use Hard Copy of the Collection

To conduct a search for specific sustainable construction practices by construction practice category, use Appendix A: Sustainable Construct Practices by Construction Practice Category and look for the construction practice category of interest (for example, "Policies and Regulations"). The user would then go to the first column of the reproduced spreadsheet page, labeled "Sustainable Practice," and read down each row in the column to find each subcategory in the "Policies and Regulations" practice category (e.g., "Policies, Procedures and Plans," "Sustainability Meetings, Teams, and Presentation") followed by the individual sustainable construction practices contained in each subcategory (e.g., "Create and follow a sustainable vision/mission statement that incorporates construction practices.").

Within each individual sustainable construction practice row, users can read the columns across the row to find information on LEED® applicability, examples of airports where the sustainable construction practice has been implemented (e.g., San Francisco International Airport), and the applicable economic, operational, natural resource/environmental, and/or social factors to consider when planning the implementation of a specific construction practice (e.g., the economic impact varies widely based upon the "detail and goals" of the vision/mission statement). A reference number identifying the source for each sustainable construction practice is also included (sources are identified by reference number at the end of Appendix A).

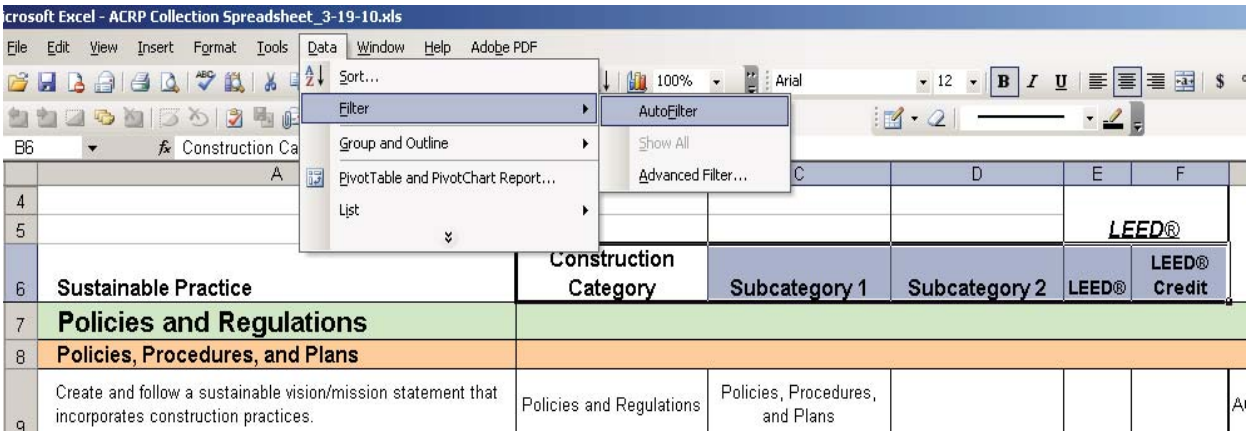
Similarly, to search for specific sustainable construction practices by construction implementation stage, users would look for the construction implementation stage category of interest (for example, "Pre-construction") in Appendix B. The user would then go to the first column of the reproduced spreadsheet page labeled "Sustainable Practice," and then read down each row in the column to find the individual sustainable construction practices contained in each construction phase category. Continuing to read across each sustainable construction practice row, users can read the columns to find the information described in the paragraph above.

5.3 How to Use Excel Spreadsheet Version of the Collection

The filter function in Microsoft Excel can be used to quickly locate practices throughout the Collection that are applicable to a user's area of interest. Filtering allows a user to see only the sustainable construction practices matching his or her search, hiding practices that are not relevant.

In each of the presentation formats of the Collection, five column headings are capable of being filtered (Excel columns C through G located on row five). These five headings allow the user to conduct a search based on construction practice categories and subcategories ("Construction Category" worksheet), or construction implementation stage categories and subcategories (Implementation Phase worksheet), depending on the worksheet of the Collection the user has open. As explained in Chapter 4, section 3, "Potential LEED Applicability" is also included as a filterable criterion so that users can conduct a search for sustainable construction practices related to LEED credits.

In the Excel version of the Collection, AutoFilter arrows "▼" appear to the right of these searchable column headings. If the AutoFilter arrows disappear on your version or are not currently



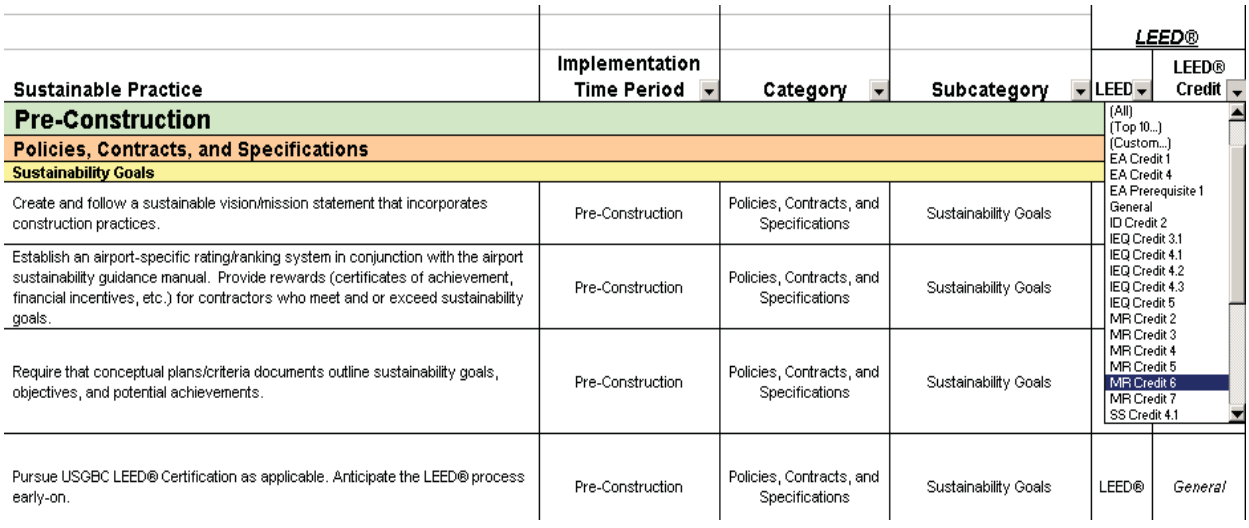
Source: Ricondo & Associates, Inc., March 2010.
Prepared by: Ricondo & Associates, Inc., March 2010.

Figure 3. Resetting AutoFilter function in Excel version of the Collection.

included, the filter function can be obtained by first highlighting the five column headings and then selecting DATA → FILTER → AUTO FILTER from the main toolbar, as shown in Figure 3.

Clicking on the AutoFilter arrow in a searchable column displays an alphabetical list of categories, subcategories, phases, or LEED® credits that are in that particular column. As shown in Figure 4, a user clicks on the AutoFilter arrow in the "LEED Credit" column to locate construction practices related to Materials and Resources (MR) Credit 6: Rapidly Renewable Materials (based on the LEED® 2009 for New Construction and Major Renovations Rating System guidebook).

After selecting "MR Credit 6," a total of 11 sustainable construction practices that are applicable to the rapidly renewable materials credit remain in the filtered view of the Collection; all other



Source: Ricondo & Associates, Inc., March 2010.
Prepared by: Ricondo & Associates, Inc., March 2010.

Figure 4. Example of LEED® credit sort criteria.

Sustainable Practice	Implementation Time Period	Category	Subcategory	LEED® LEED	LEED® Credit
Establish an appropriate project goal for renewable materials utilization.	Pre-Construction	Policies, Contracts, and Specifications	Sustainability Goals		
Use the following rapidly renewable materials for both permanent and temporary construction materials: poplar OSB & straw board or "agriboard" (formwork for temporary construction and underlayment); bamboo flooring; cork; wool carpets and fabrics; cotton-batt insulation; linoleum flooring; sunflower seed board; wheat grass or straw board cabinetry and others.	During Construction	Sustainable Materials	Rapidly Renewable Materials		
Install clay roof tiles which are made from abundant raw materials and carry effective heat gain characteristics (for cool climates).	During Construction	Sustainable Materials	Rapidly Renewable Materials		
Use paper joint tape to reinforce joints and corners in gypsum drywall interiors in lieu of fiberglass tape.	During Construction	Sustainable Materials	Rapidly Renewable Materials	LEED®	MR Credit 6

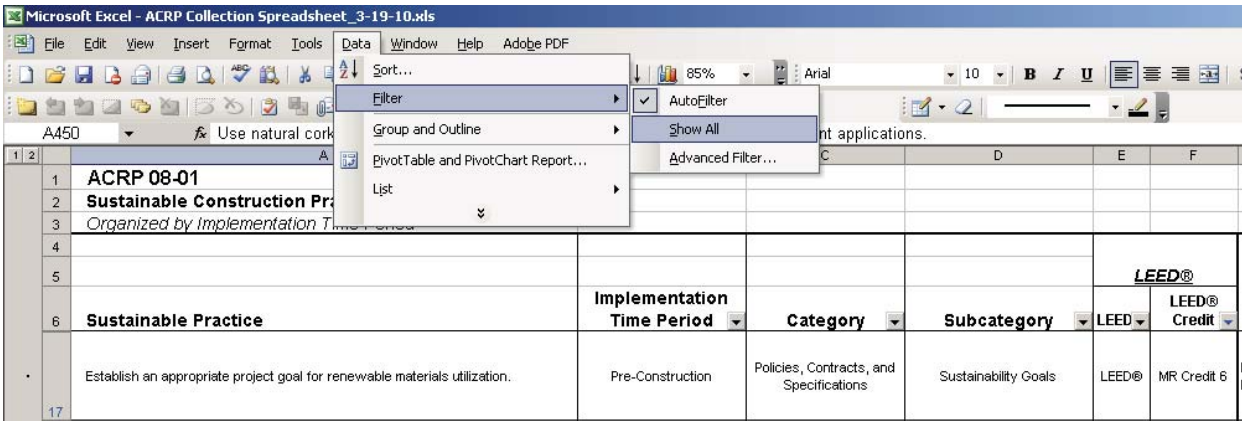
Source: Ricondo & Associates, Inc., March 2010.
Prepared by: Ricondo & Associates, Inc., March 2010.

Figure 5. Example of removing filter from Excel version of the Collection.

practices are no longer visible. Filtering does not alter the practices, sources, or Research Team Considerations in any way. As soon as the filter is removed, all data reappears the same as it was before.

There are two different options for a user to go back to viewing the list of all sustainable construction practices and headings. Clicking again on the AutoFilter arrow will display the "(All)" filter option, located at the top of the alphabetical listing. If a filtered search is performed in only one column, selecting "(All)" shows all construction practices once again, as illustrated in Figure 5.

A second option to removing all previous filters and viewing the entire Collection again, is to select DATA → FILTER → SHOW ALL from the main toolbar, as displayed in Figure 6. This will display the original view with all practices and headings.



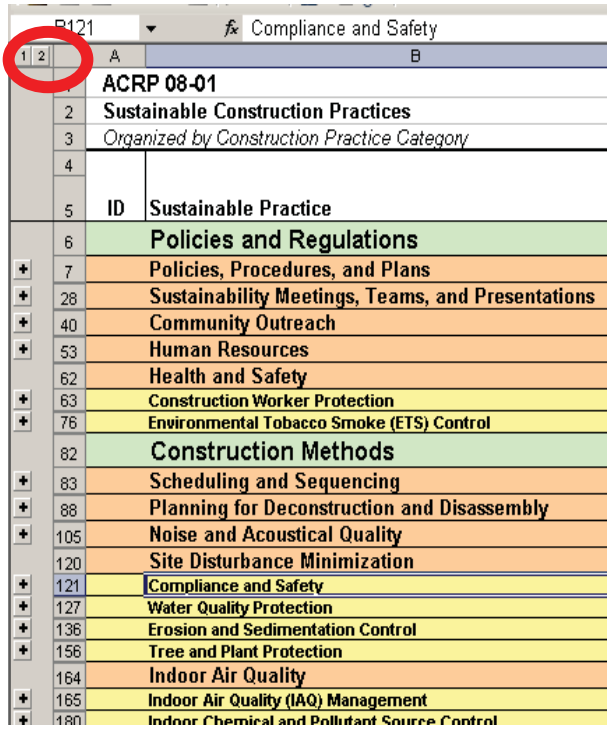
Source: Ricondo & Associates, Inc., March 2010.
Prepared by: Ricondo & Associates, Inc., March 2010.

Figure 6. Example of removing all filters from Excel version of the Collection.

The DATA → FILTER → SHOW ALL option is preferred if a user conducts a filtered search on multiple categories. For example, a user could perform a filtered search on practices that may improve health and safety that are implemented during construction. While in the "Implementation Phase" worksheet, the user would filter practices by clicking on the AutoFilter box and selecting "During Construction" from the "Implementation Phase" column and "Health and Safety" from the "Subcategory" column. After the filtered search, the user can quickly view the full listing of practices by selecting DATA → FILTER → SHOW ALL.

5.4 Standard Browsing Within the Excel Spreadsheet Version

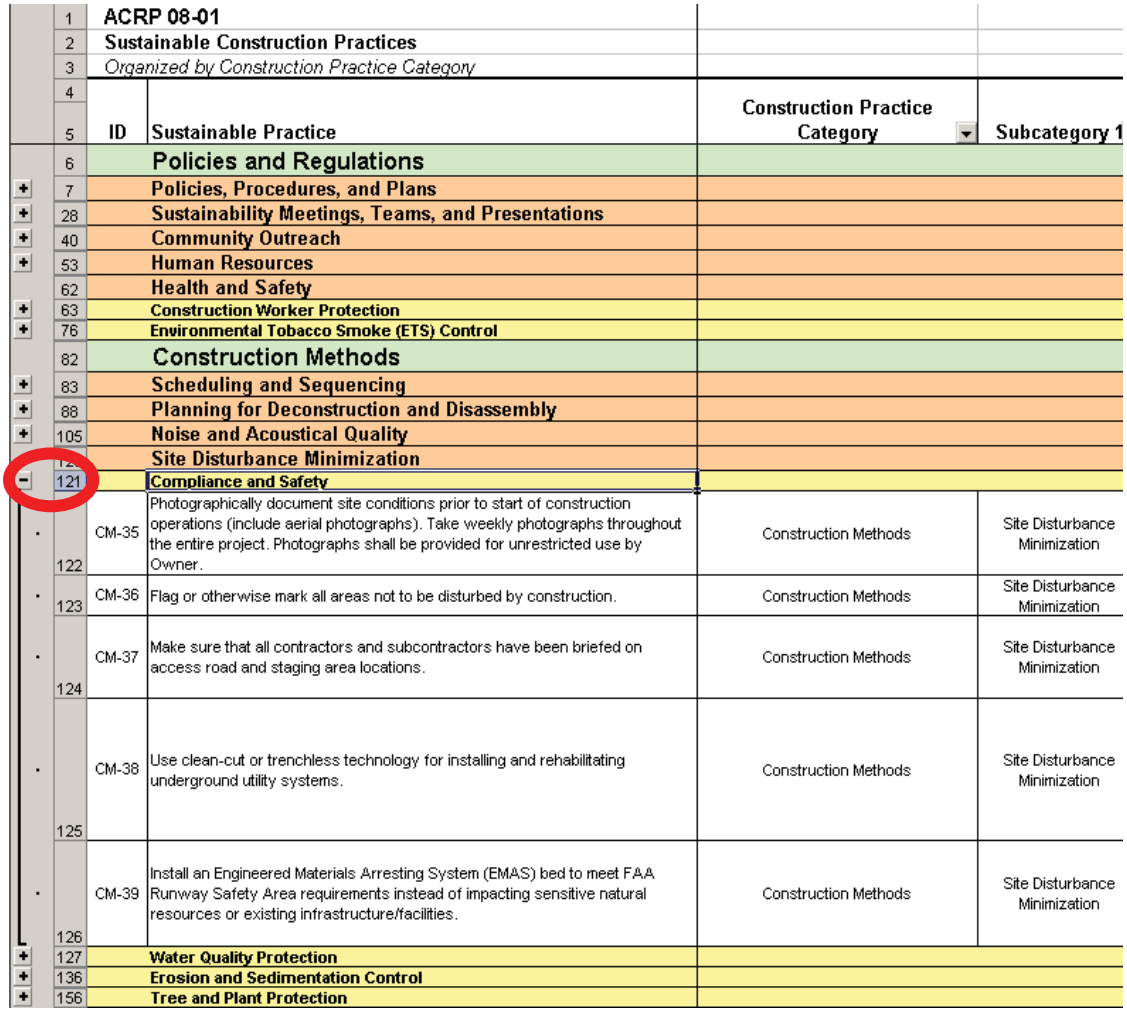
Some users may not be interested in narrowing down the list of practices by conducting a filtered search. As described in Chapter 4, the Collection has been organized in alternative formats and includes headings and subheadings to appeal to users who are interested in browsing all sustainable construction practices. To enhance the user's ability to scroll through the large number of practices, the "Group" function in Microsoft Excel has been utilized. To consolidate the entire listing of practices and headings into a list of only headings and subheadings, the user can click on box "1" located in the top left corner of the Excel worksheet, left of column "A." As illustrated in Figure 7, clicking this box hides the construction practices and displays only the main category (in green) and subheading(s). Alternatively, the original listing displaying all practices and headings can be viewed by clicking box "2" located to the right of box "1."



Source: Ricondo & Associates, Inc., May 2010.
Prepared by: Ricondo & Associates, Inc., May 2010.

Figure 7. Browsing by category and subcategory.

From the view of only the main categories and headings (selecting box 1), a user can view practices within a particular category and/or subcategory by selecting the "+" box located to the left of the heading of the category the user wishes to expand. A category can then be collapsed by selecting the box containing a "–" to the left of the category heading, as shown in Figure 8.



	ID	Sustainable Practice	Construction Practice Category	Subcategory 1
1		ACRP 08-01		
2		Sustainable Construction Practices		
3		*Organized by Construction Practice Category*		
4				
5				
6		**Policies and Regulations**		
7		**Policies, Procedures, and Plans**		
28		**Sustainability Meetings, Teams, and Presentations**		
40		**Community Outreach**		
53		**Human Resources**		
62		**Health and Safety**		
63		**Construction Worker Protection**		
76		**Environmental Tobacco Smoke (ETS) Control**		
82		**Construction Methods**		
83		**Scheduling and Sequencing**		
88		**Planning for Deconstruction and Disassembly**		
105		**Noise and Acoustical Quality**		
12		**Site Disturbance Minimization**		
121		**Compliance and Safety**		
122	CM-35	Photographically document site conditions prior to start of construction operations (include aerial photographs). Take weekly photographs throughout the entire project. Photographs shall be provided for unrestricted use by Owner.	Construction Methods	Site Disturbance Minimization
123	CM-36	Flag or otherwise mark all areas not to be disturbed by construction.	Construction Methods	Site Disturbance Minimization
124	CM-37	Make sure that all contractors and subcontractors have been briefed on access road and staging area locations.	Construction Methods	Site Disturbance Minimization
125	CM-38	Use clean-cut or trenchless technology for installing and rehabilitating underground utility systems.	Construction Methods	Site Disturbance Minimization
126	CM-39	Install an Engineered Materials Arresting System (EMAS) bed to meet FAA Runway Safety Area requirements instead of impacting sensitive natural resources or existing infrastructure/facilities.	Construction Methods	Site Disturbance Minimization
127		**Water Quality Protection**		
136		**Erosion and Sedimentation Control**		
156		**Tree and Plant Protection**		

Source: Ricondo & Associates, Inc., May 2010.
Prepared by: Ricondo & Associates, Inc., May 2010.

Figure 8. Example of how to collapse or expand categories in Excel version of the Collection.

CHAPTER 6

Case Studies

The research team attempted to obtain as much information about each sustainable construction practice as possible, given time and budget constraints. This information was used, along with our collective experience, to identify considerations potential users of the Collection should be aware of before implementing specific practices. Although the perspectives on some practices differed among airports based on size and location, many practices were rated as beneficial regardless of airport size or location. In the interviews, the most frequently mentioned sustainable construction practices included:

- Reuse and recycling of construction waste (concrete, asphalt, landscape debris, soil);
- Energy Star certified products/increasing energy efficiency;
- Development of mission statements;
- Use of sustainable and local materials;
- U.S. Green Building Council LEED certification;
- Life-cycle analyses;
- Anti-idling campaigns;
- Specifying project goals for recycled content; and
- Minimizing site disturbance, erosion/stormwater control.

Common themes from the airport operator interviews included the belief that cost considerations are an overriding factor when selecting practices to implement (as opposed to stand-alone environmental or sustainable benefits); the importance of complying with permitting and zoning requirements; the need to obtain direction from the local government (e.g., the city has higher sustainability standards with which airports must comply); and impediments to implementation (e.g., regulations/FAA approval and eligibility for funding).

A number of case studies of sustainable construction practices are provided to illustrate some of the information obtained and learned during the development of the Collection.

6.1 Case Study: Warm-Mix Asphalt

Warm-mix asphalt is a generic term applied to different techniques for producing asphalt (mixing and placing) at lower temperatures than typically used. According to the National Asphalt Pavement Association (2010), reductions of between 50°F and 100°F have been achieved. The benefits of using warm-mix asphalt techniques include reduced fuel consumption required for asphalt production, resulting in reduced emissions. Field tests conducted in Ohio showed (depending on the technique used) reduced fuel use of up to 17 percent and reductions in total particulate emissions of up to 77 percent; reductions in nitrogen oxides of up to 21 percent; reductions in carbon monoxide of up to 63 percent; and reductions in volatile organic compounds of up to 62 percent (Hurley et al. 2009).

Despite these potential benefits, airport operators are taking a cautious approach to incorporating warm-mix asphalt techniques in airport construction projects. The operator of Elmira Corning Regional Airport has opted not to use this technique because, in research the airport's engineering staff has conducted, asphalt laid using warm-mix techniques did not have the same expected lifespan as hot-mix asphalt laid using conventional techniques (Crook 2009). The City of Phoenix Aviation Department does not use warm-mix asphalt because staff has determined that warm-mix asphalt melts when exposed to the high summer temperatures experienced in Phoenix (Parker, et al. 2009).

In contrast, the Calgary Airport Authority is testing warm-mix asphalt techniques on taxiway improvements adjacent to apron areas. The Authority is conducting a timed evaluation to determine how asphalt laid using warm-mix asphalt techniques compares to asphalt laid concurrently using conventional techniques. Before using warm-mix asphalt in wider applications, the Authority needs to be confident about the longevity and strength of the pavement (Thompson 2009).

6.2 Case Study: Pavement Management

The Texas Transportation Institute (TTI) conducts research on all aspects of transportation, including pavement materials, techniques, equipment, and test procedures. Its pavement management program focuses on "improving the durability, safety, and efficiency of pavement materials and structures, within both economic and environmental constraints" (TTI 2010).

Thomas J. Freeman, Director of TTI's Pavement Management Program, noted several techniques that can be used to prevent premature distress of asphalt pavement (Freeman 2009). These include:

- Extending the base course pavement width by 1 to 2 feet beyond the top pavement layer. Because edges of pavement typically experience greater stress (primarily from moisture changes), cracks can occur in the portion of the base course that extends beyond the top layer of pavement without causing cracks in the top layer.
- Using a non-fossil-fuel based, nonvolatile, environmentally friendly prime coat. The conventional purpose of the prime coat is to waterproof and bond asphalt, yet TTI's research indicates that traditional diesel-based prime coats do not assist with pavement bonding. Thus, a prime coat that provides waterproofing is all that is needed (since bonding does not occur with traditional prime coats anyway).
- Using chip seals in cracks before using slurry seals or microsurfacing maintenance methods to stop pavement cracking.

6.3 Case Study: Material Reuse

At Dallas Love Field, the Dallas Aviation Department is in the process of removing three concourses, while simultaneously constructing a new LEED Silver Certified facility (Peacock 2009). Several sustainable construction practices are being incorporated in the process, including material reuse from concrete washout devices.

As part of the Clean Water Act, the discharge of any pollutant into navigable waters is prohibited at construction sites; a common best management practice (BMP) to comply with this act is the implementation of concrete washout devices. Concrete washout devices are commonly located at egress points and all trucks leaving the site are required to be thoroughly washed down to avoid offsite contamination. The washout from these devices should not be let into storm drains, open ditches, streets, or streams. At Dallas Love Field, construction crews are taking this concept a step further and allowing for reuse of this waste material.

The wastewater and concrete mixture recovered in the concrete washout devices are allowed to solidify and then put into an onsite rock crusher. After the hardened concrete is crushed, it is backfilled for projects as subgrade. As concourses at the airport are demolished, several tunnels must be filled, allowing for entire onsite reuse of the crushed concrete (Peacock 2009).

6.4 Case Study: Anti-Idling Campaign

Idling can cost drivers of light-duty vehicles up to 0.75 gallon of gasoline per hour, which at 5 to 10 minutes of idling per day amounts to burning nearly two tanks of fuel per year solely due to idling. Many cities and counties have implemented anti-idling programs. The City and County of Denver has established an idling ordinance, limiting idling to 5 minutes in most situations to help reduce air pollution. On an annual basis, idling in the Denver metropolitan area is responsible for an estimated 40,000 tons of harmful air pollution and 400,000 tons of carbon dioxide (CO_2) emissions (City and County of Denver 2010). As part of this city-wide ordinance, the city's Department of Aviation has implemented a strong anti-idling campaign at Denver International Airport.

In coordination with the Department of Public Works, the Department of Aviation posts signage on both the airside and landside areas of the airport to turn engines off to avoid idling. Additionally, air fresheners with the "Engines-Off! Denver" slogans are placed in vehicles after they undergo maintenance (Barrilleaux 2009). This campaign works to limit idling from construction and maintenance vehicles, as well as customer vehicles when picking up or dropping off passengers.

6.5 Case Study: LEED Awareness

The LEED Green Building Rating System was developed by the United States Green Building Council (USGBC) to provide third-party verification that a building or community was designed and built using practices that are environmentally sensitive. In 2006, the State of Hawaii passed a law that required the developers of all new construction in the state to participate in the LEED certification process. This directive applied LEED to all new airport construction, including the modernization program at Honolulu International Airport. As a relatively new statewide program, the State of Hawaii, Department of Transportation, Airports Division faced many challenges during implementation of the LEED process with the modernization program.

As many of the contractors on the project were unaware or unfamiliar with all of the LEED guidelines, significant education was needed for the venture to be successful. During an interview conducted in November 2009, the project manager, Wendy Chuk, stated that the "main challenge was the learning curve." However, to help educate the contractors, several posters were displayed around the construction site setting forth LEED requirements and processes.

A Green Building Services Consultant was also engaged to help facilitate the LEED procedures and requirements. To bring sustainable aspects of a project to fruition, the Airports Division highlighted the importance of requiring regular meetings between the team and the sustainability liaison. Additionally, airport staff was a resource to the construction team by providing fact sheets about regional materials or recycled content materials to contractors. Also, to maintain social awareness, the Airports Division passed out informational brochures to the community about upcoming LEED projects (Willhelm 2009).

6.6 Case Study: Materials Management Program

In 2004, the Port of Oakland established a Materials Management Program to manage materials generated from construction, demolition, and maintenance of Capital Improvement Program projects (e.g., roadways and parking lots) at Oakland International Airport. The program has

been used to recycle construction materials associated with the airport's $300 million Terminal Improvement Program (Port of Oakland 2010).

Through the Materials Management Program, materials such as asphalt, concrete, vegetation, and excavated soils are diverted from the landfill and reused onsite. Three on-airport locations are used for stockpiling, recycling, and rock crushing, allowing for the reduction of new materials costs and associated truck emissions related to the disposal of waste (Herman 2009). In 2006, the Port's Materials Management Program won the American Concrete Institute (ACI) Class A/D Environmental Achievement Award.

According to the Port of Oakland website, as of November 2009, the program has resulted in the recycling and reuse of over 500,000 cubic yards of construction materials (300,000 currently stockpiled for use) and will save the Port $5 million over the entire course of the program.

6.7 Case Study: Pavement Resurfacing

The Metropolitan Airports Commission oversees seven airports, including Minneapolis-St. Paul International Airport (MSP). As part of a 20-year project to resurface pavements at MSP, a new technology was used to reduce the time associated with mixing and laying asphalt pavements. The Commission contracted the work through a company that used a 300-foot machine to mill, mix, add hot tar, and then lay and pack asphalt all in one pass (Fuhrmann 2009). It should be noted that the FAA requires that this process can only be implemented for noncritical surfaces.

6.8 Case Study: Use of Solar Cells

Motivating factors for implementing sustainable construction practices will vary from airport to airport. At Tallahassee Regional Airport, the City of Tallahassee is focused on saving energy and realizing the goal of the airport becoming self-sustaining.

In 2008, a contract went to bid for the installation of a solar powered energy generation system (Clow 2009). The solar cells were recently installed even though there was no expected monetary payback: the cells were installed strictly for environmental and social benefits. The costs for these systems are not recoverable as the payback period would be more than 60 years (Clow 2009).

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APPENDIX A

Collection Sorted by Construction Practice Categories

Appendix A. Sustainable construction practices organized by construction practice category.

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Policies, Procedures, and Plans								
Create and follow a sustainable vision/mission statement that incorporates construction practices.				Widely varies on detail and goals.	Establishes that a project/airport has an environmental focus.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program.	2
Establish an airport-specific rating/ranking system in conjunction with the airport sustainability guidance manual. Provide rewards (certificates of achievement, financial incentives, etc.) for contractors who meet and or exceed sustainability goals.			LAX, ONT, VNY, PMD	Could be tied to cost savings generated by applied practices.	Helps achieve environmental objectives. Encourages other contractors to improve their sustainability efforts to achieve recognition.	Determined by goals. May have operational and/or cost implications.	Markets the specific sustainable practices and related EONS benefits on local, national, and international levels.	55
Require that conceptual plans/criteria documents outline sustainability goals, objectives, and potential achievements.				If anticipated early on, costs may be reduced.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program. May affect the ability for minority/ Disadvantaged Business Enterprise (DBE) contractors to meet requirements.	3
Document all sustainable construction activities to track progress at several stages throughout the construction process (e.g., checklists and progress reports). Prepare interim progress reports to track and document any gaps in construction or documentation. Provide continual feedback on sustainability performance.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39
Review sustainable building requirements in specifications with each subcontractor prior to commencement of work.				Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures that project team members are incorporating sustainability requirements in their daily responsibilities and assignments.	Promotes awareness and internal communication.	55
Develop detailed technical specifications and standards to implement sustainable construction practices; include these sustainability specifications in contracts.				Widely varies on detail and goals.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program. May affect the ability for minority/DBE contractors to meet requirements.	2

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Policies, Procedures, and Plans								
Use web-based, independent industry resources in project specifications to maximize the use of sustainable materials and products.	LEED®	MR Credit 4		Rapidly evolving field makes it difficult to know what is available; use available unbiased information. Examples include: GreenSpec from Building Green, Inc. (www.buildingreen.com) and Oikos (www.oikos.com).	For product benefits, seek unbiased research and reviews.	Many online directories and databases list product descriptions of environmentally preferable products and independent research to ensure that product descriptions contain unbiased information. Check for third-party independent validations of sustainable materials.	Consider working with local communities or nonprofit organizations to develop and collect reliable product information.	3
Develop and implement a program to track and report sustainable construction goals and progress achieved (e.g., a sustainability management system).			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program.	39
Apply for national, state, and local competitive grants to support the selected sustainable construction practices.			LAX, ONT, VNY, PMD	Grant opportunities vary widely by state/federal agency and over time; may help offset costs.	May enable further environmental initiatives.	Could affect the timing of initiatives and reporting requirements.	May involve DBE or community organizations.	39
Pursue U.S. Green Building Council (USGBC) LEED® certification, as applicable. Anticipate the LEED® process early in the planning process.	LEED®	General	SFO, BOS, ORD	Obtaining certification may increase initial costs of a project. If anticipated early on, costs may be reduced. Achievement of LEED® certification may result in the identification of additional sustainable practice opportunities, which may provide positive life cycle economic benefits.	Provides third-party verification of sustainable practice achievements.	Pursue as early in the project planning process as possible. Determined by goals. Facilitates documentation and progress tracking.	May help improve the community's view of the airport; good for public relations.	64
Post signage (e.g., display/poster boards) of LEED®/sustainability goals for construction projects.	LEED®	General		Minimal cost.	Creates awareness of environmental focus and benefits.	No applicable Research Team Consideration.	Promotes worker, customer, and community awareness of the airport operator's sustainability objectives/goals.	3
Develop and implement an environmental management system (EMS) that includes construction projects.			DFW, DEN; SFO, SLC	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps meet regulatory requirements and in assigning responsibilities, and helps with tracking and reporting.	May help improve the community's view of the airport; good for public relations.	2
Prepare internal and external communication reports on sustainability performance of construction projects.			LAX, ONT, VNY, PMD	Widely varies on detail and goals.	Helps meet sustainability goals and facilitates additional sustainable practices.	Helps ensure that the contractor is following sustainability requirements.	May help improve the community's view of the airport; good for public relations. Helps promote awareness.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Policies, Procedures, and Plans								
Ensure that those directly responsible for the project have been informed of the environmental impacts and associated social issues related to their part or stage of the project.				Widely varies on detail and goals.	Helps meet sustainability goals and facilitates additional sustainable practices.	Communicate sustainability goals and requirements at pre-bid, bid, and project start. Inform contractors of the environmental issues and social impacts during the preconstruction meeting.	May help improve the community's view of the airport; good for public relations.	20
Develop construction specifications for the airport using publicly accessible or "free" tools and resources, such as the National Institute of Building Sciences, Whole Building Design Guide (WBDG) Green Building Specifications (www.wbdg.org), and the Port of Portland's Master Construction Specifications website (www.portofportland.com).			ORD	Use available/existing free resources to minimize cost.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program. May affect the ability for minority/DBE contractors to meet requirements.	43, 53
Require regular sustainability progress reports during construction projects (quarterly or at construction milestones) that indicate sustainability goals, accomplishments, and lessons learned.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39
Tie sustainability reporting and performance requirements to monthly and project completion payments (invoices).			ORD	Negative cost implications for noncompliance.	Emphasizes the importance of meeting sustainability requirements.	Compliance ensures realization of operational benefits established in contracts. Clarifies requirements up front.	Compliance ensures realization of social benefits established in contracts.	18
Establish penalties for contractors who don't comply with sustainability reporting and performance requirements.			ORD	Negative cost implications for noncompliance.	Emphasizes the importance of meeting sustainability requirements.	Compliance ensures realization of operational benefits established in contracts. Clarifies requirements up front.	Compliance ensures realization of social benefits established in contracts.	18
Use web directories and links; web-based document sharing; web based procurement process - Requests for Qualifications/ Requests for Proposals (RFQ/RFP), notices/advertisements; electronic submittal forms/templates; and electronic/digital document processes to reduce paper needs.				Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May reduce printing, postage, and administrative costs.	Reduces the use of paper.	Make documents/ resources available online and/or part of the bid advertisement process. Improves the flow of information. Facilitates tracking and reporting; maximizes teamwork, transparency, and information sharing.	Enables flow of information to additional persons.	2
Develop and implement an underground and/or above ground storage tank management plan.				Helps avoid unexpected costs.	Helps meet regulatory requirements and protects the natural environment.	Establish procedures.	Improves safety and awareness.	2

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Sustainability Meetings, Teams, and Presentations								
Establish a regular meeting schedule to discuss sustainability progress (either as separate meetings or as an agenda item at other meetings).			ORD	Incorporate into the overall sustainability management program.	Creates awareness.	Engage the airport's construction and maintenance, tenants, airlines, local regulators, and/or FAA and USEPA representatives as appropriate.	Promotes awareness of sustainability objectives/goals, especially if part of an outreach program.	19
Create a "Construction Sustainability Coordinator" position or an "Office of Sustainability" within the organization.			LAX, ONT, VNY, PMD	Could result in additional project costs, but may be worthwhile if extensive sustainable practices are being implemented (e.g., may expedite the LEED® process).	Establishes that a project/airport has an environmental focus.	Assign responsibility.	Promotes awareness.	39
Form a "Green Team" that would be responsible for managing the integration of selected sustainable construction practices.			ORD	Can help identify potential cost savings.	Provides third-party verification of sustainable practice achievements. Helps achieve environmental goals.	Include members from across the organization to facilitate integration and implementation.	Helps promote internal awareness.	19
Conduct preconstruction and/or project kickoff meetings with sustainability requirements included on the agenda. Communicate sustainability goals and requirements at pre-bid, bid, and project start.				Creates awareness; helps achieve cost objectives. Helps contractors understand and comply with sustainability requirements.	Creates awareness; helps achieve environmental objectives.	Ensures sustainability is considered at the start and continued through the project.	Improves internal communication and awareness; facilitates compliance with tracking requirements.	3
As part of the preconstruction meeting (or other similar meeting), hire an inspector/construction sustainability liaison to the owner (potentially a LEED® AP) to work on sustainability training in conjunction with project and site managers. Introduce the selected inspector to the construction team and allow them to have an introductory question and answer session. Require regular meetings (weekly or monthly) with the sustainability liaison.	LEED®	ID Credit 2	LAX, ONT, VNY, PMD	Could result in additional project costs, but may be worthwhile if extensive sustainable practices are being implemented.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39
Send the selected contractor the sustainability requirements (guidance, specifications, tracking forms, LEED® requirements, etc.) prior to the preconstruction and project kickoff meeting(s).				If anticipated early on, costs may be reduced.	Incorporates environmental aspects into each project.	May help streamline the project process.	Improves internal communication and awareness. Facilitates tracking and reporting to the public.	3

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Sustainability Meetings, Teams, and Presentations								
Identify sustainability reporting (submittal) and performance requirement milestones (e.g., at project startup, monthly, and at project completion).				Widely varies on detail and goals; less so as it becomes part of standard operating procedures. Compliance ensures realization of economic benefits established in contracts.	Compliance ensures realization of environmental benefits established in contracts.	Compliance ensures realization of operational benefits established in contracts. Clarifies requirements upfront.	Compliance ensures realization of social benefits established in contracts.	3
Provide sustainable construction training and awareness programs, presentations, workshops, or meetings for contractors, airport staff, the media, and the community.			DEN	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Use internal workshops or workshops available through other organizations; for example, LEED® training workshops are available across the United States throughout the year. Visit www.usgbc.org.	Promotes awareness and internal and external communication.	15
Provide posters, flyers, and exhibit boards displaying LEED®/ sustainability requirements and processes for contractors.	LEED®	General		Creates awareness at a minimal initial cost; may help achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	May help streamline the project process.	Promotes awareness and internal and external communication.	35
Assign one or more project team members on the construction team to take the LEED® Professional Accreditation Exam, if not already accredited.	LEED®	ID Credit 2	SFO, BOS, ORD	Creates awareness; helps achieve cost objectives. Requires an upfront cost for the exam and preparatory materials. Helps achieve LEED® points.	Creates awareness of environmental focus and benefits.	Expedites the LEED® process. Pursue early on in the project planning process.	Promotes awareness of LEED® requirements on the project team.	39
Assign or hire a LEED® AP to review information regarding sustainable concepts, practices, and submittals.	LEED®	ID Credit 2	SFO, BOS, ORD	Can help identify potential cost savings.	Creates awareness of environmental focus and benefits.	Facilitates the flow of information and helps meet submittal requirements.	Helps promote internal awareness.	39
Community Outreach								
Conduct community partnering programs by developing partnerships with community groups, schools, and local businesses.			LAX, ONT, VNY, PMD	Raises awareness; enhances the airport so that it can continue to be an economic generator and create additional economic benefits for the community. Sharing resources may provide cost savings for both the airport and the community (e.g., sharing of excess construction materials).	Creates awareness of environmental focus and benefits.	No applicable Research Team Consideration.	Will reduce delays during planning, reduce the risk of environmental protest during site works, enhance community relations, and provide for greater acceptance of the completed scheme.	2, 39
Create an interactive multimedia display (i.e., video, website, kiosk, etc.) to engage and educate visitors about the sustainable aspects of construction projects.			LAX, ONT, VNY, PMD	Creates awareness at a minimal initial cost.	Creates awareness; helps achieve environmental objectives.	No applicable Research Team Consideration.	Promotes awareness and internal and external communication. Facilitates information sharing with airport customers.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Community Outreach								
Coordinate with local schools to arrange for field trips or presentations to provide education on sustainable construction practices.			ORD, LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	Establishes that a project/airport has an environmental focus.	Carefully plan and coordinate airfield tours to ensure they would not delay (or be delayed by) airport operations and/or construction projects.	Promotes awareness, communication, and educational opportunities in the local community.	39
Partner with universities and research centers to evaluate, demonstrate, and potentially market new sustainable airport construction practices.			SFO	Improves economic efficiency. May help attract grant and industry funding.	Improves environmental efficiency.	Improves operational efficiency.	Promotes awareness, communication, and educational opportunities.	16
Establish sustainable airport construction internships, stewardships, and/or public education programs (focus on low-income and diverse populations).				Provides added staff assistance and creates research and educational opportunities.	Establishes that a project/airport has an environmental focus.	No applicable Research Team Consideration.	Helps assure that the community is involved in the project. Provides job opportunities and career training for the local community. Promotes awareness, communication, and educational opportunities.	3
Conduct contractor job fairs for upcoming airport projects. Publish updates on the airport's website.				Facilitates a competitive bid process. Creates project awareness.	Creates awareness, especially on the contractor level, of environmental goals and objectives.	Facilitates the flow of information and may help expedite the selection process.	Provides job opportunities for the local and regional communities. Promotes awareness, communication, and educational opportunities.	3
Conduct contractor open houses to describe upcoming projects and sustainability requirements.				Facilitates a competitive bid process. Creates project awareness. Helps make sure procurement requirements are met for Minority-owned Business Enterprises (MBEs) and DBEs.	Creates awareness, especially for contractors, of environmental goals and objectives.	Facilitates the flow of information and may help expedite the selection process.	May help provide opportunities for the involvement of MBEs, small and/or local businesses.	3
Use contractor open houses to survey attendees about their sustainability knowledge, experience, and ability to comply with sustainability provisions.				Ensures contractors can comply with project provisions.	Ensures contractors can achieve the environmental objectives (e.g., Tier compliance of construction equipment).	Facilitates the flow of information and may help meet sustainability requirements.	May help provide opportunities for the involvement of MBEs, small, and/or local businesses.	3
Conduct an industry forum/ conference to share and learn about sustainable construction practices (engage other contractors, the local community, and the construction and aviation industries). Conduct tours of the construction site.			LAX, ONT, VNY, PMD	Raises awareness; potential cost savings from learning from others.	Creates awareness of environmental focus and benefits.	Use industry conferences, annual reports, websites, presentations, press releases, articles in trade journals, etc.	Markets the specific sustainable practices and related EONS benefits on local, national, and international levels.	3, 39
Establish industry peer review groups to provide input and experiences regarding sustainable construction practices.				Potential cost savings from sharing information and learning from others.	Provides environmental benefits from sharing information and learning from others.	Provides operational benefits from sharing information and learning from others.	Promotes awareness, communication, and educational opportunities.	3

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Community Outreach								
Create and implement a policy or code of practice regarding considerate behavior. At a minimum, it should cover: relations with neighbors, communications to neighbors, good housekeeping, presentation of the site, relations with other stakeholders, and complaints procedures.				Facilitates compliance; may help avoid potentially expensive project delays and legal issues.	Emphasizes the importance of meeting sustainability requirements.	Ensure that this policy is communicated to all of the appropriate people working on the project.	Creates internal and external communication.	20
Employ local construction workers to decrease the disruption caused to local communities by commuters, which would also provide local economic benefits.				Use community job fairs and contractor open houses to ensure a local pool of construction workers. Reduces expenses from having to travel long distances.	Reduces emissions, noise, and roadway congestion.	No applicable Research Team Consideration.	Provides job opportunities for the local and regional communities. Promotes awareness, communication, and educational opportunities.	20
Human Resources								
Include educational training on sustainability objectives established for the project team as part of the initial project planning meeting and throughout the project.			ORD, LAX, ONT, VNY, PMD	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures that project team members are incorporating sustainability requirements in their daily responsibilities and assignments.	Promotes awareness and internal communication.	19, 39
Provide training on the airport's sustainable planning, design, and construction guidelines, including their bases, the parties responsible for using the guidelines, and the sustainable rating system.			ORD	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures that project team members are incorporating sustainability requirements in their daily responsibilities and assignments. Use these forums to capture ideas on how to further improve sustainability performance.	Promotes awareness and internal communication.	19
Develop a strategic human capital retention and development plan in conformance with the overall project plan, organizational needs, and changing business needs.			LAX, ONT, VNY, PMD	Reduction in employee turnover and identification of skilled labor needs early on will reduce project delays and costs.	No applicable Research Team Consideration.	Reduction in employee turnover and identification of skilled labor needs early on will help ensure that construction proceeds according to schedule.	Provides job opportunities for the local and regional communities. Promotes awareness, communication, and educational opportunities.	39
Contract with a mix of general contractors and subcontractors with sustainability experience and/or knowledge (e.g., LEED®-accredited staff). Sustainability consulting services shall be provided by an organization with a minimum of 3-5 years experience on projects of similar size and scope.			LAX, ONT, VNY, PMD	Could result in additional project costs, but may be worthwhile if extensive sustainable practices are being implemented.	Contractor should be familiar with Environmental Management Systems (EMSs) (ISO 14001 Standard) and with the USGBC LEED® Green Building Rating Program and a successful history of completed LEED® projects.	Helps create an appropriate sustainable attitude among all contractors. A list of contractors who are members of the USGBC is provided at www.usgbc.org/myUSGBC/Members/MembersDirectory.aspx	May help improve the community's view of the airport; good for public relations.	39, 43, 55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Human Resources								
Require that contractors have a published corporate sustainability policy. Evaluate the policy during the RFP/RFQ process.				Selecting contractors that understand the concepts of sustainability may facilitate the achievement of sustainability requirements, reducing project costs.	Creates awareness of environmental focus; helps ensure that selected contractors are passionate about sustainability.	Ensures that contractors have some familiarity with sustainability concepts.	May help improve the community's view of the airport; good for public relations.	3
Use subcontractors with "in house" fabrication capabilities to increase the awareness of waste reduction and ensure more control over delivery schedules.				Could result in additional upfront project costs if the capabilities are specialized with few competitors, but may reduce life cycle costs.	May reduce environmental impacts.	May improve operational issues with materials delivery.	May reduce number of deliveries and waste haul trips, reducing impacts to surrounding community.	55
Use only design-build contractors with performance-based fee incentives to encourage innovative sustainability solutions.				May increase project costs, but could also be tied to cost savings generated by any innovative practices used.	Encourages contractors to actively pursue and implement sustainable practices, which may result in environmental benefits.	Design-build contracts and/or performance- based fee incentives may not be allowed by the contracting agency/agencies. Encourages contractors to actively pursue and implement sustainable practices, which may result in operational benefits.	Encourages contractors to actively pursue and implement sustainable practices, which may result in social benefits.	55
Link achievement of the construction team's sustainability goals to performance reviews of key personnel.			LAX, ONT, VNY, PMD	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures that project team members are incorporating sustainability requirements in their daily responsibilities and assignments.	Promotes awareness and internal communication.	39
Health and Safety								
Construction Worker Protection								
Appoint a health and safety manager for the construction site.			LAX, ONT, VNY, PMD	May increase project costs, but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Develop a site-specific health and safety plan that identifies all potential hazards and steps to be taken to mitigate accidents.			LAX, ONT, VNY, PMD	May increase project costs, but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Require that all construction workers have proper safety certifications.			LAX, ONT, VNY, PMD	May result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Participate in the Occupational Safety and Health Administration's (OSHA's) Voluntary Protection Programs.			LAX, ONT, VNY, PMD	May increase project costs, but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Health and Safety								
Construction Worker Protection								
Establish an emergency notification program. Identify and display telephone numbers and driving directions to the nearest hospital or emergency care provider.			LAX, ONT, VNY, PMD	Increases awareness and preparedness for emergencies, which may result in financial benefit.	No applicable Research Team Consideration.	Increases awareness and preparedness for emergencies.	Increases awareness and preparedness for emergencies.	39
Conduct safety observations to ensure that workers are abiding by the health and safety plan.			LAX, ONT, VNY, PMD	May increase project costs, but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Record and submit weekly reports summarizing all safety incidents as well as all events that may have resulted in an accident and an evaluation of the steps that can be taken to prevent those events in the future.			LAX, ONT, VNY, PMD	May increase project costs, but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Determine conclusively if toxic dusts or fumes exist or will enter breathing space during construction, especially during renovation of buildings; take corrective action if necessary.			LAX, ONT, VNY, PMD	Reduces potential of harm to construction workers.	Identifies and reduces emissions of toxic substances.	May cause some delays to work, but improves safety of work environment.	Reduces potential of harm to construction workers, site personnel, customers, and public.	39
Provide signs reminding workers of long-term health risks resulting from exposure to particulates and the unknown toxics attached to particulates.			LAX, ONT, VNY, PMD	Reduces potential of harm to construction workers.	Increases awareness and compliance with proper dust control measures.	Increases awareness and compliance with proper dust control measures.	Reduces potential of harm to construction workers, site personnel, customers, and public.	39
Use personal air monitoring systems to inform construction workers of hazardous environments. This technology can improve occupational safety and health in the construction workplace.				Reduces potential of harm to construction workers.	Identifies and reduces emissions of toxic substances.	May cause some delays to work, but improves safety of work environment.	Reduces potential of harm to construction workers and site personnel.	55
Provide reusable or ventilated masks/respirators for worker comfort and health. Require construction workers to wear them when dust emissions are visible.			LAX, ONT, VNY, PMD	Reduces potential of harm to construction workers.	Increases awareness and compliance with proper dust control measures.	Increases awareness and compliance with proper dust control measures.	Reduces potential of harm to construction workers and site personnel.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Policies and Regulations								
Health and Safety								
Construction Worker Protection								
Monitor the site's daily and/or historical air quality index level(s) via the U.S. Environmental Protection Agency's (USEPA's) MyEnvironment webpage. The desired location is keyed in from the USEPA Home Page (www.epa.gov) under the section titled "MyEnvironment." Water quality and health risk updates can also be accessed via this website.				Reduces potential of harm to construction workers.	Increases awareness and compliance with proper dust control measures.	Increases awareness and compliance with proper dust control measures.	Reduces potential of harm to construction workers and site personnel.	3
Health and Safety								
Environmental Tobacco Smoke (ETS) Control								
Require all parts of the construction sites to be nonsmoking.	LEED®	IEQ Prerequisite 2		May reduce site cleanup costs.	Removes tobacco smoke as a potential emission from the construction site.	Increases site safety. Depending on local regulations, the contracting agency/agencies may or may not have the authority to ban smoking onsite.	Increases site safety and eliminates exposure to tobacco smoke.	2
Prohibit smoking within structures under construction and restrict smoking onsite during construction.	LEED®	IEQ Prerequisite 2	LAX, ONT, VNY, PMD	May reduce site cleanup costs and prevent damage of installed building components.	Limits exposure to tobacco smoke.	Increases site safety. Depending on local regulations, the contracting agency/agencies may or may not have the authority to ban smoking onsite.	Increases site safety and limits exposure to tobacco smoke.	39
Provide a designated exterior smoking area (protected from the elements) that is sufficiently distant from construction activities. Locate any exterior designated smoking areas away from entries and operable windows.	LEED®	IEQ Prerequisite 2	LAX, ONT, VNY, PMD	May reduce site cleanup costs and prevent damage of installed building components.	Limits exposure to tobacco smoke.	Increases site safety. Depending on local regulations, the contracting agency/agencies may or may not have the authority to ban smoking onsite.	Increases site safety and limits exposure to tobacco smoke.	39
If an interior smoking area is necessary, provide a designated smoking room designed to effectively contain, capture, and remove ETS from the building using a separate ventilation system.	LEED®	IEQ Prerequisite 2		Increases costs but limits exposure to ETS; may prevent damage to installed building components.	Limits exposure to tobacco smoke.	Increases site safety.	Increases site safety and limits exposure to tobacco smoke.	2
Establish zero exposure of nonsmokers to ETS.	LEED®	IEQ Prerequisite 2	ORD	No applicable Research Team Consideration.	Limits exposure to tobacco smoke.	Increases site safety. Depending on local regulations, the contracting agency(ies) may or may not have the authority to ban smoking on-site.	Limits exposure to tobacco smoke.	19

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Scheduling and Sequencing								
Expedite completion of the building envelope to minimize moisture exposure to interior surfaces, thus minimizing the potential for mold.			LAX, ONT, VNY, PMD	Helps avoid additional costs associated with installing or replacing damaged materials.	Can reduce landfill hauls of damaged materials/ components. Also reduces the environmental impacts of producing new construction products and materials.	May minimize temporary airport activity delays and landside passenger traffic delays.	By preventing mold from growing, worker and occupant health can be preserved. Reduced temporary traffic delays would benefit the community.	39
Plan the phases or stages of construction to minimize exposure. Before site disturbance occurs, perimeter controls, sediment traps, basins, and diversions should be in place to control runoff and capture sediments.			LAX, ONT, VNY, PMD	Can avoid costs of fines from violating permitting agency or government regulations.	Can control runoff and capture sediments as site disturbance occurs. Minimizes runoff into nearby water resources.	Consider the local climate and geology.	May reduce impacts to water quality in the local community.	39
Use "lean construction" project management practices (e.g., minimal inventory and "cradle to grave" project delivery). A lean construction production system delivers a custom product instantly on order, but maintains no intermediate inventories.				Reduces extra handling and excessive labor. Can reduce material costs by ordering only what is needed, but may increase transportation costs if supplies are not ordered in bulk; the personnel in charge of ordering construction materials should identify which materials make the most economic sense to be ordered in bulk and which should be ordered "just in time."	Reduces waste associated with inventories and defective products. Can increase transportation-related emissions if supplies are not ordered in bulk (e.g., several trips). Reduces the environmental impacts of having to produce and haul re-ordered materials or to return excess materials.	By reducing pressures to keep construction running at maximum production, extensive intermediate inventories or “the waste of over production” can be reduced. Requires tight coordination between the construction process and the arrival of parts from supply chains.	May add to local community traffic if this practice increases the number of deliveries on a project level.	34, 62
Evaluate projects and components on a life cycle basis. Perform a life cycle assessment (LCA) of the environmental aspects and potential impacts associated with a product, process, or service by: (1) compiling an inventory of relevant energy and material inputs and environmental releases; (2) evaluating the potential environmental impacts associated with identified inputs and releases; and (3) interpreting the results to make a more informed decision. See www.epa.gov for information on managing and conducting an LCA.				May reduce total life cycle costs (construction, operation, maintenance, and decommissioning).	Considering the environmental costs and benefits of the project may reduce overall environmental impacts.	Careful selection of products may reduce project waste and minimize maintenance.	May reduce the frequency and duration of future construction projects (minimizing temporary construction impacts on the local community; e.g., noise levels and traffic impacts).	20

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Planning for Deconstruction and Disassembly								
Plan for potential uses for the structure and building components (consider future value of materials and systems during selection).			ORD	Can reduce future building costs by avoiding the need to purchase new components or having to remodel buildings.	Can reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials.	Can reduce future generation of waste; facilitates flexible use of space.	Reusing materials may reduce the frequency and duration of future construction projects (minimizing temporary construction impacts on the local community, e.g., noise and traffic).	2
Evaluate potential uses for mechanical, electrical, and plumbing systems.			ORD	Can reduce future building costs by avoiding the need to purchase new components.	Can reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials.	Can reduce future generation of waste; facilitates flexible use of space.	Reusing materials may reduce the frequency and duration of future construction projects (minimizing temporary construction impacts on the local community, e.g., noise and traffic).	2
Use homogeneous material whenever possible. Homogeneous material means a unit that can not be mechanically disjointed in single materials. Homogeneous materials include individual types of plastics, ceramics, glass, metals, alloys, paper, board, resins, and coatings.			ORD	Use of homogeneous material may reduce complexity, cost, and maintenance.	No applicable Research Team Consideration.	Reduces the duration of deconstruction.	May reduce the duration of deconstruction, minimizing temporary impacts on the local community such as traffic.	2
Provide instructions and ensure that connections are accessible to expedite the disassembly process.				Providing disassembly instructions helps ensure that components can be disassembled and potentially reused at minimal cost. Accessible connections allow disassembly to occur faster than otherwise might be possible.	May reduce duration and area of disturbance during disassembly.	Detailed instructions may decrease necessary staff training. May reduce impacts to airport operations in terminals during future rehabilitation projects.	May enhance worker safety.	2
Minimize the use of chemical (adhesive) connectors; instead use friction-based connectors.				Some friction-based connectors may be more expensive than chemical connectors.	Reduces exposure to hazardous chemical products.	May be easier to maintain.	May minimize worker exposure to potentially harmful chemicals.	2
Select fittings, fasteners, adhesives, and sealants that allow for quicker disassembly and facilitate the removal of reusable materials. Material reuse is highly dependent upon the connections.				May decrease disassembly labor costs.	May reduce duration and area of disturbance during disassembly.	May allow for easier disassembly, reducing impacts to airport operations during future projects.	May enhance worker safety.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Planning for Deconstruction and Disassembly								
Design the HVAC system so that it is easy to expand or downsize depending on the future needs of the space. Specify flexible components of HVAC, electrical and fiber optics, and other wiring.				May decrease operational costs (e.g., energy) and capital costs (e.g., equipment) by optimizing for current use.	May decrease energy consumption by not over-sizing components.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Design and install AC roof units so that additional units can be installed if necessary in the future.				May avoid additional costs associated with expanding AC roof units.	May reduce environmental impacts by eliminating need to expand structures.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Strategically locate and appropriately identify load-bearing walls.				May decrease future building costs to meet changing needs. Properly identifying load-bearing walls reduces costs associated with having to re-identify walls or creating unsafe renovations.	No applicable Research Team Consideration.	May allow for easier expansion, reducing future impacts to airport operations.	Properly identifying load-bearing walls enables safe structural modifications.	2
Design for current needs with the ability to expand in the future. Do not oversize components during the initial design phase to account for future build-out.				May decrease operational costs (e.g., energy), maintenance costs, and capital costs (e.g., equipment) by optimizing for current needs.	May ensure efficient energy consumption by not oversizing components.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce future temporary construction impacts on the local community, (e.g., noise and traffic).	2
Use a raised floor system to reduce data and communication installation costs during initial build-out and allow for easier, more economical moves and space reconfiguration.				Reduces data and communication installation costs and allows for more economical moves and space reconfiguration. Compare incremental costs of raised floor to reduced costs of installation and maintenance (materials and labor) for data and communication cabling.	Minimizes noise impacts in occupied areas. May require less data and communication wiring.	May allow for easier expansion or deconstruction, reducing future impacts to airport operations.	May improve employee productivity by reducing noise distractions.	55
Design for additional temperature, electrical, sprinkler, and communication zones in a large space so that future renovations will have adequate services.				May minimize future costs to meet changing needs.	May reduce need for future construction material.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Place entrances and corridors to spaces in such a way that future uses can take advantage of existing egresses.				May decrease future rehabilitation costs.	May reduce need for future construction material.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Planning for Deconstruction and Disassembly								
Place windows in new construction projects with appropriate spacing for future placement of dividers or permanent walls.				May decrease future renovation costs to meet changing needs.	May reduce need for future construction material.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Evaluate the structure and component life cycle prior to purchasing materials/equipment.				May reduce total life cycle costs (construction, operation, maintenance, and decommissioning).	Considering the environmental costs and benefits of the project may reduce overall environmental impacts.	Careful selection of products may reduce project waste and minimize maintenance.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Create touchdown spaces or other flexible and diverse work spaces to enable expansion as well as ad hoc collaborations and enhance opportunities for efficient use of facilities.				May reduce cost of future expansion projects.	May reduce need for future construction material.	Flexible workspaces may increase efficient use of spaces.	No applicable Research Team Consideration.	2
Noise and Acoustical Quality								
Require contractors to submit sound reduction construction plans to mitigate construction noise and vibration impacts.			LAX, ONT, VNY, PMD	May have cost and schedule implications; widely varies on detail and goals.	May reduce noise impacts on adjacent noise-sensitive land uses and help reduce vibration impacts.	May restrict type and timing of construction operations. May minimize impacts on airport activities and landside passenger traffic.	May reduce noise impacts on adjacent noise-sensitive land uses. May reduce complaints from the local community and/or improve the community's view of the airport.	39
Require mufflers on all construction equipment so that noise levels are below the construction equipment noise levels and ranges listed in Appendix A of the U.S. Department of Transportation's Special Report: Highway Construction Noise: Measurement, Prediction, and Mitigation.				May have cost implications.	May reduce noise impacts on adjacent noise-sensitive land uses.	Ensure this policy is communicated to all of the appropriate people working on the project.	May reduce noise impacts on adjacent noise-sensitive land uses.	2, 28
As a courtesy, notify neighbors prior to starting a job that will create noise. Communicate with neighbors to prevent complaints from arising and resolve concerns before a problem arises. Provide a telephone number at which the foreman can be reached prior to the start of the job.				Facilitates compliance; may help avoid potentially expensive project delays.	Emphasizes the importance of meeting noise level requirements.	Ensure this policy is communicated to all of the appropriate people working on the project.	Facilitates communication and awareness with adjacent land owners; may reduce overall noise complaints.	17

(continued on next page)

Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Noise and Acoustical Quality								
Establish and monitor compliance with a specified construction equipment operation schedule. For example, prohibit operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work between 7 p.m. and 7 a.m. on weekdays, and between 8 p.m. and 9 a.m. on weekends or holidays to prevent noise disturbances across a residential or commercial real property line.				May have cost and schedule implications.	May reduce noise impacts on adjacent noise-sensitive land uses.	May restrict type and timing of construction operations.	May reduce noise impacts on adjacent noise-sensitive land uses; may reduce noise complaints.	17
Use rubberized pavements or innovative pavement treatments to reduce traffic noise.			LAX, ONT, VNY, PMD	Consider additional costs of treatment installation and surface maintenance.	Minimizes noise impacts in occupied areas. Consider environmental impacts as treatments deteriorate.	No applicable Research Team Consideration.	May improve employee productivity by reducing noise distractions.	39
Establish construction vehicle speed limits to minimize noise and dust.				No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise-sensitive land uses and minimize dust emissions.	May improve safety of construction operations.	Creates a safer work site and may reduce noise impacts on adjacent noise-sensitive land uses.	2
Locate mechanical equipment and other sources of noise away from occupied areas (or vice versa).			LAX, ONT, VNY, PMD	May have cost and schedule implications and may be impractical/ impossible to implement depending on construction project.	May reduce noise impacts on adjacent noise-sensitive land uses.	May restrict type and timing of construction operations and may be impractical or impossible to implement depending on type of construction project.	May reduce noise impacts on adjacent noise-sensitive land uses. May improve employee productivity by reducing noise distractions.	39
Install portable and permanent noise barriers.			LAX, ONT, VNY, PMD	May have cost and schedule implications.	May reduce noise impacts on adjacent noise-sensitive land uses.	No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise-sensitive land uses; may reduce noise complaints.	39
Replace noisy construction equipment with quieter units.			LAX, ONT, VNY, PMD	May have significant cost implications.	May reduce noise impacts on adjacent noise-sensitive land uses.	No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise-sensitive land uses; may reduce noise complaints.	39
Use lower settings on power equipment whenever possible.				May have schedule implications.	May reduce noise impacts on adjacent noise-sensitive land uses, but may also increase emissions.	May have schedule implications.	May reduce noise impacts on adjacent noise-sensitive land uses; may reduce noise complaints.	17
Use rubber-tired equipment in lieu of track equipment to reduce noise.			LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise-sensitive land uses; may result in less ground disturbance and minimize dust emissions.	May be impractical or impossible to use track equipment depending on topography and soil conditions.	May reduce noise impacts on adjacent noise-sensitive land uses; may reduce noise complaints.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Noise and Acoustical Quality								
Have a designated airport compliance representative certify and randomly inspect all internal combustion, mobile portable, stationary, and power-actuated construction equipment to ensure compliance with noise reduction measures.			LAX, ONT, VNY, PMD	Could result in additional project costs, but inspection ensures compliance and may help avoid potentially expensive project delays.	May reduce noise impacts from construction equipment.	May cause brief interruptions in construction schedules for testing and corrective measures.	May reduce noise impacts on adjacent noise-sensitive land uses; may reduce noise complaints.	39
Follow OSHA's noise exposure rules regarding how long a worker may be exposed to specific noise levels before hearing protection is required: a worker is allowed to be unprotected up to 8 hours at a noise level of 90 decibels (dB); up to 4 hours at 95 dB; and up to 1 hour at 105 dB.				May have minor cost implications for earpieces, headsets, mufflers, and/or a compliance inspector.	No applicable Research Team Consideration.	No applicable Research Team Consideration.	Promotes worker safety and awareness, and creates a safer work environment.	17
Use soundless chemical demolition agents (SCDAs) as a substitute for explosives.				The relatively high cost of soundless chemical demolition agents makes traditional explosives more cost-effective in many applications.	Does not cause noise, ground vibrations, or dust. Powders used are nontoxic, consisting of oxides of calcium, silicon, and aluminum.	Safer than traditional explosives, which pose the threat of premature explosion and which may misfire; can be used near inhabited areas, natural gas lines, roadways, etc. where explosives would pose a safety risk.	Traditional explosion techniques involve risks posed by shock waves and fly rock. Reduces noise in the surrounding community and may prevent telephone calls to emergency services.	6, 55
Site Disturbance Minimization								
Compliance and Safety								
Photographically document site conditions prior to start of construction operations (include aerial photographs). Take weekly photographs throughout the entire project. Photographs shall be provided for unrestricted use by Owner.				Submit (or require the contractor to submit) a minimum number (e.g., 20) of photographs on CD, formatted to ISO 9660) with each application for payment.	Indicate photographs demonstrating compliance with environmental and/or sustainable procedures.	Promotes awareness and documents compliance with sustainable practices.	Promotes awareness and internal communication.	43
Flag or otherwise mark all areas not to be disturbed by construction.			LAX, ONT, VNY, PMD	Reduces areas of site disturbance and potential mitigation requirements.	Reduces areas of site disturbance and potential environmental impacts.	Establishes limits of construction.	Reduces areas of site disturbance and potential dust emissions.	39
Make sure that all contractors and subcontractors have been briefed on access road and staging area locations.			LAX, ONT, VNY, PMD	May help prevent costly site disturbance; briefings/meeting may have minor cost implications.	Ensures that construction traffic follows designated routes to minimize unnecessary site disturbance and traffic congestion.	Promotes site safety and establishes traffic patterns for the construction site.	Promotes site safety and establishes traffic patterns; may reduce offsite traffic congestion and impacts to surrounding roads.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Site Disturbance Minimization								
Compliance and Safety								
Use clean-cut or trenchless technology for installing and rehabilitating underground utility systems.			LAX, ONT, VNY, PMD	Excavation is typically more cost-effective when placement is shallow and traffic is not a major constraint. Cost is dependent of site characteristics and circumstances.	Creates minimal surface disruption and can eliminate the need to remove sections of streets, sidewalks, and lawns, and can avoid tree loss and tree root damage.	Reduces site disturbance. Construction often takes less time.	Reduces traffic congestion, including traffic associated with culvert excavation. Reduces safety concerns associated with steep excavation slopes, work inside trench boxes, and worker exposure to traffic. May be susceptible to fire damage.	39
Install an Engineered Material Arresting System (EMAS) bed to meet Federal Aviation Administration (FAA) Runway Safety Area requirements instead of affecting sensitive natural resources or existing infrastructure/facilities.			ELM	May have cost implications.	The EMAS concrete bed has to be periodically maintained to ensure its integrity, and reconstructed if damaged by weather events or aircraft incidents, resulting in emissions and material requirements.	EMAS beds require periodic maintenance and may need to be reconstructed if subjected to flooding.	Provides increased aircraft safety on runway ends where it is impossible or difficult to provide a standard Runway Safety Area.	23
Site Disturbance Minimization								
Water Quality Protection								
Develop and implement a Stormwater Pollution Prevention Plan for construction activities. Inspect the site frequently to ensure compliance.	LEED®	SS Credit 6.1	BOS	Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May avoid future costs associated with noncompliance, as regulated by local governmental agencies.	Helps meet regulatory requirements and protects the natural environment. Ensures that contaminants/ debris/materials are not carried offsite through stormwater.	Helps meet regulatory requirements.	Protects water quality in the local community.	2
Train on-site personnel in pollution prevention procedures and always make the SWPPP available at the construction site (and available online) for review.				May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Raises awareness.	Ensures comprehension of tasks; allows for streamlined operations.	Promotes awareness and communication; protects water quality in the local community.	2
Monitor water quality impacts before and during construction, especially after significant storm events; address issues of concern (based on data from monitoring) as soon as possible.			ORD	Widely varies based on detail and goals; less so as it becomes part of standard operating procedures. May avoid unexpected and potentially high costs.	Ensures that construction activities have not affected water quality in the area.	Address issues of concern (based on data from monitoring) as soon as possible.	Protects water quality in the local community.	2
Prepare a Spill Prevention Control and Countermeasures Plan for construction activities.			BOS	Widely varies on detail and goals; less so as it becomes part of standard operating procedures. Can avoid unexpected and potentially large contamination cleanup costs.	Can help minimize exposure of harmful substances/ contamination in the environment.	Can avoid unexpected delays due to spill cleanup.	Protects water quality in the local community. May minimize worker exposure to potentially harmful chemicals.	2

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Site Disturbance Minimization								
Water Quality Protection								
Install slurry walls and/or bedrock grouting during construction to prevent commingling of aquifers. These practices reduce the amount of ground water penetrating detention basins, which would require additional energy to pump.			ORD, LAX, ONT, VNY, PMD	Cost-effective for many groundwater control and groundwater remediation problems. Cost is dependent on the depth, length, and width of wall; site geological and hydrological characteristics; available workroom; etc.	Protects against groundwater contamination; may save energy from pumping. May require the use of heavy construction equipment.	Slurry wall/cutoff wall excavations can be performed in all types of soils and below the groundwater table. Excavation deeper than 100 feet requires a crane and clam bucket.	Protects water quality in the local community.	39
Store waste in areas sheltered from rain and runoff.				Helps avoid water contamination cleanup costs.	Can help minimize exposure of harmful substances/ contamination in the environment.	Can avoid unexpected delays due to spill cleanup.	Protects water quality in the local community.	2
Use nontoxic waste materials in landscaping applications, such as brick nuggets - a byproduct of brick manufacturing.	LEED®	MR Credit 4		Potential cost savings; brick nuggets are very durable.	Useful application of a waste product.	Brick nuggets are useful for walkways, landscaping, and ground covering needs.	Various colors, shapes, and sizes can be used to enhance the aesthetic value of the landscape.	55
Limit the number of designated concrete washout areas to avoid the expense of cleaning and maintaining several small washout areas. Make sure washouts are sized appropriately for adequate storage capacity. Use clear visible signs and educate the contractor to ensure that the designated areas are used.				Avoids the expense of cleaning and maintaining several small washout areas; may require training costs.	Limits areas of potential contamination.	Consider locations in reference to job site to minimize transportation and schedule impacts to reach designated washout area.	Protects water quality in the local community.	55
Site Disturbance Minimization								
Erosion and Sedimentation Control								
Develop and maintain a Soil Erosion and Sedimentation Control (SESC) Plan consistent with USEPA Document No. EPA 832/R-92-005 (Sept. 1992), Stormwater Management for Construction Activities, Chapter 3.	LEED®	SS Prerequisite	HNL, ORD	Widely varies on detail and goals, less so as it becomes part of standard operating procedures. Can avoid unexpected and potentially large costs.	Ensures that soil, sand, gravel, and other materials are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water quality in the local community.	2, 38
Incorporate best management practices (BMPs), such as temporary sedimentation basins, temporary ditch checks, diversion dikes, temporary ditches, sediment traps, silt fences, water quality swales, rain gardens, dry wells, and/or pipe slope drains into construction plans.	LEED®	SS Prerequisite 1	ORD, LAX, ONT, VNY, PMD	May have a high upfront cost, but may avoid unexpected and potentially high costs.	Ensures that soil, sand, gravel, and other materials are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water quality in the local community.	64

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Site Disturbance Minimization								
Erosion and Sedimentation Control								
Perform an erosion control study for the stabilization of soils.			DEN	May require additional upfront costs; may keep operating costs to a minimum. May avoid future costs associated with noncompliance as regulated by local governmental agencies.	May help prevent erosion and protect water quality.	May require additional staff training. Can help streamline operations if soil conditions are thoroughly studied.	Promotes internal awareness, communication, and education. Protects water quality in the local community.	9
Incorporate temporary and permanent soil stabilization techniques, including: compost, hydraulic mulch, hydroseeding, soil binders, straw mulch, wood mulch, and rolled mats.	LEED®	SS Prerequisite 1	LAX, ONT, VNY, PMD	May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Ensures that soil, sand, gravel, and other materials are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water quality in the local community.	39
To prevent erosion, minimize the extent and duration of bare ground surface exposure.			LAX, ONT, VNY, PMD, ORD	Temporary seeding/ composting on bare surfaces may increase costs.	Can minimize erosion and runoff into nearby water resources. May also help with dust control.	No applicable Research Team Consideration.	May increase employee welfare by reducing dust. May reduce impacts to water and air (dust) quality in the local community.	39
Maintain mulch stockpiles for use as needed to control erosion and conserve irrigation water.			SLC, U42, TVY	Reduces the demand for irrigation, saving costs.	Conserves irrigation water and reduces erosion.	Maintaining a stockpile onsite will keep operations timely.	Protects water quality in the local community.	58
Use compost for erosion control and moisture retention.			LAX, ONT, VNY, PMD	May reduce fees for disposal of construction waste.	Using compost can improve soil quality, reduce runoff, conserve water, and minimize the need for landscaping chemicals.	Food waste should not be used on or near airport property to prevent potential wildlife hazard. Consider the site topography and geology.	Protects the water supply in the local community.	39
Use lime as an aid for the modification and stabilization of soil beneath road and similar construction projects. Lime can modify almost all fine-grained soils, but the most dramatic improvement occurs in clay soils of moderate to high plasticity.			ORD	The structural contribution of lime-stabilized layers in pavement design can create more cost-effective design alternatives. Potentially more economical than importing aggregate for the same thickness of base course.	Using lime can substantially increase the stability, impermeability, and load-bearing capacity of the sub-grade. Lime could leach into groundwater, contaminating nearby water sources.	Increasing stability and reducing erosion can minimize delays due to unforeseen events. Placing the wrong kind or wrong amount of lime additive or improperly incorporating the additive into the soil can have devastating results.	Protects water quality in the local community.	44
Use biodegradable rolled mulch mats/natural fiber geotextiles (permeable fabrics) to reduce erosion. Ensure that they conform to site contours.			LAX, ONT, VNY, PMD	Biodegradable mats do not require pickup from the construction site and disposal, reducing labor costs.	Provides an alternative to plastic mats or other non-biodegradable materials. Ensures that soil, sand, gravel, and other materials are not carried away via runoff, affecting plants and animals in receiving waterbodies. Minimizes dust and helps establish vegetation quickly.	Increasing stability and reducing erosion can minimize delays due to unforeseen events. Non-biodegradable textiles do not require removal.	Protects water quality in the local community.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Site Disturbance Minimization								
Erosion and Sedimentation Control								
Minimize disturbance to landscaped areas and attempt to maintain existing topography, terrain, tree, and vegetation population (non-wildlife attracting).			LAX, ONT, VNY, PMD	Can avoid costs associated with land clearing/leveling. May avoid repurchasing landscaping elements.	Protects the natural environment; vegetation can reduce erosion and filter sediment.	No applicable Research Team Consideration.	May prevent complaints from surrounding communities and maintain an aesthetic appeal.	39
Achieve permanent soil stabilization in seeded areas by covering over 80 percent of soil surface with vegetation; make sure a layer of topsoil and compost is present to support growth.			LAX, ONT, VNY, PMD	Helps avoid water contamination cleanup costs.	Protects the natural environment; vegetation can reduce erosion and filter sediment.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	May enhance aesthetics and protect water quality in the local community.	39
Locate construction laydown areas and stockpiles in areas that will be paved as part of the construction.			LAX, ONT, VNY, PMD	Helps avoid water contamination cleanup costs.	May help avoid unnecessary soil compaction and prevent erosion. Ensures that soil, sand, gravel, and other materials are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water quality in the local community.	39
Construct stabilized construction entrances on level ground where possible. Grade the entrances to prevent runoff from leaving the construction site and provide ample turning radii.			HNL	Helps avoid water contamination cleanup costs.	May help avoid unnecessary soil compaction and prevent erosion. Ensures that soil, sand, gravel, and other materials are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Accidental deposits must be swept up immediately and may not be washed down by rain or by any other means.	Protects water quality in the local community.	13, 38
If a wash rack is provided at the construction vehicle entrance, vehicles are to be washed on a paved or crushed stone pad that drains into a properly constructed sediment trap or basin. Liquids from these activities shall be collected, managed as contaminated wastewater, and properly disposed.			HNL	May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Ensures that soil, sand, gravel, and chemicals are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Multiple steps may require more time.	Protects water quality in the local community.	38
Stabilize access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes immediately after grading and maintain them frequently to prevent erosion and control dust.			HNL	Helps avoid water contamination cleanup costs.	May help avoid unnecessary soil compaction and prevent erosion. Ensures that soil, sand, gravel, and chemicals are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water and air (dust) quality in the local community and reduces the exposure of workers to dust.	38
To minimize soil compaction, use construction equipment with longer reaches (i.e., equipment that can remain stationary, but operate over a larger radius/area).			LAX, ONT, VNY, PMD	May have cost implications (use of larger equipment).	May reduce site disturbance and dust emissions.	May increase construction schedule/ time to complete tasks.	May reduce areas of site disturbance and potential dust emissions.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Site Disturbance Minimization								
Erosion and Sedimentation Control								
Establish provisions to retain concrete wastes onsite until they can be appropriately disposed or recycled. Excess or waste concrete must not be washed into the public way or any drainage system.				Hardened waste concrete may be crushed and reused onsite, reducing costs of bringing new materials onsite.	Ensures that concrete wastes are not carried away via runoff.	May require additional space to accommodate concrete wastes.	Protects water quality in the local community.	13
For tenant improvement projects, ensure that construction entrances are properly maintained and routine clean up is enforced; ensure that construction entrances are protected from public walkways.			HNL	Helps avoid cleanup costs.	Ensures that soil, sand, gravel, and chemicals are not carried away via runoff, affecting plants and animals in receiving waterbodies.	Maintaining stability and preventing erosion can minimize delays due to unforeseen events.	Maintains public safety. Protects water quality in the local community.	38
Require hand excavation around existing underground utilities.				May require more time and increase labor costs. May help avoid costs and project delays associated with utility pipe/cable disruptions.	May help prevent erosion and protect water quality, minimizing disturbance.	May require more time, but can prevent project delays associated with broken utility pipes and cables.	May prevent power/water failures in the community and injuries to construction workers.	55
Site Disturbance Minimization								
Tree and Plant Protection								
Require each contractor to provide a plan to protect existing vegetation during all construction activities.				Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May help prevent fines for removal of trees off-airport.	Promotes awareness and protects the natural environment. May help prevent erosion and filter stormwater runoff.	Reduces site disturbance, minimizing unforeseen project delays.	Promotes internal awareness. Helps maintain aesthetic appeal.	55
Provide temporary fencing, barricades, and guards during construction to protect trees from damage above and below grade.			PDX	May cost less than removing trees and hauling them to landfills.	Protects the natural environment. May help prevent erosion and filter stormwater runoff.	Reduces site disturbance, minimizing unforeseen project delays.	Helps maintain aesthetic appeal.	53
Protect root systems of trees from the following: damage from noxious materials in solution caused by runoff or spillage during mixing and placement of construction materials, or drainage from stored materials; flooding, erosion, or excessive wetting resulting from dewatering operations and compaction; unauthorized cutting, breaking, or skinning of roots and branches; and skinning and bruising of bark.			PDX	May cost less than removing trees and hauling them to landfills. May be a part of a Spill Prevention Control and Countermeasure (SPCC) Plan and/or a Stormwater Pollution Prevention Plan (SWPPP).	Protects the natural environment. May help prevent erosion and filter stormwater runoff.	Reduces site disturbance, minimizing unforeseen project delays.	Helps maintain aesthetic appeal.	53

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Site Disturbance Minimization								
Tree and Plant Protection								
Where trenching for utilities is required within drip lines, tunnel under or around roots by hand digging or boring. Do not cut main lateral roots or tap roots over 1 inch in diameter. If necessary, cut smaller roots with sharp pruning instruments; do not break or chop.			PDX	May require more time and increase labor costs. May help avoid costs and project delays associated with removing trees and hauling them to landfills and utility pipe/cable disruptions.	May help prevent erosion and protect water quality, minimizing disturbance.	May increase time requirements due to care around existing trees. Will vary based on the number of trees within the project area.	Helps maintain aesthetic appeal.	53
Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover, or pack with peat moss and wrap with burlap. Water exposed roots, maintain them in a moist environment, and temporarily support and protect them from damage until they are permanently relocated and covered with backfill.			PDX	May require more time and increase labor costs. May help avoid costs and project delays associated with removing trees and hauling them to landfills.	Protects the natural environment. May help prevent erosion and filter stormwater runoff.	May increase time requirements due to care of existing trees. Will vary based on the number of trees located within the project area.	Helps maintain aesthetic appeal.	53
Donate healthy plants and trees removed during construction to the community.			LAX, ONT, VNY, PMD	May cost less than hauling plants and trees to landfills.	Prevents carbon dioxide from being released into the environment.	No applicable Research Team Consideration.	May help improve the community's view of the airport.	39
Prohibit burning of landscape waste. Require that all vegetation that has to be removed because of construction be chipped for mulching and composting or used for process fuel (if the full plant or tree cannot be relocated, sold, or donated intact).			SLC	May reduce hauling, disposal, and fuel costs for the contractor and reduce costs associated with purchasing and hauling topsoil onsite.	Prevents carbon dioxide from being released into the environment; may be reused on site to improve plant/tree health and reduce irrigation needs. May reduce erosion and offsite hauling. May avoid the need for mulch/erosion control materials to be brought onsite.	To reduce onsite haul distances, chip vegetation at the site or near the site of future use. Replant disturbed vegetation as soon as possible.	Protects air quality in the local community. Mulch could be donated to local residents/parks near the airport for use in landscaping.	2, 54, 58
Indoor Air Quality								
Indoor Air Quality (IAQ) Management								
Develop and implement an IAQ Management Plan for the construction and pre-occupancy phases of the building.	LEED®	IEQ Credit 3.1	ORD	Additional time and labor may be required to protect and clean ventilation systems and building spaces. Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use. If contaminants remain, they may lead to expensive and complicated cleanup procedures.	Reduces IAQ problems resulting from the construction process.	No applicable Research Team Consideration.	Helps sustain the comfort and well-being of construction workers and building occupants.	19, 64

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Indoor Air Quality								
Indoor Air Quality (IAQ) Management								
Appoint an IAQ Manager who will identify problems and mitigation methods.	LEED®	IEQ Credit 3.1	LAX, ONT, VNY, PMD	May require additional staff training.	Raises awareness.	Ensures comprehension of tasks; allows for streamlined operations; identifying problems and providing quick mitigation will avoid delays.	May improve air quality within buildings. May minimize worker exposure to potentially harmful chemicals.	39
Protect stored onsite or installed absorptive materials, such as insulation, carpeting, ceiling tile, and gypsum wallboard, from moisture damage. Sequence the installation of materials to avoid contamination.	LEED®	IEQ Credit 3.1	HNL, ORD, LAX, ONT, VNY, PMD	Can help avoid purchasing new components due to moisture damage. If contaminated materials are installed, they may lead to expensive and complicated cleanup procedures.	Can reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials.	Accomplished by traditional coverings/ shelter and packaging (if necessary). May reduce delays associated with the ordering/ transportation of new materials. Sequencing may require additional time and could delay the date of initial occupancy.	Keeping materials pristine may reduce the duration of construction projects, minimizing temporary noise and traffic impacts on the local community.	2, 64
Replace all air filter media used during construction at least 2 weeks prior to building occupancy, subsequent to building flush-out. After construction ends and prior to occupancy, conduct a 2-week building flush-out with 100 percent outside air.	LEED®	IEQ Credit 3.1	ORD	Additional time and labor may be required to protect and clean ventilation systems, but would extend the lifespan of the system, improving ventilation efficiency and reducing energy use. If contaminants remain, they may lead to expensive and complicated cleanup procedures.	Reduces IAQ problems resulting from the construction process.	May delay occupancy by 2 weeks if not accounted for at the beginning of the project.	May improve air quality within buildings. May minimize worker exposure to potentially harmful chemicals.	19, 64
Limit or do not operate air-handling equipment during construction.	LEED®	IEQ Credit 3.1	ORD, LAX, ONT, VNY, PMD	Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	Filtration media used during construction should be replaced prior to building occupancy.	May improve air quality within buildings.	19, 39, 64
If permanently installed 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.	LEED®	IEQ Credit 3.1		Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	Replace all filtration media immediately prior to occupancy.	May improve air quality within buildings. May minimize worker's exposure to potentially harmful chemicals.	2
Filtration media installed at the end of construction shall have a MERV of 13, as determined by ASHRAE 52.2-1999.	LEED®	IEQ Credit 5	ORD	Improves ventilation efficiency. May contribute to lowering health insurance rates and health care costs.	Reduces IAQ problems resulting from the construction process.	Filtration should be applied to process both return and outside air to be delivered as supply air.	May improve air quality within buildings.	19
During construction, isolate areas of work to prevent contamination of clean or occupied spaces.	LEED®	IEQ Credit 3.1	LAX, ONT, VNY, PMD	Avoids costs associated with recleaning spaces or buying new materials. Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	Avoids time associated with recleaning spaces or ordering/transporting new materials.	May improve air quality within occupied areas, minimizing occupants' exposure to poor IAQ.	39, 64

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Indoor Air Quality								
Indoor Air Quality (IAQ) Management								
Use ventilation systems overnight to purge the work area.			LAX, ONT, VNY, PMD	May increase energy costs.	Reduces IAQ problems resulting from the construction process.	If construction hours are during the day, purging the area at night will not interfere with operations.	May minimize worker's exposure to hazardous indoor air pollutants.	39
Communicate the hazards of IAQ during health and safety meetings.			LAX, ONT, VNY, PMD	May contribute to lowering health insurance rates and healthcare costs.	Promotes awareness.	Communicate with all of the appropriate people working on the project.	Promotes awareness and internal communication.	39
Increase air movement in facilities by using ceiling fans during construction.			ORD	Ceiling fans may cost additional to purchase and install.	Improves IAQ during construction.	If ceiling fans are not part of the construction scope, additional time may be needed to install and remove them.	May minimize worker exposure to hazardous indoor air pollutants.	19
Use a desiccant dehumidifier to control moisture levels during installation of interior finishes. This technology uses desiccant material to remove humidity from the surrounding space.				Can help avoid purchasing new components due to moisture damage. If contaminated materials are installed, they may lead to expensive and complicated cleanup procedures.	Can reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials.	May reduce delays associated with ordering/transporting new materials.	Keeping materials pristine may reduce the duration of construction projects, minimizing temporary noise and traffic impacts on the local community.	55
Use additional filtration to protect fresh air intake sources to keep construction dust from entering the building.			BWI	May increase energy costs, but may also extend the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	May reduce delays associated with ordering/transporting new materials.	May improve air quality within buildings. May minimize worker exposure to hazardous indoor air pollutants.	60
Prohibit "bake-out" or "superheating" of spaces to accelerate the release of gaseous emissions.				May damage building parts, requiring the purchase of new materials and additional labor costs.	Can reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials. Moisture from the air, and some volatile gases, can condense on cooler surfaces.	A "bake-out" may damage parts of the building (e.g., displacing concrete floor slabs, causing carpet and vinyl flooring to buckle, cracking windows, warping wood doors warped, etc.). May reduce delays associated with ordering/ transporting new materials.	Keeping materials pristine may reduce the duration of construction projects, minimizing temporary noise and traffic impacts on the local community.	13
Indoor Air Quality								
Indoor Chemical and Pollutant Source Control								
Use non-absorptive flooring, walls, and finish materials to resist mold growth.			ORD	May have higher upfront costs; helps avoid additional costs associated with installing or replacing materials damaged by mold. May contribute to lowering health insurance rates and health care costs.	Can reduce landfill hauls of damaged materials/ components. Also reduces the environmental impacts of producing new construction products and materials.	May reduce future delays associated with building maintenance and the ordering/transportation of new materials.	Protects worker and occupant health.	2, 19

(continued on next page)

Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Indoor Air Quality								
Indoor Chemical and Pollutant Source Control								
Only use nontoxic cleaning agents for cleaning activities.				Minimal costs; may contribute to lowering health insurance rates and health care costs.	Nontoxic cleaning supplies may be less harmful to the natural environment. Biodegradable and bio-based cleaning agents are available.	Specifications may need to be established in project standards and procedures.	Protects worker and occupant health.	2
Provide drains plumbed for appropriate disposal of liquid waste where water and chemical concentrate mixes.			ORD	May avoid future costs associated with cleanup or noncompliance, as regulated by local governmental agencies.	Helps prevent chemicals from entering groundwater.	No applicable Research Team Consideration.	Protects worker and occupant health.	19
Ensure that interior construction operations are not scheduled when indoor air quality may be unacceptable.				May contribute to lowering health insurance rates and healthcare costs.	Improves IAQ during construction.	May extend the duration of the project.	Minimizes exposure to hazardous indoor air pollutants.	43
Ensure proper ventilation, such as fume hoods, for activities that produce hazardous gasses.			LAX, ONT, VNY, PMD	May have higher upfront costs, but may also contribute to lowering health insurance rates and health care costs.	Reduces IAQ problems resulting from the construction process.	No applicable Research Team Consideration.	Limits worker exposure to hazardous or noxious fumes, vapors, or dusts.	39
During construction, prohibit the indoor use of combustion engine-based devices without direct exterior exhaust and make-up air.			LAX, ONT, VNY, PMD	May require renting or purchasing electrical or non-combustion equipment.	Reduces IAQ problems resulting from the construction process.	No applicable Research Team Consideration.	May minimize worker exposure to hazardous indoor air pollutants.	39
Within interior spaces, do not use solvents that may penetrate and be retained in absorptive materials, such as concrete, gypsum board, wood, cellulose products, fibrous material, and textiles.				Can help avoid the need to replace components damaged by moisture. If contaminated materials are installed, they may lead to expensive and complicated cleanup procedures.	Can reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials.	Specifications may need to be established in project standards and procedures. May reduce future delays associated with building maintenance and the ordering/transportation of new materials.	May minimize worker exposure to hazardous indoor air pollutants.	13
Pre-ventilate packaged dry products at least 48 hours prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.				May have minor cost implications resulting from energy use.	Reduces IAQ problems resulting from the installation of materials.	Provide a temperature range of 60°F to 90°F continuously during the ventilation period. Do not ventilate within limits of work unless approved by the architect.	May minimize worker exposure to hazardous indoor air pollutants.	13

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Dust Control								
Develop and implement a Construction Dust Control Plan. The plan should document wind patterns, including direction and velocity; show locations of disturbed soil; include BMPs that will be used for each disturbed soil location during each phase of construction; provide for BMP inspections and personnel training; and provide inspection and record- keeping forms, to be kept onsite with the Construction Dust Control Plan. The plan should also include a tracking protocol for implementation of the Construction Dust Control Plan.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Promotes awareness.	Adjust BMPs for dust control based on meteorological conditions and the activity level involving disturbed soil.	Improves road safety and reduces dust. Protects air quality in the local community.	39
For soil stockpiles or areas under active construction, cover soil during rainfall, high winds, and at night with plastic sheets or other cover that can be easily removed.			LAX, ONT, VNY, PMD	Minimal cost for covering materials.	Helps control dust.	Minimal time requirements; may require additional staff training.	Improves road safety and reduces dust. Protects air quality in the local community.	39
Water down loose materials and exposed earth (using non-potable water) to reduce the potential for dust. Use water from on-airport detention basins, cisterns, or creeks.			ORD, LAX, ONT, VNY, PMD	May have minor cost implications due to water use and labor.	Can prevent erosion and the contamination of nearby water sources. Helps control dust.	Consider the site topography and geology.	Protects air quality in the local community. Reduces demand for potable water.	2
Spray down truck wheel wells (using non-potable water) and use rumble strips before exiting the construction site.				Minimal additional costs.	Helps prevent toxins, pollutants, and/or sediment from traveling offsite and contaminating groundwater.	Use water from on-airport detention basins, cisterns, or creeks.	Protects air quality in the local community.	2
Perform regular street sweeping during construction.				Minimal additional costs for equipment and labor.	Helps prevent toxins, pollutants, and/or sediment from traveling offsite and contaminating groundwater. May temporarily increase dust.	To avoid temporary dust exposure, schedule sweeping before or after regular work hours.	Improves road safety and reduces dust.	2
Install temporary fencing (covered) around the perimeter of the construction site to prevent fugitive dust emissions.				The installation of fencing with covering may have cost implications.	Helps control dust.	Minimal time requirements; may require additional staff training.	Improves road safety and reduces dust. Protects air quality in the local community.	2
Require haulers to cover truck beds or maintain at least 2 feet of freeboard for dust suppression.				Minimal cost for covering materials. May reduce the size of hauls, potentially requiring additional vehicle trips.	Helps control dust.	Minimal time requirements; may require additional staff training.	Protects air quality in the local community.	2
Restrict traffic flows to stabilized construction roads.			LAX, ONT, VNY, PMD	Reduces areas of site disturbance and potential mitigation requirements.	Minimizes the amount of dust generated; promotes awareness.	May allow for safer operations.	Improves road safety and reduces dust. Protects air quality in the local community.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Dust Control								
Use integral dust collection systems on drywall sanders, cutoff saws, and routers.				May have higher upfront costs but may contribute to lowering health insurance rates and health care costs.	Minimizes the accumulation of dust and other contaminants.	May require additional staff training.	Improves worker health. Protects air quality in the local community.	55
Use wet rags, damp mops, and vacuum cleaners with high efficiency particulate air (HEPA) filters to clean dust.				May contribute to lowering health insurance rates and health care costs. May require additional labor.	Minimizes the accumulation of dust and other contaminants.	May be time consuming.	Protects worker and occupant health.	55
Water/Wastewater								
Reduce Potable Water Use								
Use non-potable water or gray water for concrete mixing and aggregate wash down.			LAX, ONT, VNY, PMD	Storage tanks and cisterns may have a high upfront cost; reduces the cost of potable water use.	Conserves potable water.	Requires the approval of a licensed structural engineer.	May improve the community's view of the airport if part of an outreach program. Conserves local and regional potable water supplies.	39
Use non-potable water or gray water for consolidation of backfill material around potable/non-potable pipelines.			LAX, ONT, VNY, PMD	Storage tanks and cisterns may have a high upfront cost; reduces the cost of potable water use.	Conserves potable water.	Requires the approval of a licensed structural engineer.	May improve the community's view of the airport if part of an outreach program. Conserves local and regional potable water supplies.	39
Use non-potable water or gray water for irrigation of landscaping on construction sites.	LEED®	WE Credit 1	LAX, ONT, VNY, PMD	A separate tank, filter, and special emitters may be necessary. Storage tanks and cisterns may have a high upfront cost.	Conserves potable water.	No applicable Research Team Consideration.	May improve the community's view of the airport if part of an outreach program. Conserves local and regional potable water supplies.	39
Consult state water recycling criteria to ensure that recycled water is treated correctly to achieve the appropriate level for the respective tasks.			LAX, ONT, VNY, PMD	May avoid future costs associated with non-compliance, as regulated by local governmental agencies.	Helps prevent toxins, pollutants, and/or sediment from traveling off-site and contaminating groundwater.	May require additional staff training.	Ensures public safety.	39
If temporary irrigation is required, use drip or bubbler systems and rain sensor overrides.	LEED®	WE Credit 1		Higher initial cost; helps reduce water bills. Have lower maintenance requirements. Municipalities may offer rebates or incentives for water-efficient irrigation systems, dedicated water meters, and rain or moisture sensors.	Conserves potable water.	No applicable Research Team Consideration.	Conserves local and regional potable water resources.	55, 64
Plant landscaping (non-wildlife attracting) that is native to the region, consistent with a xeriscaping approach.	LEED®	WE Credit 1	DEN	Saves costs on landscaping (no watering labor or irrigation system is required). Requires less maintenance and fertilizer than turf grass.	Conserves water. Native species require less fertilizer and pesticides, protecting water quality.	Less maintenance is required for irrigation.	Creates an aesthetically pleasing building site integrated with its natural surroundings. Conserves local and regional potable water resources.	55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Water/Wastewater								
Water Use Reduction								
Collect and use reclaimed gray water and/or harvested stormwater for non-potable needs, such as sewage conveyance, vehicle maintenance and washing, urinal and toilet flushing, custodial uses, etc.	LEED®	WE Credit 2	ORD	Collection and use of rainwater for non-potable water applications has fewer code requirements and associated costs than gray water. Storage tanks and cisterns may have a high upfront cost.	Reduces runoff.	No applicable Research Team Consideration.	May improve the community's view of the airport if included in an outreach program.	19
Provide training for construction workers and signage for facility users on how they can help reduce water use.			LAX, ONT, VNY, PMD	Costs of training and signage are minimal; education may lower water use bills.	Promotes awareness. Conserves water.	Requires staff training.	Promotes internal awareness and communication.	39
Install metering networks to facilitate accurate measurement of water use.			LAX, ONT, VNY, PMD	Requires additional upfront cost. Promotes awareness, which may reduce utility bills.	Promotes awareness. Conserves water.	No applicable Research Team Consideration.	Promotes internal awareness, communication, and education.	39
Use and install high-efficiency products certified by the USEPA WaterSense program (toilets, urinals, faucets, sinks, and washing machines).	LEED®	WE Credit 3	LAX, ONT, VNY, PMD	Helps reduce water bills; may have a higher upfront cost.	Conserves water.	No applicable Research Team Consideration.	Conserves local and regional water resources. May improve the community's view of the airport if included in an outreach program.	39
Designate truck and vehicle cleaning areas, but limit washdown of vehicle and equipment service pads and other work areas. Liquids from these activities shall be collected, managed as contaminated wastewater, and properly disposed.				Helps avoid water contamination cleanup costs.	Promotes awareness; prevents toxins, pollutants, and sediment from traveling offsite and contaminating groundwater.	May allow for safer operations.	Protects local and regional water resources.	53
Limit steam cleaning and high pressure washing of vehicles and equipment.			PDX	Helps reduce water bills.	Conserves water.	No applicable Research Team Consideration.	Conserves local and regional water resources.	53
Water/Wastewater								
Stormwater Management and Treatment								
Install biological filtration systems/constructed wetlands for stormwater management that also function as ecological features and provide aesthetic benefits.	LEED®	WE Credit 2	LAX, ONT, VNY, PMD	Helps prevent damage from flooding.	Prevents toxins, pollutants, and sediment from traveling offsite and contaminating groundwater.	Must be designed/ installed to not attract wildlife.	Provides aesthetic benefits. Protects water quality in the local community.	39
Construct dry wells, dry basins, and/or perforated drain pipes to avoid creating inundated areas, which attract wildlife.			LAX, ONT, VNY, PMD	Helps prevent damage from flooding.	Helps reduce the potential for flooding; prevents toxins, pollutants, and sediment from traveling off-site and contaminating groundwater.	Helps minimize the presence of wildlife that may be hazardous to airport operations.	Reduces wildlife hazards.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Construction Methods								
Water/Wastewater								
Stormwater Management and Treatment								
Install 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.	LEED®	WE Credit 2	ORD	May minimize wastewater treatment costs and help avoid water contamination cleanup costs.	Prevents toxins, pollutants, and sediment from traveling offsite and contaminating groundwater.	May require additional time/labor to install tanks underground.	Protects water quality in the local community.	19
Install detention basins, detention ditches, and ditch checks for effective first-flush treatment.	LEED®	WE Credit 2	ORD	Helps avoid water contamination cleanup costs.	Prevents toxins, pollutants, and sediment from traveling offsite and contaminating groundwater.	Must be designed/ installed to not attract wildlife.	Protects water quality in the local community.	2
Install bioswales along roadways and parking areas to encourage groundwater infiltration of stormwater runoff. On airside projects, such bioswales must be designed so that they do not provide habitat for wildlife.	LEED®	WE Credit 2		May minimize wastewater treatment costs and help avoid water contamination cleanup costs.	Helps treat stormwater; prevents toxins, pollutants, and sediment from traveling offsite and contaminating groundwater.	Must be designed/ installed to not attract wildlife.	Provides aesthetic benefits. Protects water quality in the local community.	2
Plant nitrogen-fixing vegetation (e.g., legumes) in fertilized areas.			LAX, ONT, VNY, PMD	May minimize wastewater treatment costs and help avoid water contamination cleanup costs.	Helps fertilize soil to support plant life and prevent erosion.	Must not attract wildlife.	Provides aesthetic benefits.	39
Install curb breaks and drainage ditches where possible.				Helps avoid water contamination costs. Helps prevent damage from flooding.	Improves drainage.	Helps minimize the presence of wildlife that may be hazardous to airport operations.	Protects water quality in the local community.	2
Protect storm sewer inlets during construction by installing flexible inlet filters to fit a wide array of drainage structures and offer various levels of infiltration (e.g., FLEXSTORM inlet filters).				Helps avoid fines and water contamination cleanup costs.	Prevents siltation and pollution of rivers, lakes, and ponds. Helps satisfy the EPA's NPDES Phase II directives.	Reduces jobsite flooding and keeps projects running. Resists clogging and are easy to install and remove. Filter bags should typically be removed when they are more than half filled with sediment and debris.	Prevent hazardous road icing conditions by eliminating ice buildup at curb inlets.	1

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Logistics								
Scheduling								
Closely coordinate deliveries of construction materials with scheduled installation times to minimize vehicle queue times.			HNL, LAX, ONT, VNY, PMD	Planning and coordinating the materials ordering processes on site prevents cumulative over-ordering. It may reduce costs associated with installing or replacing damaged materials, but could be more expensive since items are not ordered in bulk.	Can increase transportation-related emissions if materials are not ordered in bulk (e.g., several trips).	Consider potential weather restraints (e.g., snow) or terrain hazards and the delays they may cause. May also reduce the size of the staging area and materials storage areas.	May add to local community traffic if this practice increases the number of deliveries on a project level.	39
Use "just in time" delivery of construction materials to reduce staging requirements and to prevent re-ordering of materials.			LAX, ONT, VNY, PMD	May avoid damage that comes from storage or movement of materials. Saves costs associated with the re-ordering of supplies. Can reduce material costs by ordering only what is needed but may increase transportation costs if supplies are not ordered in bulk; the personnel in charge of ordering construction materials should identify which materials make the most economic sense to be ordered in bulk and which should be ordered "just in time."	Can increase transportation-related emissions if supplies are not ordered in bulk (e.g., several trips). Reduces the environmental impacts of having to produce and haul re-ordered materials or return excess materials.	Consider potential weather restraints (e.g., snow) or terrain hazards and the delays they may cause. May also reduce the size of the staging area and minimize impacts on airport activities.	May add to local community traffic if this practice increases the number of deliveries on a project level.	39
For trades or materials where “just in time” deliveries cannot be set up, provide for suitable, safe, and secure storage so that damage during storage and moves is avoided.				The cost of safe and protected storage space is potentially offset by preventing the need to re-order materials that were damaged.	May increase the amount of impervious surface. Consider using and/or modifying existing spaces if the duration of storage is minimal.	May reduce delays associated with the ordering/transportation of new materials.	No applicable Research Team Consideration.	66
Packaging/Delivery Methods								
Reduce packaging waste through vendor participation using bulk packaging techniques or choose products with minimal or no packaging.				May reduce product/ material costs by using fewer packaging materials. Consider additional transportation requirements, material handling, storage requirements, and costs/ risk of damage.	Reduces packaging waste, environmental impacts from transportation of waste, and impacts to landfills.	Consider storage requirements and material handling requirements to reduce damage.	Reduced transportation of materials/products and packaging waste lowers the impact of delivery vehicles on local communities.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Logistics								
Packaging/Delivery Methods								
Ask suppliers to deliver supplies using reusable delivery containers or sturdy returnable pallets and containers. Have suppliers pick up pallets and empty containers.				May reduce product/ material costs by using fewer packaging materials. Consider additional transportation requirements, storage requirements, and costs/ risk of damage.	Consider trade-off of reduced packaging impacts but increasing transportation impacts.	Consider storage requirements and material handling requirements to reduce damage.	No applicable Research Team Consideration.	55
Purchase precut and prefabricated components when available and order materials to size.				Component costs may be higher, but may allow for just-in-time construction processes, reducing construction schedule and costs, including material transportation costs.	Reduces raw material waste at the construction site. Reduces material hauls, which reduces emissions and the requirement for fossil fuel use.	Enables just-in-time construction techniques.	Reduces the impact of delivery vehicles on local streets.	55
Use easily stackable units, such as cladding systems, curtain walls, steel beams, etc.				Reduces transportation costs.	Reduces transportation impacts. Reduces packaging waste, environmental impacts from transportation, and impacts to landfills.	Consider storage requirements and material handling requirements to reduce damage.	Reduced transportation of materials/products and packaging waste lowers the impact of delivery vehicles on local communities.	55
Encourage alternative sustainable packaging techniques (e.g., metal strapping rather than shrink-wrap, paper packaging rather than plastic, and shredded paper rather than foam).				Alternative packaging may reduce costs. Consider additional transportation requirements, material handling, storage requirements, and costs/ risk of damage.	May reduce packaging waste or environmental impact of packaging waste (i.e., packaging waste can be recycled, reused, or is biodegradable), reduces environmental impacts from transportation of waste, and reduces impacts to landfills.	Consider storage requirements and material handling requirements to reduce damage.	Reduced transportation of materials/products and packaging waste lowers the impact of delivery vehicles on local communities. Reduces impact on local landfills by using recyclable or biodegradable products.	55
Adopt a "first-in, first-out" policy to prevent finish materials from becoming outdated. The first materials delivered to the site should be the first ones used onsite.				Avoids cost of replacing spoiled or outdated materials.	Reduces waste from spoilage. Reduces transportation impacts of removing spoiled materials and delivering replacement materials.	Consider placement of materials and work flow to ensure compliance with policy.	Reduced transportation lowers the impact of delivery vehicles and waste haulers on local communities.	55
Use an overland conveyor system in construction to transport materials from stockpile areas; if possible, use communal conveying systems.				Trade-off with costs associated with truck transportation of materials.	Reduces transportation requirement, thereby reducing emissions and the requirement for fossil fuel use. Helps minimize energy consumption during construction and reduces site traffic and noise.	Use a conveyance system for projects requiring significant grading changes.	May improve logistics and security.	2, 18, 55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Equipment								
Energy Conservation and Alternative Energy								
Develop and implement an energy conservation/efficiency plan.				Depending on scope, may require some up-front cost to implement (e.g., new equipment); typically results in operational savings, reducing energy costs.	Reduces energy consumption. Environmental benefits will vary based on local source of electricity (i.e., coal, natural gas, nuclear, renewable, etc.).	Depending on scope, may require operational changes and training of employees and contractors.	May reduce energy demand and costs in the local community.	2
Install freight elevators as early as possible and coordinate building enclosure at the elevator shafts to minimize temporary hoisting needs.				Minimizes cost associated with leasing temporary hoisting equipment.	No applicable Research Team Consideration.	Consider timing of the change from using temporary hoisting equipment to using freight elevators.	No applicable Research Team Consideration.	55
Use alternating current gearless elevators.				Saves electricity by lowering power consumption by about 40 percent.	Reduces power consumption, thereby reducing emissions.	No applicable Research Team Consideration.	May reduce energy demand and costs in the local community.	55
Install Energy Star certified products for temporary and permanent building equipment. Categories include appliances, electronics, office equipment, lighting, food services, and other commercial products.	LEED®	EA Credit 1		Depending on scope, may require some up-front cost to implement (e.g., new equipment); typically results in operational savings, reducing energy costs.	Reduces energy consumption. Environmental benefits will vary based on local source of electricity (i.e., coal, natural gas, nuclear, renewable, etc.).	No applicable Research Team Consideration.	May reduce energy demand and costs in the local community.	55
Use localized hot water equipment rather than centralized equipment; localized equipment is typically more efficient than centralized equipment.				Eliminates long piping runs and heat losses associated with recirculation piping. May require higher initial costs for localized equipment, but may provide cost savings in materials and energy use.	Reduces energy consumption due to heating losses; uses fewer materials and resources.	Domestic hot water for general plumbing fixtures should be designed for a temperature between 120°F and 140°F.	May reduce energy demand and costs in the local community.	55
Use solar hot water heat or instantaneous hot water heat in construction trailers for heating and cooling.				Eliminates cost associated with running pipes from centralized hot water systems. Eliminates cost associated with heating water even when it is unused.	Reduces energy consumption due to heating losses; uses fewer materials and resources.	Instantaneous or "demand" water heaters heat water directly without the use of a storage tank to avoid the standby heat losses associated with conventional storage tank water heaters.	May reduce energy demand and costs in the local community.	18, 48
Use a global positioning system (GPS) based earthmover to enable machines to get to grade with fewer passes.				Requires less fuel and incurs less wear, thereby reducing costs.	Limits ground disturbance to intended and specified areas.	More efficient use of labor and equipment, reducing project duration.	Improves safety.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Equipment								
Energy Conservation and Alternative Energy								
Prior to placing concrete or asphalt, create a "spatial image" or "digital scan" of the area, plotting three-dimensional points every few millimeters. Laser scanning helps obtain accurate pre-and post-construction terrain models for determination of earthwork quantities, monitoring pavement smoothness and adherence to grade design, and monitoring ground movement near excavations, large embankments, or pile-driving operations.			ORD	Increases the accuracy of measurements, improving productivity and layout work.	Helps determine the amount of earthwork required, reducing unnecessary haul trips and the associated emissions.	Helps meet specified requirements for levelness and flatness. A scan typically takes 5 to 20 minutes to complete. Scanned images can also be imported into computer assisted drawing software to aid in design work. To obtain more accurate information, the instrument can be placed higher off the ground or even on an aircraft. Scans can be completed in total darkness.	May enhance safety by improving precision and reducing the duration of construction projects.	45
Use a machine-integrated laser infrastructure system that provides precise elevation information on an in-cab display to achieve accurate blade positioning.				Helps achieve grade faster and in fewer passes, reducing fuel consumption and operating costs. Does not require the expense of grade stakes, grade checkers, or stake-setting surveyors.	May reduce fuel consumption, reducing construction vehicle emissions.	Reduces delay times associated with airfield construction.	May enhance safety by improving precision and reducing the duration of construction projects.	14
Use digital imaging and ground penetrating radar signal analysis to help predict the initiation and propagation of reflective pavement cracking.				May have a high upfront cost but may avoid unexpected and potentially high costs and operational delays.	Improves mapping accuracy of underground voids and the groundwater table.	Helps identify the severity of pavement cracking and the level of maintenance required to improve the surface. Helps predict future repaving and restructuring projects.	May improve safety by identifying deep surface penetrations and weak pavement areas.	4
Install a reinforcing and stress absorbing membrane interlayer system under the asphalt overlay to delay reflective cracking. Interlayer systems are typically comprised of geosynthetics, geocomposite, steel reinforcement netting, and polymer-modified fine hot-mix asphalt.				Provides cost savings over the life cycle of the pavement; reduces pavement maintenance costs.	Less frequent maintenance reduces energy and emissions from repaving/resurfacing equipment.	Reduces the severity and rate of reflective cracking, reducing the frequency of pavement resurfacing and restructuring; reduces delay times associated with airfield construction.	May improve safety by preventing deep surface penetrations and weak pavement areas.	4

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Equipment								
Energy Conservation and Alternative Energy								
Install pipes with acoustic measuring devices to detect vibrations and/or sound waves in pipelines, indicating defects. Three types of acoustic technologies are used for pipeline assessment: leak detectors, which are used to detect the acoustic signals emitted by pipeline leaks; acoustic monitoring systems, which are used to evaluate the condition of prestressed concrete cylinder pipe (PCCP) by detecting the signals emitted by breaking prestressed wires; and sonar, or ultrasonic systems, which emit high frequency sound waves and measure their reflection to detect a variety of pipe defects.				This technology works on all pipes, including plastic/polyvinyl chloride (PVC), and eliminates the high cost and difficulty of use traditionally associated with leak noise correlators. May incur higher initial costs; however, the higher cost offsets the risk of damage created by defective pipes.	Reduces risk of water loss or contamination due to damaged or faulty pipes.	Helps identify pipeline defects and the level of maintenance required; enhances safety and prevents delays from pipeline failure.	May help avoid pipeline failures that could cause air and/or water pollution in the local community.	55
Use appropriately sized equipment for the project. Lease if not currently owned.				Oversized equipment may cost more than necessary for the job.	Oversized equipment uses more energy than required for the job and may cause erosion.	Fully understand job requirements, with appropriate contingency, to properly specify equipment requirements.	May reduce noise impacts on surrounding land uses.	10
Use alternative fuels (biodiesel, ethanol, compressed natural gas, propane, hydrogen) in an onsite batch plant.				Costs vary based on local availability. It may be necessary to install retrofits for specific types of fuels.	Alternative fuels have fewer emissions than gas or diesel. Emissions from gas and diesel are the leading causes of air quality issues, leading to heart and lung disease, asthma, etc.	Consider retrofit and maintenance requirements associated with the selected alternative fuel.	May help improve air quality, decreasing health impacts on local communities. Use of alternative fuels helps reduce carbon emissions and climate change.	7
Use solar-powered flashers instead of flashers requiring batteries. Solar-powered flashers require no maintenance, are automatically powered, and save money by eliminating the need to recycle batteries. Solar-powered flashers cost approximately $6 more than regular flashers, but the payback period may be only 2 months.			DAL, RBD	Initial costs may be higher than for battery-powered flashers; however, solar-powered flashers require minimal maintenance, are automatically recharged, and reduce costs by eliminating the need to recharge or replace.	Reduces the need to replace nonrechargeable batteries and the environmental impact of battery disposal. Eliminates the need to use the grid to recharge batteries.	Eliminates labor to recharge and/or replace batteries. Depending on the environment, may require occasional cleaning to ensure proper charging. May not be appropriate for environment with little sunlight due to weather conditions or geography.	No applicable Research Team Consideration.	51

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Equipment								
Lighting								
Establish a schedule for when construction lighting is required and develop a policy to reduce lighting when not needed.			LAX, ONT, VNY, PMD	Reduces energy costs.	Reduces light emissions and energy consumption.	Requires that employees and contractors are trained on lighting and are incentivized (if necessary) to follow procedures.	Reduces light emissions on surrounding communities and adjacent land uses.	39
Specify strict site lighting criteria and update periodically in conjunction with seasonal daylight fluctuations to maintain safe light levels while avoiding offsite lighting and night sky pollution.	LEED®	SS Credit 8	LAX, ONT, VNY, PMD	Reduces energy costs.	Reduces light emissions and energy consumption.	Requires that employees and contractors are trained on lighting and are incentivized (if necessary) to follow procedures.	Reduces light emissions on surrounding communities and adjacent land uses.	39
Require the use of energy efficient lamps for temporary lights and temporary emergency lighting that can be turned off during nonworking hours to conserve energy.				May incur higher initial costs; however, bulbs typically last longer, requiring less frequent changes and cost less to operate.	Longer lasting bulbs mean less waste and disposal. However, some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs and creates better lighted work environments. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	Better lighting may improve safety.	55
Reduce construction at night to minimize lighting impacts and improve safety. If construction at night is necessary, focus lighting toward the earth.	LEED®	SS Credit 8	LAX, ONT, VNY, PMD	Reducing nighttime construction typically reduces project costs.	Reduces nighttime light emissions.	Reduces the complexity of the construction site.	Reduces light emissions on surrounding communities and adjacent land uses.	39
Monitor interior and exterior lighting systems regularly during construction to maintain proper illumination and minimize offsite impacts. Ensure that the maximum candela value of all interior lighting falls within the building (not out through windows) and the maximum candela value of all exterior lighting falls within the property.	LEED®	SS Credit 8	ORD	May reduce lighting costs.	Reduces light emissions and energy consumption.	Proper illumination improves construction worker safety and site security.	May reduce light emissions on surrounding communities and adjacent land uses.	19
Use full cutoff luminaries, low-reflectance, non-specular surfaces, low-angle spotlights, and/or shielding for roadway and building lighting.	LEED®	SS Credit 8	ORD	May require higher initial costs.	Reduces light emissions on adjacent land uses.	Proper illumination improves construction worker safety and site security.	May reduce light emissions on surrounding communities and adjacent land uses.	19
Designate specific recycling areas for light bulbs that contain mercury.				No applicable Research Team Consideration.	Ensures that mercury from spent light bulbs is captured and properly recycled.	Communicate recycling procedures with all of the appropriate people working on the project.	Ensures that mercury from spent light bulbs is captured and properly recycled.	3
Install recyclable lamps and provide recycling information for all luminaries.			LAX, ONT, VNY, PMD	May increase costs of temporary construction lighting.	Reduces environmental impact of temporary construction lighting.	Communicate recycling procedures with all of the appropriate people working on the project.	Promotes awareness and may help improve the community's view of the airport; good for public relations.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Equipment								
Lighting								
Where acceptable, use high pressure sodium (HPS) lamps instead of metal halide (MH) lamps; HPS lamps produce more lumens per watt, have less mercury content per lamp, and have a greater average rated life expectancy than MH lamps.			LAX, ONT, VNY, PMD	May incur higher initial costs; however, bulbs typically last longer, requiring less frequent changes, and cost less to operate.	Longer lasting bulbs reduce waste. Some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs and creates better lighted work environments. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	Better lighting may improve safety.	39
Use and install high frequency electronic ballasts with fluorescent 2-, 4-, and 8-foot tubular lamps.			LAX, ONT, VNY, PMD	May incur higher initial costs.	No applicable Research Team Consideration.	Proper illumination improves construction worker safety and site security.	Better lighting may improve safety.	39
Use and install compact fluorescent light bulbs in lieu of incandescent lamps, especially in areas with low ceiling heights and minimal light requirements.			LAX, ONT, VNY, PMD	May incur higher initial costs; however, bulbs typically last longer, requiring less frequent changes, and cost less to operate.	Longer lasting bulbs reduce waste. Some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs and creates better lighted work environments. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	Better lighting may improve safety.	39
Avoid using fluorescent, compact fluorescent, and light-emitting diode (LED) lights that contain mercury (as well as electrical switches and thermostats).				May reduce disposal costs.	Mercury is highly toxic and could cause poisoning if ingested or inhaled.	No applicable Research Team Consideration.	Improves health and safety of installers and building occupants.	55
Use and install metal halide lamps, low-temperature fluorescents, and/or solar-powered fixtures for exterior lighting.				May incur higher initial costs; however, bulbs typically last longer, requiring less frequent changes, and cost less to operate.	Longer lasting bulbs reduce waste. Some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs. Solar fixtures can be installed in remote locations. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	No applicable Research Team Consideration.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Equipment								
Systems Commissioning								
Develop and use a systems commissioning plan. Establish systems commissioning requirements consistent with sustainable design to ensure optimal performance of systems and complete a summary systems commissioning report.	LEED®	EA Prerequ isite	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Most effective when begun at project inception since it involves the project owner, users, occupants, operations and maintenance staff, design professionals, and contractors. Improves energy efficiency, reducing emissions from the use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	39, 64
Early on, identify an individual to lead the commissioning process. The commissioning authority should review and oversee the completion of commissioning process activities, have documented experience in at least two building projects, and be independent of the project design and construction management team.	LEED®	EA Prerequ isite 1	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from the use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	64
Incorporate commissioning requirements into construction documents. Have a contract in place to implement best practice commissioning procedures and tie payment to completion of the contract.	LEED®	EA Prerequ isite 1	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from the use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	64
Review the design intent and the basis of design documentation for proper systems commissioning.	LEED®	EA Prerequ isite 1	ORD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from the use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	19
Provide the airport operator with a single manual that contains the information required for recommissioning systems.	LEED®	EA Prerequ isite 1	ORD	Lowers costs for recommissioning, expediting the process.	Improves energy efficiency, reducing emissions from the use of fossil fuels.	Expedites recommissioning.	Promotes internal awareness.	19
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.	LEED®	EA Prerequ isite 1	ORD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from the use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	19
Establish and follow systems commission requirements for runway lighting and illuminated signage, runway navigational aids, runway site lighting systems, traffic signals, pump stations, and oil/water separators.			ORD	Reduces energy use, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from the use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	No applicable Research Team Consideration.	19

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Equipment								
Maintenance								
Require contractors to submit a pre-construction plan to use recycled oil, nontoxic lubricants, and other environmentally friendly maintenance agents during construction. The plan should also stipulate when and how used oil can be recycled.			HNL; LAX, ONT, VNY, PMD	Costs vary widely on detail and goals; less so as it becomes part of standard operating procedures.	Reduces requirement for disposal of used oil. Reduces environmental impact associated with drilling, pumping, transporting, and refining crude oil.	Must educate employees and contractors, establish procurement policies and procedures, implement procedures for recycling oil.	May help improve the community's view of the airport if part of an outreach program.	2, 38, 39
Contain and clean all chemical spills properly and dispose of clean up supplies properly.			LAX, ONT, VNY, PMD	Initial costs to establish safeguards offset risks and costs associated with cleanup of chemical spills.	Reduces risk of soil and groundwater contamination from chemical spills.	Must educate employees and contractors and implement procedures for cleanup of chemical spills and proper disposal of cleanup supplies.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	39
Conduct maintenance activities under cover from precipitation.			LAX, ONT, VNY, PMD	Initial costs associated with maintenance hangar mitigate risk of soil and groundwater contamination.	Reduces risk of soil and groundwater contamination from chemical spills.	No applicable Research Team Consideration.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	39
Maintain current Material Safety Data Sheets (MSDS) onsite.			LAX, ONT, VNY, PMD	Minimal cost to distribute MSDS offsets risks and costs associated with cleanup of chemical spills.	Reduces risk of soil and groundwater contamination from chemical spills.	Create awareness of existence and purpose of MSDS.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	39
Have floor drains in vehicle maintenance areas discharge into an oil-water separator to capture oil and other contaminants. The separator should be periodically pumped, and the oil processed for recycling.			SLC	Initial costs associated with drainage and separators; mitigates the risk of soil and groundwater contamination.	Reduces risk of soil and groundwater contamination from chemical spills.	Educate employees and contractors. Establish procedures and a schedule for cleaning the separator.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	58
Send end-of-life diesel engines to a remanufacturing plant to be reconstructed into methane-fueled generator sets. These generator sets convert methane from animal waste into usable energy.				Remanufacturing plants may offer to pick up old engines for free, saving costs associated with the transport and/or landfill of end-of-life equipment.	May reduce landfill waste, consumption of iron ore, and reduce GHG emissions caused by disposing end-of-life equipment. Methane generator sets provide renewable electricity and reduce GHG emissions.	No applicable Research Team Consideration.	May help improve the community's view of the airport if part of an outreach program.	49

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Surface Transportation								
Construction Vehicles								
Emissions Reduction								
Conduct an emissions inventory for all construction activities based on known emissions sources, or based on land use if details are not available.			LAX, ONT, VNY, PMD	Depending on scope of project, emissions inventory may be fairly costly to conduct.	Helps identify emission sources and where mitigation efforts should be concentrated to reduce emissions.	No applicable Research Team Consideration.	Helps identify emission sources and where mitigation efforts should be concentrated to reduce emissions.	39
Identify efficient construction scheduling and operations to mitigate air emissions.			LAX, ONT, VNY, PMD	May have schedule implications.	May reduce total emissions over varying periods of time (daily or annually).	May result in extending construction schedule to minimize emissions on a daily or annual basis.	May reduce total emissions.	39
Use ultra low sulfur diesel (ULSD) fuel in all construction vehicles.			ORD	May increase fuel costs due to lower fuel economy during transition period. Older vehicles may require additional maintenance.	Reduces emission of air pollutants, such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	Stipulate that the use of ULSD is a mandatory airport practice. Monitor the performance of older vehicles for potential fuel system leaks or premature fuel filter plugging during the change-over to ULSD fuel.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	2, 18
Use biodiesel and/or other alternative fuels in construction vehicles.			STL	Fuel costs may be higher. Fuel costs may also increase due to lower fuel economy. Retrofits may be required depending on alternative fuel selected. Incentives may be offered.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	Ensure an adequate, local supply of selected alternative fuel. Monitor the performance of older vehicles for potential fuel system leaks or premature fuel filter plugging. Biodiesel should not be used in vehicles manufactured pre-1993. A blend of at least 20 percent biodiesel, 80 percent diesel can be partially counted as an alternative fuel under the Energy Policy Act of 1992.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	2
Require that at least a portion of the construction vehicle fleet is hybrid/electrical and/or incorporate clean air technologies; also consider alternative fuels in shuttle buses and other onroad vehicles.			LAX, ONT, VNY, PMD	May reduce overall fuel costs due to lower fuel consumption. Alternative fuel costs may be higher. Alternative fuels also increase costs due to lower fuel economy. Retrofits may be required depending on alternative fuel selected.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	Ensure adequate local supply of selected alternative fuel. Maintain an inventory of all installed retrofit equipment/emissions reductions to ensure that goals/guidelines are achieved and for documentation and/or marketing purposes.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Surface Transportation								
Construction Vehicles								
Emissions Reduction								
If appropriate, use diesel-electric hybrid bulldozers to burn less fuel and consume fewer parts and fluids over the lifetime of the equipment.			ORD	An electric drive system enables the operator to move approximately 25 percent more material per gallon of fuel consumed compared to conventional mid-sized bulldozers. The electric drive train configuration has fewer moving parts, requiring less service and replacement than conventional transmissions, extending the drive train component life and reducing lifetime operating costs.	Diesel-electric bulldozers consume 10-30 percent less fuel per hour than conventional mid-sized bulldozers, reducing GHG's by 10-30 percent. Movement of the cab is also quieter.	The engine is beltless which helps reduce the frequency of maintenance; oil and filter change intervals are twice as long. Ensure that operators are properly trained on the new technology.	Improves local air quality.	25, 36
Replace aging construction equipment with new low emission models when available and technically feasible.			LAX, ONT, VNY, PMD	Consider lower operating costs of new equipment and payback in relation to remaining useful life of older equipment.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	Maintain an inventory of all installed retrofit equipment/emissions reductions to ensure that goals/guidelines are achieved and for documentation and/or marketing purposes.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39
Install retrofits on existing construction equipment that allow for the use of alternative fuels.			ORD	Initial cost for retrofit may be offset by lower life cycle costs.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	10
Install low emission engines (re-engine) into old equipment chasses.			LAX, ONT, VNY, PMD	Lower investment than a new vehicle.	Keeps the chassis from entering the waste stream. New engines are typically more fuel efficient with lower emissions.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Surface Transportation								
Construction Vehicles								
Emissions Reduction								
Install particulate filters and/or diesel oxidation catalysts on construction vehicles. The equipment should be included on the USEPA's Verified Retrofit Technology List (www.epa.gov/otaq/retrofit/retroverifiedlist.htm) or verified by the California Air Resources Board (CARB) (www.arb.ca.gov/diesel/verdev/verdev.htm).			SLC, ORD	May require investment to upgrade vehicles and equipment.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	18
Develop a vehicle inspection program to ensure that pollution control devices are in place.			SLC, LAX, ONT, VNY, PMD	Establish penalties for noncompliance and present guidelines to contractors prior to project start. Consider cost of inspection process, offset by risk of noncompliance.	Emphasizes the importance of meeting sustainability requirements. Compliance ensures realization of requirements established in contracts. Reduces emissions.	Clarify requirements up front. Maintain an inventory of all installed retrofit equipment/ emissions reductions to ensure that goals/ guidelines are achieved and for documentation and/or marketing purposes.	Compliance ensures realization of air quality benefits established in contracts.	2, 39
Perform routine maintenance and engine rebuilds to maintain original construction vehicle emission levels.			LAX, ONT, VNY, PMD	Should be considered part of normal operating cost, not incremental. Requires only routine maintenance and rebuilds, maximizes useful life of the vehicle, and maintains operating efficiency.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39
Require all construction vehicles to meet the state's voluntary or future low emission vehicle standards.			LAX, ONT, VNY, PMD	May require investment to upgrade vehicles and equipment that do not meet the standards.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39
Develop a Tier compliant and retrofit program for construction vehicles (e.g., retrofit all pre-Tier, Tier 1, and Tier 2 construction vehicles).			LAX, ONT, VNY, PMD	May require investment to upgrade vehicles and equipment.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Surface Transportation								
Construction Vehicles								
Emissions Reduction								
Implement proposed Tier 4 emission standards to encourage the use of newer and/or retrofitted nonroad diesel equipment.			LAX, ONT, VNY, PMD	Consider cost of inspection process, offset by risk of noncompliance.	Reduces emission of air pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	Maintain an inventory of all installed retrofit equipment/emissions reductions to ensure that goals/guidelines are achieved and for documentation and/or marketing purposes.	Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39
Place signage (magnetic stickers) on alternative/ULSD fuel and retrofitted construction vehicles (e.g., "Low-Impact Construction Vehicle," or "This Construction Vehicle Runs on Biofuels").			ORD	Marginal costs for signage.	Creates awareness of environmental focus and benefits.	Develop procedures for verifying and inspecting vehicles.	Creates awareness in the community of specific actions the airport operator is taking to reduce the impact of airport construction.	3
Encourage contractors to carry double hauls when leaving the site.			MSP	May reduce hauling costs.	Ensure that roadways can support the additional weight and the potential for erosion is negligible.	No applicable Research Team Consideration.	No applicable Research Team Consideration.	30
Construction Vehicles								
Reduced Vehicle Idling								
Install anti-idling technology to reduce/eliminate idling, such as Temp-A-Start (www.tempastart.com) automatic engine start/stop technology for diesel engines.			LAX, ONT, VNY, PMD	Technology may have an initial cost; however, less idling reduces fuel consumption and costs. May reduce required maintenance service.	Reduces emissions, fuel consumption, and the environmental impact of drilling, pumping, transporting, and refining crude oil.	Temp-A-Start maintains engine oil temperature and provides for driver comfort. Ensure operators are properly trained on anti-idling technologies.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39, 57
Ensure that construction activities do not require significant vehicle idling times.			LAX, ONT, VNY, PMD	Lowers fuel costs.	Reduces emissions, fuel consumption, and the environmental impact of drilling, pumping, transporting, and refining crude oil.	Plan construction activities to reduce staging time of construction equipment.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39
Ensure that no construction vehicles idle within 100 feet of a sensitive receptor area, such as air intakes.			LAX, ONT, VNY, PMD	May require minimal costs for signage and compliance; fines could be established to support the initiative.	Reduces IAQ pollution.	In coordination with Public Works, post signage for "no idling" areas in construction areas. Implement Vehicle Idling Program inspection logs.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Surface Transportation								
Construction Vehicles								
Reduced Vehicle Idling								
In coordination with public works, post signage for "no idling" areas in construction areas.			DEN, LAX, ONT, VNY, PMD	Marginal costs for signage.	Reduces emissions, fuel consumption, and the environmental impact of drilling, pumping, transporting, and refining crude oil.	In coordination with Public Works, post signage for "no idling" areas in construction areas. Implement Vehicle Idling Program inspection logs.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	9, 39
Turn off construction vehicles if they will be left idle for over an established time limit, e.g., 3 minutes.			BWI, ORD	Lowers fuel costs. In general, 10 seconds of idling uses more fuel than restarting a car.	Reduces emission of such air pollutants as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	An idling engine does not run at peak efficiency, which results in incomplete combustion of fuel, residue on spark plugs, and dirty engine oil. According to the U.S. Department of Energy (DOE), fuel injection engines do not need to be warmed up for more than 30 seconds except on extremely cold days (below 0°F).	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter, including asthma, bronchitis, and heart and lung disease. Reduces emission of greenhouse gases.	19, 41, 60
Place air fresheners in construction vehicles promoting an “engines-off” campaign. The air fresheners could be mounted after performing routine maintenance.			DEN	Marginal cost to build awareness. Easily offset by fuel savings.	Reduces emission of such air pollutants as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide, and carbon dioxide.	No applicable Research Team Consideration.	Reduces health impacts associated with diesel particulate matter.	9
Construction Vehicles								
Construction Traffic Control								
Require detailed site access plans for all milestone stages of work that minimize impervious site effects during construction.				Costs are minimized as it becomes part of standard operating procedures.	Minimizes site impacts.	May require staff training.	Promotes internal awareness, communication and education.	55
Share construction equipment with other contractors. List equipment available for use on a communal website, display boards/posters, and/or hold a meeting with all contractors to discuss available equipment.				May reduce equipment leasing costs or the number of contractors required to own or lease equipment, who would pass that cost on to the airport operator. Reduces transportation requirement and related costs. Must consider cost sharing agreements and liability issues.	Reduces transportation requirement, thereby reducing emissions and the requirement for fossil fuel use.	Requires greater logistical coordination between contractors, which could negatively affect schedule. Consider liability issues.	Reduces the impact of delivery vehicles on local streets. May negatively affect jobs at equipment manufacturers.	55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Surface Transportation								
Construction Vehicles								
Construction Traffic Control								
Implement an unrestricted flow of traffic control information between the contractor(s), the Construction Coordination Office, and the public.			LAX, ONT, VNY, PMD	Costs are minimized as it becomes part of standard operating procedures.	Minimizes site impacts.	Communicate with all of the appropriate people working on the project.	Minimizes impact to local traffic and congestion; promotes awareness.	39
Coordinate with the appropriate state/local transportation services to evaluate potentially vulnerable roadway areas and avoid damage from construction.			LAX, ONT, VNY, PMD	Costs are minimized as it becomes part of standard operating procedures.	Minimizes site impacts.	No applicable Research Team Consideration.	Promotes awareness and protects local roadways.	39
Work with local radio affiliates to include construction updates during morning and afternoon traffic alerts. Announce construction traffic reports on local AM radio stations.			ORD	Costs are minimized as it becomes part of standard operating procedures.	Increases awareness and compliance with noise and traffic control measures.	Requires close coordination between contractors, the airport, and the public.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27
Release a construction project outlook report at the start of the construction season to local media outlets to provide advanced notice of any modifications to existing streets and intersections and provide information regarding truck haul routes in use.			ORD	Costs are minimized as it becomes part of standard operating procedures.	Increases awareness and compliance with noise and traffic control measures.	Minimal time requirements.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27
Publish a landside construction awareness brochure for construction-related roadways closures, access routes, detours, etc.			ORD	Marginal impact compared to the risk of negative public perception.	Increases awareness and compliance with noise and traffic control measures.	Minimal time requirements.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27
Publish an airfield construction awareness brochure highlighting runway and taxiway closures due to construction activity.			ORD	Marginal impact compared to risk of negative public perception and impact to air traffic/airlines and on-time departures and arrivals.	Provides advanced notification of airfield closures, potential delays, and construction noise.	Provide alternatives to ensure that airline traffic operates as efficiently as possible within the constraints imposed by construction.	Minimizes impact to airline traffic. Allows airlines and ground crews to plan ahead.	27
Display construction traffic information on signage near the airport.			ORD	Marginal impact compared to risk of negative public perception.	Creates awareness; reduces traffic congestion.	Ensure proper placement of signage to provide advanced notification so that motorists can plan accordingly.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Surface Transportation								
Construction Vehicles								
Construction Traffic Control								
Immediately repair any construction-related roadway damage.			LAX, ONT, VNY, PMD	Left untreated, roadway damage will cost more to repair later. Minimizes risk of vehicle damage and personal injury.	May temporarily increase vehicle emissions and noise but could reduce the potential for more complex repairs.	Provide appropriate signage before and during repairs.	Enhances roadway safety; prevents damage to vehicles.	39
Limit traffic and staging locations to areas that will be paved.			LAX, ONT, VNY, PMD	Helps avoid water contamination cleanup costs and landscaping repairs.	May help prevent soil compaction and erosion. Ensures that soil, sand, gravel, and chemicals are not carried away via runoff.	Communicate with all of the appropriate people working on the project.	Minimizes health impacts caused by dust and particulate matter.	39
Clearly identify refueling stations for demolition equipment, material haulers, and material lifts.				May reduce fuel costs. Consider distributing/ presenting a map of the location and the desired route.	Creates awareness.	May reduce minor refueling delays and avoid confusion.	Minimizes traffic impacts on and/or off the airfield.	55
Alternative Transportation								
Public Transportation Access and Carpooling								
If possible, locate the construction staging area (or shuttle bus locations) within 0.5-mile walking distance of an existing commuter rail or subway/elevated train station and/or within 0.25-mile walking distance of one or more stops for two or more bus lines.	LEED®	SS Credit 4.1		If possible, work with a local Transportation Management Association (TMA) to develop alternative transportation access options.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Post display boards that illustrate available shuttles and public transportation connection opportunities, routes, fares, and directions.	Transit use decreases congestion onsite and decreases traffic disruption and congestion in neighboring areas.	64
Coordinate with local and regional transit authorities to advance multiple transit connection opportunities to the construction site.	LEED®	SS Credit 4.1	LAX, ONT, VNY, PMD	If possible, work with a local TMA to develop alternative transportation access options.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Post display boards that illustrate available shuttles and public transportation connection opportunities, routes, fares, and directions.	Transit use decreases congestion onsite and decreases traffic disruption and congestion in neighboring areas.	39
Provide incentives such as discounted fares to encourage the use of public transportation.	LEED®	SS Credit 4.1	LAX, ONT, VNY, PMD	Obtain airport funds raised from permit or fee parking to subsidize mass transportation passes for construction workers.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Post display boards that illustrate public transportation connection opportunities, routes, fares, and directions.	Minimizes impact to local traffic and congestion.	39
Provide a transportation plan to and from the construction site that lists available public transportation options, directions, fares, and any available discounts or airport incentives.	LEED®	SS Credit 4.1	LAX, ONT, VNY, PMD	Reduces land requirements; minimizes the number of construction employee spaces required (keeping spaces open for fee-based customer parking).	Post display boards that illustrate public transportation connection opportunities, routes, fares, and directions.	Post display boards that illustrate public transportation connection opportunities, routes, fares, and directions.	Minimizes impact to local traffic and congestion.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Surface Transportation								
Alternative Transportation								
Public Transportation Access and Carpooling								
Provide consolidated construction employee private vehicle parking/staging areas with regular shuttles during construction.				Minimizes the number of construction employee spaces required (keeping spaces open for fee-based customer parking).	Post display boards that illustrate the shuttle routes and public transportation connection opportunities, routes, fares, and directions.	Post display boards that illustrate the shuttle routes and public transportation connection opportunities, routes, fares, and directions.	Decreases congestion on site.	2
Coordinate carpooling to construction sites by developing schedules and incentives (such as preferential parking) based on locations. Use website schedules, meetings, and/or displays boards in common areas.	LEED®	SS Credit 4.4	LAX, ONT, VNY, PMD	Reduces land requirements; minimizes the number of construction employee spaces required (keeping spaces open for fee-based customer parking).	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting. Decreased onsite parking minimizes site erosion.	Use website schedules, meetings, and/or displays boards in common areas.	Decreases congestion on site.	2, 39
Alternative Transportation								
Bicycle Access/Use								
Provide centralized facilities for secure bicycle storage.	LEED®	SS Credit 4.2		Use airport funds raised from permit or fee parking to encourage bicycle use.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Include bike racks at construction staging locations and provide signs near the construction site that indicate the availability of bicycling facilities and their location.	Minimizes impact to local traffic and congestion.	2
Provide convenient changing/shower areas for bicyclists.	LEED®	SS Credit 4.2		Use airport funds raised from permit or fee parking to encourage bicycle use.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Provide signs near the construction site that indicate the availability of bicycling facilities and their location.	Minimizes impact to local traffic and congestion.	2
Provide incentives to encourage that a minimum of 5 percent of construction workers use bicycles for all or part of their daily commute.	LEED®	SS Credit 4.2		Use airport funds raised from permit or fee parking to encourage bicycle use.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Provide signs near the construction site that indicate the availability of bicycling facilities and their location.	Minimizes impact to local traffic and congestion.	64
Develop and implement a "ZipBike" or other bike sharing program for construction workers to travel between facilities.			LAX, ONT, VNY, PMD	Use airport funds raised from permit or fee parking to encourage bicycle use.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Include bike racks at construction staging locations and provide signs near the construction site that indicate the availability of bicycling facilities and their location.	Decreases congestion on site.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Goals and Policies								
Require contractors to develop a waste management plan that contains waste targets; an estimate of the waste to be generated on site; actions to reduce waste; and actions to avoid waste going to a landfill.	LEED®	MR Credit 2	HECA, ORD, LAX, ONT, VNY, PMD, EGGD, EGKK, LGAV	Potential substantial cost savings from reduced material hauling, disposal fees, and fuel costs.	Conserves natural resources. Reduces materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials. The reuse of materials onsite may reduce offsite hauls, decreasing emissions, energy consumption, and traffic.	May streamline the quantification and organization of materials onsite, potentially reducing impacts to airport operations. Essential for quantifying and organizing materials onsite during demolition. Facilitates resource sharing among projects.	Reduced offsite hauling could reduce temporary construction-related traffic in the surrounding community. Salvageable and/or recyclable waste could be donated or sold at a reduced cost to the local community.	39, 64
Include recycling requirements and other sustainable practices in technical specifications to help convey expectations to contractors; this may include providing environmental planning checklists to contractors.			HNL, DEN, LAX, ONT, VNY, PMD, ORD	Increased recycling efforts may reduce disposal costs. Clearly specifies contractor responsibilities.	May enhance recycling activities and thus reduce the emissions from hauling, the traffic impacts, and the consumption of fossil fuels.	May require additional staff training to explain procedures and requirements to contractors.	Educates construction workers and identifies that sustainability is a priority at the airport.	2, 9
Include in all contract documents the minimum quantities of excess materials that will be accepted for return by the vendor and the required condition of such material.			LAX, ONT, VNY, PMD	Helps avoid unexpected costs associated with over-ordering materials and may reduce costs of hauling to landfills.	May reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials.	The contractor should avoid under-ordering materials, which could result in operational delays.	Reduced material hauling could reduce traffic in the surrounding community.	39
If using a waste contractor, verify that the contractor's waste licenses are relevant and up to date.				Work with contracts administration; ensures that contractors are familiar with current standards and practices.	Ensures that contractors are aware of and up-to-date on current regulatory practices and requirements.	Ensures that contractors are familiar with current standards and practices.	Stresses that construction waste management is a priority at the airport; helps ensure contractors are honest and experienced.	66
Provide contractors with a list of local companies that reuse and recycle materials.				May reduce hauling, disposal, and fuel costs.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Update through periodic construction open houses.	May help provide opportunities for the involvement of MBEs, small, and/or local businesses.	46
Allocate personal responsibility for onsite waste reduction (i.e., appoint a Waste Manager).				Consistent and knowledgeable application of standards and specifications across all projects.	Consistent knowledge and understanding of environmental standards and specifications across all projects.	Applies consistent knowledge and understanding of applicable standards and practices, tracking and reporting across all projects.	Reduced off-site hauling could reduce traffic in the surrounding community.	66

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Goals and Policies								
Develop a balanced earthwork plan and keep as much excavated earth onsite as possible to reduce offsite hauling. Develop an inventory of topsoil for potential reuse.			ORD	May reduce hauling, disposal, and fuel costs.	Conserves natural resources. Reduces roadway congestion, energy use, and emissions. May avoid having to haul new material to the site.	Consider the reuse of earthwork/soil for another project. Avoid 'double-hauling' of materials. Inventory of soils may streamline the reuse of soil airportwide. Site management to avoid erosion and dust is essential.	Excess airport earthwork could be donated or sold at a reduced cost to the community. Reduced offsite hauling could reduce temporary construction-related traffic in the surrounding community.	18
Develop a detailed lay-down/sequencing plan.			LAX, ONT, VNY, PMD	Better material management. May reduce hauling, disposal, and fuel costs.	Reduces the demand for raw materials.	Facilitates project staging of materials, and material sharing. Could reduce temporary construction-related surface transportation impacts as vehicles would make fewer trips offsite.	Reduced offsite hauling could reduce traffic in the surrounding community.	39
Designate a hazardous waste containment area and arrange for a hazardous waste inspector to periodically assess the site. Also designate special construction waste containment areas (medical, industrial, pollution).	LEED®	MR Credit 2	STL	May reduce hauling, disposal, and fuel costs.	Reduces construction worker and community exposure to waste.	May involve several regulatory requirements.	May minimize construction worker and community exposure to waste.	2
Establish a hazardous waste management plan for all storage and operational use of hazardous materials, including battery collection.			MKE	May help avoid expensive costs associated with hazardous waste accidents. Address regulatory requirements.	Minimizes contamination of soil, water, and other resources.	May require specialized containment and operational conditions; requires staff training.	May minimize construction worker exposure to hazardous waste.	24
Designate a permanent, easily accessible, central storage area or secondary containment area onsite for reuse and proper storage of construction materials.	LEED®	MR Credit 2	ORD	May reduce hauling, disposal, and fuel costs for the airport operator/ contractor and minimize or avoid the cost of bringing new materials onsite.	The emissions associated with haul routes and storage sites should be considered when locating the site. May reduce emissions and traffic impacts from offsite disposal trips.	The storage area should be strategically located so it does not require idling and/or delay of airport/construction operations.	Reduced offsite hauling could reduce traffic in the surrounding community.	18, 54
To ensure compliance with waste management and recycling goals, submit updated site waste recycling forms on a monthly basis, including the amounts of construction or demolition materials recycled or salvaged.	LEED®	MR Credit 2	PDX	Increased recycling efforts may reduce disposal costs; however, the cost of monitoring the recycling efforts may outweigh the benefits if not part of everyday practice.	Conserves natural resources. May enhance recycling activities and thus reduce emissions from hauling, traffic impacts, and the consumption of fossil fuels.	May require additional staff training to explain procedures and requirements to contractors. Essential to become part of everyday practice.	Educates construction workers and identifies that sustainability is a priority at the airport.	53

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Goals and Policies								
Submit a final site waste recycling form prior to contract closeout that sets forth the total amount of construction or demolition materials recycled over the duration of the project.	LEED®	MR Credit 2	PDX	Increased recycling efforts may reduce disposal costs; however, the costs of monitoring the recycling efforts may outweigh the benefits.	Ensures compliance with waste management and recycling goals. May enhance recycling activities and thus reduce emissions from hauling, traffic impacts, and the consumption of fossil fuels.	Partners contractor and construction management teams. May require additional staff training to explain procedures and requirements to contractors.	Educates construction workers and identifies that sustainability is a priority at the airport.	53
Do not remove protective packaging from materials before they are needed to prevent spoilage and to allow for the return of unused materials.				Usually unused materials can be sold back to the supplier at a 50 percent restocking fee.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Consider onsite staging and storage requirements.	No applicable Research Team Consideration.	67
Provide financial incentives to contractors who substantially exceed requirements of the Construction Waste Management Plan.				May reduce hauling, disposal, and fuel costs.	Conserves natural resources.	Contractual requirements to be specified; perhaps difficult to monitor.	Stresses that construction waste management is a priority at the airport.	66
Construction Waste Management								
Storage and Collection of Recyclables								
Recycle aluminum, glass, plastics, paper, and corrugated cardboard.				Requires initial startup costs and the use of dedicated storage/ containment areas; potential for cost savings or offsets.	Keeps materials out of the waste stream and conserves natural resources by reusing materials.	Expand the type of recyclables as applicable.	Consider partnering with local communities.	2
Recycle gas and oil filters, waste gasoline, motor oil, antifreeze, scrap metal, tires, electrical wiring, deicing fluid, grease, sludge, hazardous materials, and spent solvents.				Reduces disposal and waste handling costs.	Keeps hazardous materials out of the waste stream.	Requires storage and containment areas, and staff training.	Consider partnering with local communities.	2
Recycle batteries, light bulbs, toner cartridges, and electronics (including monitors).				Reduces disposal and waste handling costs.	Keeps hazardous materials out of the waste stream.	Requires storage and containment areas, and staff training.	Consider partnering with local communities.	2
Determine the disposal costs, hauling costs, and revenue generated for reusing materials; compare them with the cost of purchasing/constructing new items.	LEED®	MR Credit 3	ORD	Helps identify cost-saving opportunities.	A credit under USGBC LEED® criteria.	May require a tracking system and coordination amongst contractors.	Quantify and include as part of a public outreach plan.	19
Coordinate recyclable collection infrastructure with hauler capability.			LAX, ONT, VNY, PMD	May reduce hauling, disposal, and fuel costs.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	May require flexibility to provide onsite staging, storage, containment areas. Helps avoid delays during materials removal.	May facilitate use of local, small businesses.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Storage and Collection of Recyclables								
Use cardboard balers, aluminum can crushers, recycling chutes, and other technologies to enhance recycling activities and reduce the number of waste hauls.				Reducing material volumes reduces handling and hauling costs.	Reduced volumes reduce truck hauling trips, thereby reducing energy use and emissions.	Reduced material volume reduces onsite storage and containment requirements.	Reduced off-site hauling could reduce traffic in the surrounding community.	2
Ensure that the construction manager understands the demolition requirements and properly sets up the demolition process to identify and organize materials according to how they can be reused and/or recycled.				May reduce hauling, disposal, and fuel costs.	May reduce materials/ components sent to the landfill. The reuse of materials onsite may eliminate offsite transportation and thus decrease construction vehicle emissions and energy consumption.	Could reduce temporary impacts to surface transportation if vehicles make fewer trips offsite.	Reduced offsite hauling could reduce traffic in the surrounding community.	52
Ensure that recycling bins are full and packed before using new bins.				Reduces handling and hauling costs.	Reduces energy use and emissions from transport.	Requires sufficiently sized and organized storage area. Ensure that such areas do not become wildlife attracting.	May help minimize traffic impacts.	55
Charge a fee to contractors who contaminate recycling bins.				Creates financial incentive for contractors to recycle material properly and provides a mechanism to recover costs if material has to be sorted before a recycler will accept it.	Encourages contractors to recycle material properly.	Encourages contractors to recycle material properly.	Stresses that construction waste management is a priority at the airport.	55
Construction Waste Management								
Materials Reuse								
To facilitate the reuse of materials, track and evaluate the following waste for recycling (at a minimum): land-clearing debris, cardboard, metal, brick, concrete, asphalt, plastic, clean wood, glass, gypsum wallboard, carpet, and insulation.	LEED®	MR Credit 2	ORD	Helps offset construction-demolition costs. May minimize or avoid the cost of bringing new materials onsite.	Conserves natural resources.	Make a part of everyday practice. Streamlines the reuse of materials, and encourage the use of materials/ products with recycled content.	Facilitates material reuse and sharing programs both onsite and within the community.	2
Reuse project waste as a resource on another project. Reuse may include concrete, asphalt, land and clearing debris, small ancillary buildings or structures, and building components. List materials available for use on a communal website, display boards/posters, and/or hold a meeting with all contractors to discuss available materials.			ORD	May reduce hauling, disposal, and fuel costs.	May reduce materials/ components sent to the landfill and the environmental impacts of producing new construction products and materials.	List materials available for use on a communal website, display boards/posters, and/or hold a meeting with all contractors to discuss available materials.	If the waste cannot be reused on site, consider sharing opportunities with the local community and/or nearby projects, minimizing haul distances and emissions.	2

(continued on next page)

Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Materials Reuse								
Use an on-site batch plant (or onsite rock crusher) to crush concrete and reuse it onsite.			PBI, LNA, F45, DAL, RBD, MSP, BWI	May reduce hauling, disposal, and fuel costs for the airport operator/ contractor and minimize or avoid the cost of bringing new materials onsite.	May help extend the life of existing landfills and reduce the need for new landfills through the reduction of total waste generated. Reduces the demand for raw materials.	Requires storage and containment areas, and staff training.	Reduced off-site hauling could reduce traffic in the surrounding community.	60
Use a "rubbleizer" machine that performs multiple tasks in a single step - sending vibrations into concrete to break into usable pieces less than 4 inches.				May reduce labor and fuel costs for the airport operator/contractor and save costs associated with purchasing new concrete and masonry.	May reduce emissions and allow for enhanced onsite recycling of concrete, reducing the environmental impacts of producing and hauling new construction products and materials. May reduce offsite transportation and thus decrease construction vehicle emissions and energy consumption.	Expedites the removal of concrete, reducing delays.	May help minimize traffic impacts.	65
If no local markets exist for recycling drywall in the area, recycle non-contaminated drywall by grinding and spreading on open land at the airport at a rate of approximately 5 tons per acre and then tilling into the soil.				May reduce hauling, disposal, and fuel costs. The airport operator/ contractor should also factor in the cost to grind and apply the drywall.	Ensure that the drywall is free of hazardous materials before implementing this practice. Place the ground drywall on flat land away from waterbodies to avoid runoff.	No applicable Research Team Consideration.	A unique practice that may educate construction workers and the local community.	54
Donate unused paint to a local graffiti removal program.			SLC	May decrease costs by donating the material rather than sending it to a disposal service.	Finding a use for unused waste reduces the chance of improper disposal and contaminating the environment.	Requires worker/staff education and instruction to achieve; consider appointing a community liaison.	Resource sharing with the community; improves community relations.	58
Minimize the use of temporary wood structures.				May decrease costs if reusable formwork is used on multiple projects.	Using reusable formwork can reduce the amount of materials sent to the landfill and conserve natural resources.	No applicable Research Team Consideration.	May help minimize traffic impacts.	55
Use ultra screen sight and sound barriers (lightweight panels with no special equipment for installation, maintenance, or replacement) instead of traditional sight and sound barriers.				May decrease installation and maintenance costs.	May reduce sight and sound impacts compared to traditional barriers.	Typically requires less time and labor for installation and maintenance than for traditional sight and sound barriers.	No applicable Research Team Consideration.	55
Use chain clamps as alternatives to traditional methods of pipe fit-up as each clamp can fit up elbows, tees, flanges, and other pipe fittings.				Although chain clamps can be expensive compared to traditional pipe fit-up methods, they may reduce labor and disassembly costs.	Chain clamps may reduce the quantity of pipe fit-up materials used, including plastics.	May allow for easier disassembly, reducing impacts to airport operations during future projects.	No applicable Research Team Consideration.	55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Materials Reuse								
Reuse existing runway pavement (e.g., for taxiways).	LEED®	MR Credit 3	ORD	Determined through facility planning. May reduce costs associated with hauling, disposal, fueling, and purchasing new pavement.	May reduce the amount of pavement sent to the landfill and the environmental impacts of producing new pavement.	As part of EONS, determine cost savings of not demolishing and reconstructing.	Reduced off-site hauling could reduce traffic in the surrounding community.	2
Use excess asphalt paving to fix surrounding roads, drives, parking lots, etc.				May reduce hauling, disposal, and fuel costs and save costs associated with purchasing new asphalt.	May reduce materials/ components sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	Uses construction crews already in place; may require contract modification or flexibility.	Reduced offsite hauling could reduce traffic in the surrounding community.	55
Use concrete chunks, old bricks, broken block and other masonry rubble for backfill along foundation walls where permitted.				May reduce hauling, disposal, and fuel costs and save costs associated with purchasing new concrete and masonry.	May reduce materials/ components sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	May reduce temporary impacts to surface transportation as vehicles would make fewer trips offsite.	Reduced offsite hauling could reduce traffic in the surrounding community.	55
Recycle crushed, unreinforced concrete by using it in swales, fill, rip-rap and drainage.	LEED®	MR Credit 4		Minimizes the costs of buying new materials and transporting them to the construction site.	Reduces landfill hauls. Reduces the environmental impacts of producing new construction products and materials.	As part of EONS, determine cost savings of not demolishing and reconstructing.	May improve the community's view of the airport if included in an outreach program. Reduces offsite hauls, thereby reducing surface transportation congestion.	65
Use excess concrete for parking stops, jersey barriers, etc.				May reduce hauling, disposal, and fuel costs and save costs associated with purchasing new concrete.	May reduce materials/ components sent to the landfill and the environmental impacts of producing and hauling new construction products and materials. May reduce offsite transportation and thus decrease construction vehicle emissions and energy consumption.	May reduce temporary impacts to surface transportation as vehicles would make fewer trips offsite.	Reduced offsite hauling could reduce traffic in the surrounding community.	55
Use pre-assembled rebar cages when possible to reduce onsite rebar waste.				May achieve cost savings.	Reduces need for excess material recycling and reuse.	May require less staff training.	Reduced offsite hauling could reduce traffic in the surrounding community.	55
Separate subsoil and topsoil and ensure proper storage for reuse.				Facilitates use; minimizes 'double' and 'triple' touching.	Vegetating long-term stockpile with suitable plants may help prevent dust blow and erosion, silt runoff, and the establishment of invasive or noxious weeds.	To avoid soil compaction, heavy machinery must not be driven on stockpiles. Stockpiles should not be located with 10 meters of a watercourse.	Reduced off-site hauling could reduce traffic in the surrounding community.	20
Reuse items, such as electrical boxes, breaker equipment, wall outlets, and other electrical equipment where possible and practical.	LEED®	MR Credit 3		Potential cost savings from reuse on other projects or sale.	Reduces waste materials.	Make contractor aware of need to recycle these types of materials; consider code/ regulatory requirements.	Include in resource database; becomes potential low-cost resource option to community.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Materials Reuse								
Reuse empty wire spools for other purposes and tasks (e.g., stools for the break area).	LEED®	MR Credit 3		Disposal cost savings.	Reduces waste materials.	Make the contractor aware of the need to recycle these types of materials; consider code/regulatory requirements.	Creates contractor awareness.	55
Save worn out nickel-cadmium (NiCad) batteries from portable power tools for delivery to a specialized battery-recycling site.				Disposal cost savings.	Keeps materials out of the waste stream.	Requires temporary storage and transfer.	No applicable Research Team Consideration.	55
Use prefabricated foam insulated concrete panels.				Longer-term energy cost savings potential and benefits during construction using prefabricated, lighter materials.	Reduced energy use and emissions during construction; longer-term energy and cost savings potential.	Prefabricated materials facilitate installation and use.	No applicable Research Team Consideration.	40
Use insulating concrete forms (ICFs) for decreased waste; ICFs also optimize energy performance and reduce impacts from construction.				The use of ICFs decreases pour time and reduces the overall amount of concrete required. ICFs also provide enhanced durability.	Conserves resources. Reduces exterior noise.	Reduces installation/ construction time.	May help minimize noise and traffic impacts.	2
Construction Waste Management								
Salvaged Materials and Resources								
Identify salvage opportunities prior to demolition activities to encourage the reuse of salvaged materials (fencing, kiosks, parking curbs, signage, lighting, benches, floor tile, doors, windows, carpeting, HVAC, etc.).	LEED®	MR Credit 3		Potential cost savings from reuse on other projects or sale.	Conserves natural resources.	Identify at outset, organize and monitor during construction, and establish staging and storage areas. Explore salvage markets local to the site for use in acquiring salvaged materials.	Becomes potential asset to local community; consider sale or donation.	2
Coordinate with other airport projects to share salvaged materials and resources.			LAX, ONT, VNY, PMD	Potential cost savings from reuse on other projects or sale.	Conserves natural resources.	Identify at outset, organize and monitor during construction, and establish staging and storage areas.	Reduced off-site hauling could reduce traffic in the surrounding community.	39
Donate salvaged materials (such as fencing and floor tile) to local organizations. Use a public information website or other means to list salvaged materials for sale or donation.				May require minimal additional administrative and handling costs.	Conserves natural resources.	Requires establishing temporary and longer-term staging and storage areas.	Potential asset to local community; include as part of outreach program.	2
Remove elements that pose a contamination risk prior to reusing structures.			ORD	Plan for expenses; addresses regulatory requirements.	Minimizes contamination of soil, water, and other resources.	May require specialized containment, operational conditions, and contractor expertise.	Minimize construction worker exposure to hazardous wastes.	19

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Reuse and Recycling Materials								
Construction Waste Management								
Salvaged Materials and Resources								
Use a "Construction Waste Management Database" provided by the Whole Building Design Guide at www.wbdg.org/tools/cwm.php to identify salvaged materials and resources, and companies that haul, collect, and process recyclable debris from construction projects.	LEED®	MR Credit 2	LAX, ONT, VNY, PMD	The Database is an online service for those seeking companies that recycle construction debris in their area. A search can be conducted by state, zip code, or material(s) to be recycled.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	Consider using the Whole Building Design Guide, which can be accessed at www.wbdg.org/tools/cwm.php, or a similar tool.	Organizes resource reuse and waste disposal; becomes a tool for use by others.	39
Reuse forms to the greatest extent possible without damaging the structural integrity of concrete and without damaging the aesthetics of exposed concrete.	LEED®	MR Credit 3		Cost savings from reuse on other projects.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	Typically part of standard operating procedures.	May help minimize traffic impacts.	43
Office Waste Reduction								
Require electronic submittals to minimize or eliminate printed copies of reports and other submittals. Negotiate electronic/paperless submittals and change orders in construction contracts (require electronic submittals).			LAX, ONT, VNY, PMD	Reduces costs from storage and handling multiple copies of documents; facilitates access and distribution; facilitates record keeping.	Substantially reduces paper used in multiple submittals.	Can still maintain printed copies in a central location to facilitate use/ review.	Facilitates access/transparency and distribution.	39
Establish a "green meetings" policy that minimizes the use of printed materials.			LAX, ONT, VNY, PMD	Minimal or negligible cost to implement.	Reduces use of paper and other materials.	Establishes consistent protocols.	Include as part of community outreach program.	39
Use conference calls and web-based conferences and programs instead of in-person meetings when possible to reduce printed materials and to reduce emissions from transportation.			ORD	Reduces costs for materials and travel.	Conserves natural resources and reduces energy use and emissions from travel.	Examples include: NetMeeting, LiveMeeting, GoToMeeting, Webinars, and others.	Reduces emissions from air travel.	19
Establish a document management system so that project files can be submitted and archived electronically by employees, consultants, and contractors.				Initial startup costs; saves costs by reducing the demand for paper.	Reduces the use of paper.	Establishes consistent document control protocols, improves record keeping, access, and distribution.	No applicable Research Team Consideration.	2

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Recycled Content								
Establish project goals for recycled content materials and identify material suppliers that can achieve this goal. Consider the following major building components: aggregate in cast-in-place concrete; fly ash in cast-in-place concrete; 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 furnishes; equipment; sheet metal ductwork; and site lighting.	LEED®	MR Credit 4	ORD, SLC, U42, TVY	Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	May help improve the community's view of the airport if part of an outreach program.	2
Identify the value of both the post-consumer recycled content and the post-industrial content so that they can be compared with the total value of the materials in the project. Divide the weight of recycled content in the item by the total weight of all material in the item, and then multiply the resulting percentage by the total value of the item to determine the value of the recycled content portion of a material or furnishing. Mechanical and electrical components shall not be included in this calculation. Recycled content materials shall be defined in accordance with the Federal Trade Commission document, *Guides for the Use of Environmental Marketing Claims*, 16 CFR 260.7 (e), available at www.ftc.gov/bcp/gr0ule/guides980427.htm.	LEED®	MR Credit 4	ORD	Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	May help improve the community's view of the airport if part of an outreach program.	19

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Recycled Content								
To identify recycled content materials available and common percentages, include contact information in project specifications for reference and search tools such as the *Guide to Resource-Efficient Building Elements* from the Center for Resourceful Building Technology (www.crbt.org./index.html), the *Recycled Content Product Directory* from the applicable state integrated waste management board, and Oikos (www.oikos.com).	LEED®	MR Credit 4	LAX, ONT, VNY, PMD	Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	39
Use recycled crushed material from other local projects. For example, asphalt grindings and rail ballasts can be taken from nearby projects and used for haul roads or bituminous runway shoulders.	LEED®	MR Credit 4	ORD	Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	Supports local projects and improves community relations. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	19
Ensure that the specified recycled content materials are installed and quantify the total percentage of recycled content materials installed.	LEED®	MR Credit 4	ORD	Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	19
Provide fact sheets to designers that include available recycled content materials and the organization's target for each material.	LEED®	MR Credit 4	LAX, ONT, VNY, PMD	Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	39
Use the Waste Resource Action Programme's (WRAP) “Recycled Content Tool” to calculate the recycled content of a project and identify quick wins and benefits to maximize the recycled content of materials used with construction.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	20
Use recycled content material made from high-density polyethylene (HDPE) or comingled plastic for items such as trash receptacles, benches, tables, and bike racks.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Recycled Content								
Use recycled plastics for roadway markers, speed bumps, parking stops, and traffic signs.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
Use cold-rolled steel framing, as it typically contains 20-25 percent recycled material.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
Use hollow metal doors and frames from recycled metal content.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
Install gypsum wallboard; gypsum wallboard incorporates recycled scrap wallboard and byproduct gypsum. Synthetic gypsum content in drywall helps prevent against moisture.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
Use composite boards, including paper and wood/paper building boards that use milling byproducts, waste woods, recycled paper, and/or agricultural waste (wheat-straw board).	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
Use high-recycled-content cast iron for sanitary waste and vent piping.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
If using plastic electrical device wall plates, ensure that they are made of at least 20 percent recycled plastic.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Recycled Content								
Install terrazzo materials that contain recycled content.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
For asphalt pavements, use recycled materials, such as rubber, glass, asphalt roofing shingles, and blast furnace slag; this pavement can be used for access roads and non-FAA regulated pavements.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	May help improve the community's view of the airport if part of an outreach program.	7
Use recycled rubber and plastic materials for temporary barriers and A-frame barricades.	LEED®	MR Credit 4		Potential cost savings.	Helps conserve natural resources.	Establish specifications in product purchasing.	No applicable Research Team Consideration.	55
Install flooring from recycled and reusable materials, such as rubber, glass, agriculture fibers, and plastic, which can last longer and is easy to maintain.	LEED®	MR Credit 4		Materials from recycled and reused materials typically last longer, and are easier to maintain, than traditional flooring materials.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
Use geotextile products manufactured from recycled plastic or natural-fiber geotextiles.	LEED®	MR Credit 4		May have a higher upfront cost.	Helps conserve natural resources.	Establish specifications in product purchasing.	No applicable Research Team Consideration.	55
Use cellulose insulation made from 75-85 percent recycled newsprint.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Product availability may be limited.	No applicable Research Team Consideration.	55
Local/Regional Materials								
Use the following locally/regionally available materials: concrete, asphalt, structural steel, masonry, post-industrial recycled gypsum wallboard, storm system concrete pipes of all sizes, manholes and handholes, electrical duct banks, cable, gas and water piping, rail tracks, rail ties, rail ballast, landscape material, and seed.	LEED®	MR Credit 5	ORD	Regional building materials are more cost effective for projects because of reduced transportation costs.	Reduces the environmental impacts resulting from transportation.	For buildings, specify mechanical, electrical and plumbing equipment and components that meet the regional material goals. The availability of regionally manufactured materials is dependent on the project location.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	2, 18, 64

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Local/Regional Materials								
Establish a goal for the minimum percentage of local/regional materials and products that are manufactured within a radius of 500 miles. Identify the value of local/regional materials so that they can be compared with the total value of the materials in the task/project. (Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen.)	LEED®	MR Credit 5	ORD	Regional building materials are more cost effective for projects due to reduced transportation costs. Consider early in the design process, if possible, since research may be required to determine what products can be sourced locally and be realistically expected to be purchased for the project.	Reduces the environmental impacts resulting from transportation. It is also important to discuss the source of raw materials used to manufacture building products.	Identify and specify materials and material suppliers that can achieve the regional materials goal.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	19, 64
During construction, ensure that the specified local materials are installed and quantify the percentage of the local materials installed based on a percentage of overall construction cost.	LEED®	MR Credit 5	ORD	Regional building materials are more cost effective for projects because of reduced transportation costs.	Reduces the environmental impacts resulting from transportation. May require hiring a LEED® AP or other professional to monitor compliance.	May require a tracking system and personnel to monitor compliance.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	19, 64
Engage the FAA in discussing the use of regional or local suppliers as part of projects that use FAA funding and adhere to FAA rules.			LAX, ONT, VNY, PMD	Regional building materials are more cost effective for projects because of reduced transportation costs. Consider early in the design process, if possible, since research may be required to determine what products can be sourced locally and be realistically expected to be purchased for the project.	Reduces the environmental impacts resulting from transportation.	No applicable Research Team Consideration.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	39
Allow contractors to suggest availability of local materials - keep lines of communication open.	LEED®	MR Credit 5		Regional building materials are more cost effective for projects because of reduced transportation costs. Consider early in the design process, if possible, since research may be required to determine what products can be sourced locally and be realistically expected to be purchased for the project.	Reduces the environmental impacts resulting from transportation.	Consider establishing and promoting a website where contractors can indicate the availability of regional materials.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	56

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Rapidly Renewable Materials								
Use the following rapidly renewable materials for both permanent and temporary construction materials: poplar OSB and straw board or "agriboard" (formwork for temporary construction and underlayment); bamboo flooring; cork; wool carpets and fabrics; cotton-batting insulation; linoleum flooring; sunflower seed board; wheat grass or straw board cabinetry; and others.	LEED®	MR Credit 6		As rapidly renewable materials may be harvested more quickly, they tend to result in a faster payback on investment for manufacturers. As demand increases, they are expected to become cost-competitive with conventional materials.	Rapidly renewable materials are made from plants and typically harvested within a 10-year cycle. Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	No applicable Research Team Consideration.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	2, 64
Establish an appropriate project goal for use of renewable materials.	LEED®	MR Credit 6	LAX, ONT, VNY, PMD	As rapidly renewable materials may be harvested more quickly, they tend to result in a faster payback on investment for manufacturers. As demand increases, they are expected to become cost-competitive with conventional materials.	Rapidly renewable materials are made from plants and typically harvested within a 10-year cycle. Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	Percent of rapidly renewable materials equals the total cost of rapidly renewable materials divided by the total materials cost.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	39, 64
Ensure that the specified rapidly renewable materials are installed.	LEED®	MR Credit 6	ORD	As rapidly renewable materials may be harvested more quickly, they tend to result in a faster payback on investment for manufacturers. As demand increases, they are expected to become cost-competitive with conventional materials.	Rapidly renewable materials are made from plants and typically harvested within a 10-year cycle. Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	May require a tracking system and personnel to monitor compliance.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	19, 64
Install clay roof tiles, which are made from abundant raw materials and carry effective heat gain characteristics (for cool climates).	LEED®	MR Credit 6		Reduces maintenance costs; clay roof tiles provide improved durability and an increased life cycle.	Requires less energy to produce and has a long life cycle. Production of clay has a low environmental impact; clay can be easily recycled. Reduces the use and depletion of finite raw materials. Building-integrated solar clay tiles are also available.	Clay roof tiles are fireproof.	May enhance architectural features.	55
Use paper joint tape to reinforce joints and corners in gypsum drywall interiors in lieu of fiberglass tape.	LEED®	MR Credit 6		May result in less cracking and thus fewer call backs, saving time and money.	A potential health hazard results from the dust produced during the removal of fiberglass casts.	Provides strength to joints between plasterboard sheets. Easier to remove than fiberglass tape.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Rapidly Renewable Materials								
Use paper-faced compressed straw panels as an alternative for interior wall partitions.	LEED®	MR Credit 6		Straw is relatively inexpensive since it is a waste product of grains. Avoids unpredictable lumber prices.	Straw mats are a rapidly renewable waste product of grains, such as harvested wheat, rice, barley, oats, and rye. Since straw is still burned in fields in some areas, air pollution associated with burning straw is avoided. While straw provides few nutrients to the soil, it does add organic matter and helps aerate the soil.	Straw densely packed into bales is fire resistant since the tight packing keeps the available oxygen needed for combustion limited and the high silica content in straw is said to impede fire.	May reduce the risk of accidents that can occur when shifting winds blow smoke over highways and ignite straw left in fields.	26, 55
Install carpets made with bio-based materials, such as cotton, jute, sisal, hemp, wool, and polylactic acid (PLA) fiber.	LEED®	MR Credit 6		Carpet made of wool is usually more expensive (although inherently flame resistant).	Reduces the use and depletion of finite raw materials and long-cycle renewable materials. Improves indoor air quality.	No applicable Research Team Consideration.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	43
Use natural cork, strawboard, and recycled-content fiber board in flooring underlayment applications.	LEED®	MR Credit 6		As demand increases, they are expected to become cost-competitive with conventional materials.	Synthetic carpet fiber, backing, pad, adhesive, seam sealants, and floor preparation chemicals are all potential sources of VOCs in indoor air. These natural materials do not emit harmful chemicals.	Cork floor tile should be composed of 100 percent natural cork bark and recycled cork granules and set in a natural or synthetic flexible resin matrix; it should be homogeneous and uniform in composition throughout the tile thickness.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	55
Use a carbon-negative, hemp-based building material from renewable sources that is several times stronger than concrete. The material can be used as a substitute for concrete for the creation of buildings, insulating walls, and insulation layers for floors and roofs.	LEED®	MR Credit 6	LAX, ONT, VNY, PMD	Produced mainly from renewable sources, hemp-based building materials are mixed on site and deliver high levels of insulation, air-tightness, and vapor permeability. The product can have a lifespan of approximately 100 years.	More carbon is absorbed through growing the hemp than creating the building material, which helps reverse the damaging effects of greenhouse gases. Hemp-based building materials can lock up approximately 110 kilograms of carbon dioxide per cubic meter of wall.	Weighs less than concrete and is less prone to cracking. May be used to create insulating walls and insulation layers for floors and roofs. Can be used to provide buildings with beneficial thermal and acoustic properties.	Creates a healthy living and work environment.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Pavements and Building Structures								
Use Portland cement concrete with 25 percent fly ash (can be substituted for up to 60 percent of cement in a concrete mix) that has less embodied energy and reduces water permeability.	LEED®	MR Credit 4		May reduce material costs.	Fly ash is a byproduct of coal-fired power plants; it contains some radioactivity otherwise disposed in landfills.	Coal fly ash blended cements may range from 0 percent - 40 percent coal fly ash by weight, according to ASTM C 595, for cement Types IP and I(PM). 15 percent is a more accepted rate when coal fly ash is used as a partial cement replacement. May enhance concrete capabilities. Availability is variable. Establish specifications for use/ composition.	May help improve the community's view of the airport if part of an outreach program.	43, 55
Use ground granulated blast furnace (GGBF) slag to replace up to 70 percent of the Portland cement in concrete mixtures. Most GGBF slag concrete mixtures contain between 25 and 50 percent GGBF slag by weight, providing protection against sulphate attack and chloride attack.	LEED®	MR Credit 4		GGBF slag cement is typically less expensive than Portland cement. GGBF slag has replaced sulfate-resisting Portland cement on the market for sulfate resistance because of its superior performance and greatly reduced cost.	Useful application of a waste product.	Must be in compliance with ASTM C989, Grade 100 or Grade 120. Availability is variable. Establish specifications for use/composition. Improves durability, reducing maintenance costs and the need for repairs that may delay operations.	May help improve the community's view of the airport if part of an outreach program.	43, 55
Use silica fume as a replacement for 5 to 7 percent of Portland cement to improve compressive strength, bond strength, and abrasion resistance; reduce permeability; and protect from corrosion.	LEED®	MR Credit 4		May reduce material costs. Extends the life cycle of cement, reducing the frequency of repairs and replacement.	Silica fume is very fine pozzolanic material produced by electric arc furnaces as a byproduct of the production of elemental silicon or ferro-silicon alloys.	Reduces the need for maintenance, thereby reducing operational delays. Replacement levels higher than 10 percent can lead to workability issues. Availability is variable. Establish specifications for use/composition.	Prevents silica fume from being discharged into the atmosphere.	43
Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement. Hardened, cured waste concrete may be used as aggregate in concrete mix (if approved by the engineer).	LEED®	MR Credit 4		May reduce material costs. May reduce disposal costs for waste, as in many urban areas, concrete can no longer be accepted in landfills.	In many urban areas, concrete can no longer be accepted in landfills.	Concrete admixtures are now available that retard the setting of concrete so effectively that a partial load can be brought back to the ready mix plant for 1 or 2 days then reactivated for use. Establish specifications for use/composition.	Reduced off-site hauling could reduce traffic in the surrounding community.	43

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Pavements and Building Structures								
Use scrap tires as an alternative fuel source (tire-derived fuel, or TDF) in cement production kilns or purchase concrete from kilns that use recycled tires.				Tires contain 1.25 times the energy content of coal, so the savings on energy costs can be significant. The cement industry is the largest end-user of TDF. Tires have consistent and predictable properties, so TDF performance in the kiln is well understood.	Tires contain less nitrogen than coal; the higher the nitrogen level at which tires are substituted for coal, the greater the reduction of nitrogen oxides. Emissions demonstrate a consistent reduction in sulfur and other emissions with the use of TDF.	The use of TDF is typically limited because tires also contain zinc, which slows the setting time for concrete. Availability is variable.	The use of tires as a source of energy may not be well received because of concern over potential emissions; the loss of a resource used as fuel diverts tires from higher value-added markets. In reality, the addition of TDF typically has a neutral to positive effect on air emissions.	5, 11
Use the asphalt, aggregate, fibers, and limestone filler from recycled roof shingles in hot-mix or warm-mix asphalt.				Asphalt mixes with recycled roof shingles may be more resistant to thermal cracking (undergoing further testing), reducing maintenance costs.	Reduces the demand on virgin materials. Reduces landfill-bound waste.	Must abide by NESHAP 40 CFR Part 61, Subpart M (must be asbestos free, cannot include nails or deletious material; must follow grind size and moisture content specifications). Samples should be proportioned and pre-blended prior to heating.	May help improve the community's view of the airport if part of an outreach program. Reduces landfill-bound waste in the local community, especially after large storm events.	68
Use carbon fiber reinforcement instead of rebar or steel mesh (these products corrode and are one of the weakest parts of the concrete structure).				Reduce cracking and extend life in concrete, reducing maintenance costs.	The product is lightweight and corrosion resistant, making it stronger and easier to use than steel, producing lighter weight components, product developers contend.	Establish specifications for use. Extends the structure's life cycle, reducing the frequency of building repairs.	No applicable Research Team Consideration.	40
Use rubberized pavements or innovative pavement treatments to improve durability and reduce maintenance.			LAX, ONT, VNY, PMD	Reduces maintenance costs and replacement costs by extending the pavement's life cycle. May reduce the need for expensive noise barriers.	Can reduce road noise by as much as 15 dB. Makes use of recycled tires.	Extends pavement life cycle, reducing the frequency of rehabilitation and maintenance.	Reduces noise in nearby communities.	7, 39
Use rubber modified asphalt (RMA) with crumb rubber content no greater than 20 percent.				RMA, specifically when used in stress absorbing membranes or stress absorbing membrane interlayers, reduces the occurrence of reflective cracking because of its elastic properties, thereby reducing maintenance costs.	Decreases noise levels (up to 5 dB). Depending on the application selected, between 500 and 2,000 scrap tires can be used in each lane mile of pavement.	Improves skid resistance.	Reduces noise in nearby communities.	8, 55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Pavements and Building Structures								
Use warm-mix asphalt to reduce energy needs during construction.			BOS, ORD	Uses 20 percent less energy to make, reducing production costs.	The asphalt is heated 75-50°F less than traditional 'hot-mix' asphalt, reducing GHG emissions onsite and at the production plant. Produces 20 percent fewer greenhouse gas emissions than traditional asphalt.	Some sources claim warm-mix asphalt compacts better, allowing for sturdier runways. Requires FAA coordination/approval.	Because warm-mix asphalt is not heated as high, the work environment is healthier for the crews installing the pavement.	19, 32
Install light colored/high albedo pavement for roadways (i.e., Portland cement), parking lots, sidewalks, and plaza areas.	LEED®	SS Credit 7.1	LAX, ONT, VNY, PMD	Absorbs less heat, which may aid in energy savings. Reduces costs associated with HVAC equipment.	Reduces heat islands, minimizing impacts on the microclimate and human and wildlife habitat.	Improves roadway visibility, thereby improving safety.	Reduces heat islands in the local community, reducing temperature compared to absorptive pavements.	39
Use asphalt pavements for access roads and non-FAA-regulated pavements.				Asphalt typically requires about 20 percent less energy to produce and construct than other pavements, consuming less fuel.	The production and installation of asphalt produces lower levels of greenhouse gases than other pavements. Dark-colored pavement may increase the heat island effect. Consider shading and/or open-grid systems where possible.	Asphalt pavement is generally faster to construct and rehabilitate, opening to traffic as soon as it has been compacted and cooled.	Consider the amount of absorptive pavements in the local community to ensure that heat islands would not be an issue of concern.	7
Provide shade for new pavement from the existing tree canopy or within 5 years of landscape installation. Landscaping (trees) should be in place at the time of occupancy.	LEED®	SS Credit 7.1		Reduces costs associated with HVAC equipment and may extend the life cycle of the covered pavement.	Reduces stormwater runoff and heat islands, minimizing impacts on the microclimate and human and wildlife habitat.	May reduce glare, enhancing safety in parking lots and roadways.	Vegetated areas provide aesthetic benefits.	64
Place a minimum of 50 percent of newly constructed parking spaces under cover. Any roof used to shade or cover parking must have an SRI value of ≥29 or be a vegetated green roof.	LEED®	SS Credit 7.1		Green roofs require lower maintenance than standard roofs (if native species are planted), but typically require additional upfront investment.	Reduces heat islands, minimizing impacts on the microclimate and human and wildlife habitat. Green roofs reduce stormwater runoff.	May reduce glare, enhancing safety in parking lots and roadways.	Vegetated roofs provide aesthetic benefits.	64

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Pavements and Building Structures								
Install permeable pavement (pavers or pervious concrete) for roadways, shoulders, non-traffic pavements, maintenance roads, utility yards, and airside and landside parking facilities, where possible.	LEED®	SS Credit 6.1	ORD, LAX, ONT, VNY, PMD	The cost of permeable pavement may be similar to (or potentially higher than) the cost of traditional pavement materials. However, the use of permeable paving can reduce the cost of providing larger or more stormwater BMPs onsite.	Porous pavement can be used to turn runoff into infiltration, restore the hydrology of a site, improve water quality, replenish aquifers, protect streams, reduce heat islands, and clean stormwater. It should be avoided where activities generate contaminated runoff, and in areas that have low soil permeability, seasonal high groundwater tables, and those close to drinking water supply wells.	May melt together in extreme heat, filling the "permeable" voids. Sand applied to the pavement will clog the surface. Chlorides from road salt may migrate into groundwater. Plowing may be challenging because the edge of the snow plow blade can catch the edge of the blocks, damaging the surface. Infiltrating runoff below pavement may cause frost heave, although design modifications can reduce this risk. Snow melts faster on a porous surface because of rapid drainage below the snow surface.	Improves water quality and reduces flooding in the local community.	7, 18, 50, 61
Use granite aggregate as a sub-base for runways.			MSP	Granite aggregates have an expected lifetime of 40-50 years, reducing maintenance costs and the frequency of restructuring/repaving.	Provides self-draining properties. An extended lifespan reduces the demand for new materials, thereby reducing emissions from production and transportation.	Extended lifespan reduces the need for runway restructuring, thereby reducing operational delays.	No applicable Research Team Consideration.	30
Extend the base course width of a pavement by 1-2 feet beyond the top pavement to prevent premature distress.				Edges experience the greatest stress (largely from moisture changes), so extending the base course will result in the top pavement layer having an extended life cycle, thereby reducing maintenance costs and the frequency of restructuring/repaving.	Reduces the demand for new materials, thereby minimizing emissions from production and transportation.	Extended lifespan reduces the need for pavement restructuring, thereby reducing operational delays.	No applicable Research Team Consideration.	29
To prevent premature distress of pavement, use a non-fossil fuel based/nonvolatile environmentally friendly prime coat to waterproof asphalt instead of a diesel-based prime coat.				Prevents premature distress of pavement, thereby reducing maintenance costs and the frequency of restructuring/repaving.	Reduces the quantity of air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers. VOCs also contribute to smog generation and outdoor air pollution.	Extended lifespan reduces the need for pavement restructuring, thereby reducing operational delays.	No applicable Research Team Consideration.	29

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Pavements and Building Structures								
During a pavement course, cut off the last foot of existing pavement and begin the next course from that spot to ensure good joint density. The last foot removed has a lower density than the rest of the course (it is weaker and leads to cracking and distress).				Prevents premature distress of pavement, thereby reducing maintenance costs and the frequency of restructuring/repaving.	Reduces the demand for new materials, thereby minimizing emissions from production and transportation.	Extended lifespan reduces the need for pavement restructuring, thereby reducing operational delays.	No applicable Research Team Consideration.	29
Use chip seals instead of slurry seals to stop pavement cracking and prevent future cracking. Once chip seals are used, then micro surfacing can be applied.				Life cycle (4 to 6 years) and cost (per square yard) are the same as for a slurry seal. Equipment to apply a slurry seal is not as common as the equipment for a chip-seal application.	An extended pavement life cycle reduces the demand for new materials, minimizing emissions from production and transportation.	Provides increased skid resistance, an anti-glare surface during wet weather, and an increased reflective surface for night driving. The incidence of cracked windshields can be reduced by using volcanic cinders or manufactured lightweight aggregate.	No applicable Research Team Consideration.	29
Use precast high performance concrete for buildings.				Prefabrication may reduce product and transportation costs.	Focuses environmental controls at production facility.	Establish specifications for use.	No applicable Research Team Consideration.	40
Use "Roman concrete" instead of traditional concrete to extend the durability of a structure. Roman concrete consists of volcanic ash or 'pozzolan' (silica and small amounts of alumina and iron oxide) instead of sand and is mixed at a ratio of two parts pozzolan to one part lime.				Prevents premature distress and extends life cycle, reducing maintenance costs and the frequency of restructuring/repaving.	Prior to purchasing, consider the emissions associated with hauling the Roman concrete components long distances.	Extended lifespan reduces the need for rebuilding or restructuring, reducing operational delays.	No applicable Research Team Consideration.	21
Use recycled newspaper or waste agriculture materials in expansion joint fillers to keep them dry and clean.				Less expensive than conventional fillers. Since rapidly renewable materials may be harvested more quickly, they tend to result in a faster payback on investment for manufacturers.	Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	No applicable Research Team Consideration.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	55
For structural steel, consider metal finishing based on physical processes such as abrasive blasting, grinding, buffing, and polishing, rather than multiple coatings.				No applicable Research Team Consideration.	Avoid plated metals that use cadmium or chromium plating materials and cyanide or formaldehyde copper plating solutions.	No applicable Research Team Consideration.	Protects the health of installers and occupants.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Pavements and Building Structures								
Use fiber cement siding as a replacement for wood or typical exterior wall cladding. Fiber-cement siding is composed of cement, sand, and cellulose fiber that has been autoclaved (cured with pressurized steam) to increase its strength and dimensional stability. The fiber is added as reinforcement to prevent cracking.				Looks like wood while achieving higher durability and lower maintenance costs. The installed costs are typically less than for traditional masonry or synthetic stucco, equal to or less than hardboard siding, and more than vinyl siding.	Termite-resistant, water-resistant, non-combustible, and warranted to last 50 years.	Appropriate for hot and humid climates because fiber-cement siding is resistant to rot, fungus, and termite infestation. Manufacturers state that it has excellent weathering characteristics, strength, and impact resistance. Unless top coat is applied in the factory, siding may need to be painted every 4-5 years.	No applicable Research Team Consideration.	5, 42
Use large panel formwork systems to reduce concrete waste generated by losses caused by damaged formwork, which usually accounts for 30 percent of the total concrete waste.				May increase material costs; however, may reduce transportation of materials, thereby reducing transportation and waste disposal costs.	Uses fewer raw materials; reduces material waste, transportation impacts, and landfill impacts; and improves air quality by reducing negative impacts related to concrete processing.	Enables just-in-time construction techniques.	Reduces the impact of delivery vehicles on local streets.	55
Use biodegradable form releasing agents.				No applicable Research Team Consideration.	Conventional form-release oils can be a major source of volatile organic compounds (VOCs), soil contamination, and human health risks. Biodegradable nonpetroleum alternatives contain a fraction of the federally permitted VOC limit for concrete form-release agents.	May minimize exposure of workers to hazardous pollutants.	Protects the health of installers and occupants.	55
Roofing Materials								
Install high reflectance/high albedo roofing materials with a high solar reflectance index (SRI), as described in the ASTM E 1980 standard. Low-sloped roofs (slope <= 2:12) should have an SRI value of 78 or above; steep-sloped roofs (slope > 2:12) should have an SRI value greater than 29.	LEED®	SS Credit 7.2		Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing because of high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing impacts on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	64

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Roofing Materials								
Install a vegetated green roof system for at least 50 percent of the roof area to reduce the heat island effect.	LEED®	SS Credit 7.2	ORD	Provide energy saving insulation benefits and require lower maintenance than standard roofs (if native species are planted). Green roofs typically require an additional up-front investment.	Reduces stormwater runoff - typically only 25 percent of rainfall on a green roof becomes runoff. Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat. "Extensive" green roof systems with 1 to 5 inches of topsoil can be installed that improve filtration and treatment of rainwater.	No applicable Research Team Consideration.	Provide aesthetic benefits and reduce heat islands.	19
Use a combination of vegetated and high albedo surfaces.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Provides energy saving insulation benefits and requires lower maintenance than standard roofs (if native species are planted). Green roofs typically require an additional up-front investment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing because of high emittance and low absorption, which may increase heating costs.	Reduces stormwater runoff and heat islands, minimizing impacts on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Provides aesthetic benefits and reduce heat islands.	39
Install a Cool Roof Rating Council (CRRC) rated roof product or an Energy Star cool roof with equivalent reluctance and emittance properties (www.coolroofs.org).	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing because of high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing impacts on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Roofing Materials								
Use a single ply roofing membrane with high emittance properties.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing because of high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing impacts on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39
Apply high reflectance coating to the surface of a conventional roof membrane.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing because of high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing impacts on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39
Use metal roofs with industrial grade coating that are high reflectance and high emittance.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing because of high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing impacts on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39
For roofing shingles, use recycled steel/aluminum, photovoltaic roofing technologies, plastic shingles, natural slate shingles, certified wood shingles, and/or clay roof tiles to reduce the heat-island effect.	LEED®	SS Credit 7.2		Potential material cost savings; longer-term operational benefits.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat.	Consider the regional climate (e.g., exposure to storms, tornados, hail, the solar resource potential, etc.).	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	55
Use roofing membranes containing thermoplastic olefins (TPO) in lieu of PVCs.	LEED®	MR Credit 6		Higher cost compared to PVC.	A properly formulated membrane sheet will not pose environmental hazards and is well suited for landfill disposal, recycling, or incineration. There are no environmental concerns with the base polymers and all of the raw materials and base additives are nonhazardous.	Nonhalogenated materials, such as mineral hydrate, can be applied as flame-retardants. The following alternatives to PVC can also be used for roofing membranes: ethylene propylene diene monomer, nitrile butadiene polymer, and low-slope metal roofing.	PVC poses a risk in building fires since it releases deadly gases long before it ignites. PVC is manufactured near low-income communities in Texas and Louisiana. The toxic impact of pollution from the PVC factories on the nearby communities has made them a focus in the environmental justice movement.	55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Foundations								
Add polyethylene vapor retardant under the floor slab and avoid a layer of sand between the polyethylene and the concrete to reduce the occurrence of mold.				Increases floor life cycle, thereby reducing maintenance costs and the frequency of replacement.	Reduces indoor air quality hazards associated with mold, thereby improving employee health.	May help extend the life cycle of the floor slab, reducing building maintenance.	No applicable Research Team Consideration.	55
Install a layer of gas-permeable material under the foundation, e.g., 4 inches of gravel, covered by plastic sheeting.				Reduces ground source moisture and energy use, thereby saving costs. It is more cost-effective to include radon-resistant techniques while building a structure rather than installing a radon reduction system in an existing building.	Creates a physical barrier to radon entry, thereby reducing the risk of lung cancer in occupants.	May require hiring staff experienced in radon minimization.	No applicable Research Team Consideration.	47
Seal and caulk all openings in the concrete foundation floor and install a gas-tight 3" or 4" vent pipe that runs from under the foundation through the building to the roof.				Reduces ground source moisture and energy use, thereby saving costs. It is more cost-effective to include radon-resistant techniques while building a structure rather than installing a radon reduction system in an existing building.	Creates a physical barrier to radon entry and a pathway for the radon to be redirected outside, thereby reducing the risk of lung cancer in occupants.	May require hiring staff experienced in radon minimization.	No applicable Research Team Consideration.	47
Provide capillary break (damp-proofing) between the footing and foundation wall or perimeter foundation for slab-on-grade.				A non-insulated foundation can result in significant heat loss from an otherwise tightly sealed, well-insulated building. Less expensive to install than exterior insulation for existing buildings.	Reduces the demand for HVAC operation, thereby reducing emissions.	May help extend the life cycle of the floor slab, reducing building maintenance.	Improves air quality in the local community.	55
Install drainage tile at foundation footings.				Reduces ground source moisture and energy use, thereby saving costs. Less expensive to install than exterior insulation for existing buildings.	Reduces the presence of mold, thereby improving indoor air quality. Reduces the demand for HVAC operation, thereby reducing emissions.	May help extend the life cycle of the floor slab, reducing building maintenance.	No applicable Research Team Consideration.	55
Use foundation anchor systems that do not require excavation.				No applicable Research Team Consideration.	Limits excavation and soil/material disposal or storage.	Establish specifications for use.	Avoids construction noise and air pollution associated with excavation.	55
Building Interiors								
Install carpet tiles from post industrial nylon that are reusable and recyclable.	LEED®	MR Credit 4		Potential cost savings.	Reduces land fill use, conserves use of natural resources.	Specifications may need to be established in project standards and procedures to use on a project.	No applicable Research Team Consideration.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Building Interiors								
Use ceramic tile containing post-consumer or post-industrial waste.	LEED®	MR Credit 4		Potential cost savings.	Reduces land fill use, conserves use of natural resources.	Specifications may need to be established in project standards and procedures to use on a project.	No applicable Research Team Consideration.	55
Use structural insulated panels (SIPs) consisting of oriented-strand board (OSB) for floors, walls, and/or roofs.				Provides a tighter building envelope with higher insulating properties, thereby decreasing operating costs. Due to the standardized and 'all-in-one' nature of SIPs, construction time can be reduced and may require fewer trades for system integration.	Helps conserve natural resources.	SIPs consist of a sandwich of two layers of structural board with an insulating layer of foam in between. The board can be sheet metal or OSB and the foam either expanded polystyrene, extruded polystyrene, or polyurethane.	No applicable Research Team Consideration.	55
Do not use particleboard or medium-density fiberboard that contains urea formaldehyde.				No applicable Research Team Consideration.	Reduces long-term exposure in completed structure.	No applicable Research Team Consideration.	Protects the health of installers and occupants.	13
Use concrete pigments to turn plain concrete slabs into finished floors, eliminating the need for conventional finish flooring.				Uses less material to turn concrete into finished surfaces, thereby reducing costs.	Avoids the need for additional products and coatings, eliminating the environmental impacts associated with manufacturing and maintaining those materials.	No applicable Research Team Consideration.	Enhances aesthetics; avoids traffic resulting from the transportation of finish flooring.	5
Install moisture-resistant greenboard and mold-resistant purpleboard drywall.			ORD	Higher cost than traditional drywall because of their advanced properties.	Greenboard has the same gypsum core as the other varieties, but is covered in a thicker, more water-resistant paper than standard drywall. The paper is coated with wax to help control moisture absorption.	Although greenboard drywall's paper covering is water-resistant, it is not waterproof. The brittle gypsum core is not suitable for wet applications or for floors or ceilings. It is installed in the same manner as standard wallpaper.	No applicable Research Team Consideration.	18
Use drywall clips instead of traditional metal or wood blocking to install drywall. These clips create a single or double-stud corner, versus the three or four-stud corners that the blocking provided.				May reduce the wood used for framing by eliminating the need for nonstructural studs, and can be easier to install than extra wood backing. Reduce heat loss by allowing insulation behind the studding without the risk of non-insulated cavities.	With the use of drywall clips, the drywall is separated from the framing pieces, which helps minimize sound transmission through the walls. For further sound transmission control, specialized sound isolation drywall clips can be used, which are attached to the studs then nailed to the drywall.	Provides sufficient support and backing that is comparable to and sometimes better than the traditional three- or four-stud corners.	No applicable Research Team Consideration.	5

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Building Interiors								
Prior to purchasing insulation products, ensure that they were not manufactured using chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) refrigerants.	LEED®	EA Credit 4		No applicable Research Team Consideration.	CFC and HCFC deplete the ozone layer, allowing harmful ultraviolet radiation to penetrate through to the Earth's surface.	Establish product specifications.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	55
Require or recommend sleeves/ sealants that ensure low transfer rates of radon.				No applicable Research Team Consideration.	Longer-term environmental considerations.	Specifications may need to be established in project standards and procedures.	Reduces exposure of workers and building occupants to radon.	55
Use biodegradable hydraulic elevator oils.				Higher cost than mineral oils; however, reduces liability and costs for oil cleanup from spills and leaks.	Reduces environmental issues caused by spills and leaks.	No applicable Research Team Consideration.	Can be domestically produced.	55
Provide incentives for reduced PVC use in site conduit applications and require all PVC used underground to be encased in concrete. Alternatives for piping include cast iron, steel, concrete, vitrified clay, and copper. Siding alternatives include fiber-cement board; stucco; recycled, reclaimed, or Forest Stewardship Council (FSC) certified sustainably harvested wood, OSB, brick, and polypropylene.				PVC conduit is usually lower in cost than other forms of conduit.	PVC poses major hazards in its manufacture, product life, and disposal. Toxic manufacturing byproducts include dioxin, ethylene dichloride, and vinyl chloride, which can cause cancer, endocrine disruption, neurological damage, birth defects and impaired child development, and other hazardous health effects. The additives required to manufacture PVC make large scale post consumer recycling problematic for most products and interfere with the recycling of other plastics.	Alternatives: Flooring and carpet: linoleum, bamboo, ceramic tile, carpeting with natural fiber backing or polyolefins, reclaimed or FSC wood, cork, rubber, concrete, and non-chlorinated plastic polymers. Wall coverings and furniture: natural fibers such as wood and wool, polyethylene, polyester, and paint. Electrical insulation and sheathing: halogen free, linear low-density polyethylene, and thermoset crosslinked polyethylene. Windows and doors: recycled, reclaimed, or FSC wood, fiberglass, and aluminum.	PVC poses a risk in building fires since it releases deadly gases long before it ignites. PVC is manufactured near low-income communities in Texas and Louisiana. The toxic impact of pollution from the PVC factories on the nearby communities has made them a focus in the environmental justice movement.	33, 55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Building Interiors								
Use vitrified clay pipes (VCP) for drain piping in lieu of more expensive cast iron pipes.				VCPs have a lifespan of 80 to 100 years because they are resistant to corrosion and chemical attack, abrasion, temperature, and impermeability, providing life cycle cost benefits.	The raw materials for manufacturing VCPs are clay and recycled materials from the ceramic industry. The environmental impact of manufacturing VCPs is relatively small compared with most other types of sewer materials.	Benefits include impermeability, hardness, and mechanical strength. Commonly used in sewer gravity collection mains because of its resistance to domestic and industrial sewage, particularly sulfuric acid. Only hydrofluoric acid and highly concentrated caustic wastes are known to attack VCP; wastes are not permitted to be discharged into a municipal sewage collection system without adequate pretreatment.	No applicable Research Team Consideration.	12, 55
Do not use fiberglass insulation or duct liners that contain phenol formaldehyde binders. As a substitute, use loose fill or blown fiberglass insulation that requires no formaldehyde binder. Fiberglass insulation produced with acrylic binder or nonfiberglass battings made of cotton, sheep's wool, or mineral (rock or slag) wool can also be used.				All of the alternative batting insulation products are made almost entirely from recycled or renewable materials. They offer similar thermal performance as fiberglass but at a slight cost premium.	The extended use of fiberglass duct liners may result in microbial growth. A phenol-formaldehyde binder can off-gas and be a moderate indoor air quality concern. Most fiberglass insulation has at least 30 percent recycled glass content, but is made of boron, a finite recourse.	Nonfiberglass batting offers similar thermal performance as fiberglass.	Reduces exposure of workers and building occupants to formaldehyde.	55
Use a pressurized aerosol duct sealing for internally sealing existing heating and cooling HVAC ducts.	LEED®	EA Credit 1		Lawrence Berkeley National Laboratory testing demonstrated that aerosol sealing can reduce leakage by a factor of 5 to 8, saving an estimated $300 per year on the heating and cooling costs of a typical home. Aerosol duct sealing is easy to use compared with traditional methods, such as applying mastic, because it eliminates the need to open wall, floor, and ceiling cavities to access hard-to-reach leaks.	An insignificant amount of adhesive particles are deposited on interior duct walls, and they have no harmful effect on the IAQ of a building.	Before aerosol sealing, test ducts to determine the leakage volume. Aerosol sealing is not recommended for gaps larger than 0.25-inch.	No applicable Research Team Consideration.	42

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Building Interiors								
Use duct mastics (gooey sealants that are painted on and allowed to harden) in lieu of duct tapes to minimize leakage effects.				Duct mastics provide improved sealing over duct tapes, reducing energy costs. Maintenance costs may decrease due to less frequent application of duct tape.	Improved sealing results in improved energy efficiency and lower heating/cooling demand, reducing emissions caused by HVAC operation.	Duct tape does not adequately seal HVAC joints and has a short lifespan.	No applicable Research Team Consideration.	55
Electrical Materials								
Use and install compact fluorescent lighting (CFL).	LEED®	EA Credit 1		Consumes as little as one-fifth the power and lasts up to 13 times longer than incandescent fixtures.	Reduces carbon monoxide emissions and emissions from the production and materials use due to the extended lifespan of CFL.	Produces about 90 percent less heat than incandescent bulbs while delivering more light per watt.	Reduces energy demand and improves air quality in the local community.	55
Use and install slim-profile lighting systems.	LEED®	EA Credit 1		Can save energy costs because of better lumen output and a thinner lamp.	Reduces emissions from energy use; consider slim profile solar lights to enable remote use and/or to provide safety lighting.	Provides a highly concentrated light source that can enhance the performance of the luminaries.	Reduces energy demand and improves air quality in the local community.	55
Minimize the use of lit signage outdoors and maximize the use of photovoltaic panels for construction and warning signage where applicable.	LEED®	EA Credit 1		Reduces energy costs.	Reduces emissions from energy use.	Photovoltaic panels can be placed in remote locations and do not require connection to a grid.	Reduces energy demand; photovoltaic signage provides visible evidence of the airport's commitment to sustainability.	55
Use and install LED lights.	LEED®	EA Credit 1		Consumes less energy than incandescent lights and often results in recovering the additional first cost within one year through energy savings; requires less maintenance and provides improved performance. All LED products should have a warranty of at least 5 years with a recycling program provided by the manufacturer.	More energy efficient and longer lasting than incandescent lights, reducing emissions from power generation and production.	Provide improved robustness, smaller size, faster switching, and greater durability and reliability. May require more precise current and heat management than traditional light sources. Solar-powered LED lights offer additional advantages, including application in remote location without grid access or as an emergency-response application.	Reduces energy demand in the local community.	13, 55
Install photoluminescent signage for safety pathway markings, exit signs, and egress signage.	LEED®	EA Credit 1		Requires no backup power supply, no conduit, no battery, and is easy to install. An electrician is needed to install light fixtures near the signs to meet manufacturer specifications and code requirements.	The signs themselves do not draw any power; thus, their use does not generate emissions.	Absorbs energy provided by visible and near-visible light and then releases that energy as light at a later time. Must be exposed to ambient light of a minimum intensity and type for a set period of time to absorb enough energy to emit useful light.	The signage may not be properly charged and functional if an emergency occurs immediately after occupants enter a building.	55

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Electrical Materials								
Use bio-based transformer fluids.				Bio-based oil can extend the service life of a transformer by enhancing its insulating life and performance.	Reduces waste generation by prolonging the life of old, installed transformers (retrofitted with bio-based fluids). Reduces accidental contamination in the event of a leakage by using fluid that can degrade faster than conventional dielectric coolant.	These fluids may improve equipment efficiency. Bio-based transformer fluids are not subject to federal regulation of used oils, but instead are covered by the Edible Oil Regulatory Reform Act.	The food-grade formula and higher flash point result in a less hazardous working environment, and improve worker health and safety. Reduces fire-safety hazards associated with mineral oil.	37
Require early installation of permanent electrical systems to minimize the number of temporary circuits needed for construction activities.				May reduce costs associated with the use (purchase or rent) of temporary circuits.	Reduces emissions from energy use.	May reduce safety hazards.	No applicable Research Team Consideration.	55
For electrical systems, use telecommunications cabling and electrical device wall plates that have a high percentage of recycled plastic.				Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Establish recycled content goals during the design phase.	No applicable Research Team Consideration.	55
Do not use halogen lights.			YYZ	Four halogen downlights are needed to provide the same effective general lighting levels as one 100 watt globe in the middle of a room. Additional energy is required as the use of a transformer usually located in the ceiling above each light fitting is required. The transformers can use an additional 10 percent to 30 percent of the bulb energy.	More than 90 percent of the energy that goes into common halogen lights turns into heat; as a result, the lights use more electricity than needed, making them very inefficient.	Halogen lights may pose a fire risk if not installed properly.	Reduces energy demand and improves air quality in the local community.	31, 59
Polymer Concrete Surface Systems								
Use enamel waterborne epoxy and chemical-resistant waterbase methane products for architectural surface coatings.				Polymer concrete surface systems protect against freeze-thaw cycles, chemical stains, and surface penetration; reduces associated maintenance and energy costs.	Polymer concrete surface systems reduce the heat island effect; they are about 20°F cooler than light-colored concrete (available in a variety of colors).	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive materials.	5

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Polymer Concrete Surface Systems								
Use 100 percent solid, two-component epoxy resin for crack repair.				Polymer concrete surface systems are a low-maintenance alternative to tile, hardwood, or carpet flooring and offer design flexibility. Also protects against freeze-thaw cycles, chemical stains, and surface penetration.	Polymer concrete surface systems reduce the heat island effect; they are about 20° cooler than light-colored concrete.	The epoxy resin is 5 times the strength of concrete.	Reduces the need for rehabilitation, minimizing construction noise and traffic.	5
Use precolored matrix mixes that require no liquid colorant additives.				Costs for most low-VOC products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	These precolored matrixes use dry pigments recovered from iron oxide runoff from coal mines, the largest single source of water pollution in the United States.	No applicable Research Team Consideration.	Protects water quality in the local community, especially near coal mines.	5
Use degreasers that are made of d-limonine, a terpene extracted from citrus peel oils.	LEED®	MR Credit 6		Cost competitive because these degreasers are an agricultural waste product.	Citrus peel oils are an agricultural waste product, as well as a rapidly renewable product.	No applicable Research Team Consideration.	Reduces agricultural waste in local communities.	5
Use an acrylic sealer to complete the third and final part of a polymer concrete surface system.				Polymer concrete surface systems are a low-maintenance alternative to tile, hardwood, or carpet flooring and offer design flexibility. Also protects against freeze-thaw cycles, chemical stains, and surface penetration.	Resistant to ultraviolet rays and abrasions; protects surfaces from moisture penetration, staining, dirt, dust, and wear.	Provides a non-porous surface finish that protects and enhances the finished application for both vertical and horizontal installations.	Provides a non-yellowing coating and may enhance color retention, maintaining aesthetics.	5

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Polymer Concrete Surface Systems								
Use an elastomeric acrylic caulk in concrete slab expansion joints and masonry perimeters, and for sealing around doors and windows.				Can be used to refurbish old or damaged floors. Polymer concrete surface systems are a low-maintenance alternative to tile, hardwood, or carpet flooring and offer design flexibility. Also protects against freeze-thaw cycles, chemical stains, and surface penetration.	The elastomer acrylic caulk should be composed primarily of natural ingredients, such as calcium carbonate, potassium, and sand.	Provides a surface that is easy to clean and maintain; dries quickly, reducing down time.	Provides a paintable surface to maintain aesthetics.	5
Low-Emitting Materials								
For adhesives and sealants, the VOC content used must be less than the current VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #1168, and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.	LEED®	IEQ Credit 4.1	ORD	Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19, 64
For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content calculated according to 40 CFR 59, Subpart D.	LEED®	IEQ Credit 4.1		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	13, 64

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Low-Emitting Materials								
Do not use adhesives or sealants that use mercury and/or persistent, bioaccumulative, and toxic pollutants.				Health concerns associated with exposure to mercury and PBT result in increased expenses and liability for building owners, operators, and insurance companies.	Mercury does not degrade in the environment. Human nervous systems are sensitive to all forms of Mercury. Methylmercury (caused by sulfate reducing bacteria) bioaccumulates in organisms as it moves through the food chain, adversely affecting humans, fish, and waterfowl.	Mercury negatively affects the nervous system of installers and building occupants.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	22
Use water-based adhesives and sealants that contain no VOCs on porous or nonporous surfaces.	LEED®	IEQ Credit 4.1		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	VOCs react with sunlight and nitrogen oxides in the atmosphere to form ground-level ozone, a chemical that has a detrimental effect on human health, agricultural crops, forests, and ecosystems.	No fire or explosion hazards. May require longer drying times. Use of high VOC-content materials can cause illness and may decrease occupant productivity.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	55
Seal interior concealed joints to reduce airborne sound transmission by using nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant with a VOC content of 250 grams per liter or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).	LEED®	IEQ Credit 4.1		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Obtain a recommendation in writing by the ornamental formed-metal manufacturer.	Reduces noise in the local community.	13

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Low-Emitting Materials								
Use nonsagging, paintable, nonstaining latex sealant complying with American Society for Testing and Materials (ASTM) C 834; of type and grade required to seal joints in ornamental formed metal.	LEED®	IEQ Credit 4.1		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces noise transmission through perimeter joints and openings. Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	No applicable Research Team Consideration.	13
Use aliphatic-resin, polyurethane, or resorcinol wood glue.	LEED®	IEQ Credit 4.1		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	No applicable Research Team Consideration.	13
Use zero- or low-VOC field-applied paints and coatings.	LEED®	IEQ Credit 4.2		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	2

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Sustainable Materials								
Low-Emitting Materials								
Follow standards and prohibitions documented in SCAQMD Rule 1113 (paints and coatings) and applicable source-specific SCAQMD standards.	LEED®	IEQ Credit 4.2	LAX, ONT, VNY, PMD	Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	39
For interior paints and coatings, VOC emissions must not exceed the VOC and chemical component limits of Green Seal's Standard GS-11 requirements.	LEED®	IEQ Credit 4.2	ORD	Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19
For field applications that are inside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to 40 CFR 59, Subpart D.	LEED®	IEQ Credit 4.2		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	13

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Low-Emitting Materials								
For carpet systems, VOC emissions must meet or exceed the requirements of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program. Composite wood and agrifiber must contain no added urea formaldehyde resins.	LEED®	IEQ Credit 4.3	ORD	Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19
Specify low-VOC carpet systems. Ensure that VOC limits are clearly stated where carpet systems are addressed. Be attentive to carpet installation requirements.	LEED®	IEQ Credit 4.3	ORD	Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19
Install VOC-free natural linoleum flooring, reclaimed wood products (such as remilled structural timbers), recycled glass tile, or ceramic tile in lieu of carpet materials that contain VOCs.	LEED®	IEQ Credit 4.3		Costs for most low-VOC-content products are generally competitive with costs for conventional materials, but may be more expensive when first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	55
Do not install vinyl flooring with high PVC content. Carpet containing PVC can release toxic chemicals, including dioxin, into the air; PVC often contains phthalate-based softening agents, which are recognized as reproductive toxins that may contribute to indoor pollution.	LEED®	IEQ Credit 4.3		Non-PVC flooring has a higher cost because of the widespread use and availability of polyvinyl chloride.	PVC is not biodegradable. Long-term leeching could lead to ground water contamination. If burned, PVC releases harmful gases. It is highly toxic during production. Recycling is difficult because of the diverse additives used.	No applicable Research Team Consideration.	Protects installers and building occupants.	55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Low-Emitting Materials								
Use natural linoleum flooring or reclaimed wood products, such as remilled structural timbers.	LEED®	IEQ Credit 4.3		Typically more expensive than vinyl flooring.	Renewable and biodegradable. Natural linoleum flooring is made from linseed oil, pine resin, wood flour, cork powder, limestone dust, natural pigments, and jute.	Durable and resilient. Has a 30-40 year lifespan compared to a 10-20 year lifespan for vinyl flooring.	Protects installers and building occupants.	55
Clean up carpet spills immediately to prevent stains and fungus. Perform extraction cleaning every 6 to 12 months, preferably with hot water or steam.				Helps ensure a long life cycle of carpeted areas, thereby reducing costs associated with carpet replacement.	Improves indoor air quality and reduces emissions associated with the production and transport of new carpeting.	May require additional labor and/or staffing.	Protects installers and building occupants.	55
Vacuum heavily trafficked areas daily using equipment with powerful suction and a HEPA filtration bag.				Helps ensure a long life cycle of carpeted areas, thereby reducing costs associated with carpet replacement.	Improves indoor air quality and reduces emissions associated with the production and transport of new carpeting.	May require additional labor and/or staffing.	Protects installers and building occupants from exposure to dust and other pollutants.	55
During deconstruction, vacuum old carpets prior to removal using a certified Carpet and Rug Institute (CRI) Green Label vacuum cleaner. Also vacuum the floor immediately after old carpet is removed.				May reduce health expenses for construction workers.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.	May require additional labor and/or staffing.	Protects workers from exposure to dust and other pollutants.	43
Ensure that all shop-finished materials meet the VOC emission requirements. Materials to consider are primed steel; finished metals, including aluminum, finished millwork, and finished steel; and wood doors and windows.				Costs for most low-VOC-content products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	2
Remove all equipment containing polychlorinated biphenyl (PCB).			HNL	Health concerns associated with PCBs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the environmental risk from leakage resulting from deterioration or damaged equipment.	PCBs cause skin problems in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs do not readily break down in the environment.	Reduces the risk of exposure to hazardous combustion byproducts in case of fire. Reduce risks to occupants from exposure to PCB.	38, 63

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Appendix A. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Certified Wood								
Establish an FSC-certified wood products goal and identify suitable suppliers. This includes, but is not limited to: structural framing and general dimensional framing, flooring, finishes, furnishings, and non-rented temporary construction applications, such as bracing, concrete form work, and pedestrian barriers. Wood-based materials and products should be compared with the total value of the materials in the task/project.	LEED®	MR Credit 7	SFO, ORD	The cost of FSC-certified wood is equal to or higher than the cost for conventional wood products and varies by region.	Encourages environmentally responsible forest management. Irresponsible forest practices result in destruction of forests and wildlife habitat, soil erosion and stream sedimentation, water and air pollution, and waste generation.	No applicable Research Team Consideration.	Respects indigenous peoples' rights and adheres to applicable laws and treaties. Preserves forest land for future generations. Benefits responsible forest workers and forest-dependent communities.	2, 64
Use FSC-certified products in temporary and permanent construction materials and finished products; meet established FSC goals (www.fscus.org/green_building).	LEED®	MR Credit 7	SFO, ORD	The cost of FSC-certified wood is equal to or higher than the cost for conventional wood products and varies by region.	Encourages environmentally responsible forest management. Irresponsible forest practices result in destruction of forests and wildlife habitat, soil erosion and stream sedimentation, water and air pollution, and waste generation.	May require a tracking system and personnel to monitor compliance.	Respects indigenous peoples' rights and adheres to applicable laws and treaties. Preserves forest land for future generations. Benefits responsible forest workers and forest-dependent communities.	2, 64
Ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.	LEED®	MR Credit 7	ORD	The cost of FSC-certified wood is equal to or higher than the cost for conventional wood products and varies by region.	Encourages environmentally responsible forest management. Irresponsible forest practices result in destruction of forests and wildlife habitat, soil erosion and stream sedimentation, water and air pollution, and waste generation.	May require a tracking system and personnel to monitor compliance.	Respects indigenous peoples' rights and adheres to applicable laws and treaties. Preserves forest land for future generations. Benefits responsible forest workers and forest-dependent communities.	19, 64
Wood Preservatives								
Prohibit the use of creosote-coated lumber.			LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.	May reduce product life cycle.	Creosote-treated lumber emits a bad odor, can soil clothes, has vapors that are toxic to plants, and is difficult to saw, sand, and paint. Direct contact can cause skin irritation and plant damage or death.	39
Reduce the requirements for preservative-treated wood.			LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.	May reduce product life cycle. Any treated material shipped to the construction site should be stored out of contact with standing water and wet soil and protected from precipitation.	Preservative-treated lumber may emit a bad odor, soil clothes, have vapors that are toxic to plants, and be difficult to saw, sand, and paint. Direct contact can cause skin irritation and plant damage or death.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Sustainable Materials								
Wood Preservatives								
Do not use chromate copper arsenate (CCA) pressure-treated lumber. Use lumber that is treated with less toxic, borate-based chemicals for dry conditions and use Ammoniacal Copper Quaternary (ACQ) for wet conditions.			LAX, ONT, VNY, PMD	The cost of site-applied borate treatments exceeds the costs of other chemical treatments because of shipping costs (limited availability). ACQ typically has a higher cost than CCA. CCA is no longer being produced for residential or general consumer use.	Burning, mechanical abrasion, direct contact with wood, sawdust, and acidic rainfall can release arsenic in CCA-treated lumber. Use sustainably harvested wood independently certified by organizations such as the FSC, Smartwood Program of the Rainforest Alliance, and Scientific Certification Systems. ACQ is less toxic than CCA and performs similarly.	Full-scale commercial introduction of borates in the United States has slowed because of the leaching problem of borates. As borates are water soluble, water dilutes them and leaves the wood unprotected from decay after a period of time. In a location unexposed to water, they are effective in preserving wood.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	39, 55
Use expanded polystyrene (EPS) foam instead of extruded polystyrene (XPS) for rigid board insulation.				EPS costs less than XPS.	EPS is the only common rigid foam board stock insulation made with neither CFCs nor HCFCs. However, XPS is stronger, denser, smoother, and more water-resistant, and has a higher R-value per inch. If the correct density is chosen for the application, EPS is not affected by moisture.	EPS insulation installation is simpler; it can be molded and shaped easily. XPS is flammable and must be protected by a 15 minute thermal barrier, such as 0.5 inch of gypsum board.	Enhances safety; encourages manufacturers to produce products in a more environmentally-conscious manner.	55
Use recycled wood/plastic composite lumber in structural applications as an alternative to synthetic wood materials.	LEED®	MR Credit 4		Cost-competitive with high-end materials such as finger jointed pine and redwood, but more expensive than standard treated products.	Uses recycled plastic trash bags and waste wood fibers. Contains none of the toxic chemicals used in conventionally treated lumber. Reduces the amount of virgin materials used in production.	Manufacturers claim it is more durable than conventional preservative-treated lumber because the wood fibers act as reinforcement; the plastic encapsulates and binds the wood together to resist moisture penetration. May weigh more than standard lumber products.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	42, 55

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Appendix A. (Continued).

Acronyms:

AC – Air Conditioning
ACQ – Ammoniacal Copper Quaternary
ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers
ASTM – American Society for Testing of Materials
BMP – Best Management Practices
BOS – Boston Logan International Airport
BWI – Baltimore-Washington International Airport
CARB – California Air Resources Board
CCA – Chromate Copper Arsenate
CFC – chlorofluorocarbon
CLF – Compact Fluorescent Lighting
CFR – Code of Federal Regulations
CRI – Carpet and Rug Institute
CRRC – Cool Roof Rating Council
DAL – Dallas Love Field Airport
dB – decibel
DBE – Disadvantaged Business Enterprise
DEN – Denver International Airport
DFW – Dallas/Fort Worth International Airport
DOC – Diesel Oxidation Catalysts
EA – Energy and Atmosphere
EGGD – Bristol International Airport
EGKK – London Gatwick Airport
EMAS – Engineered Materials Arresting System
EMS – Environmental Management System
EONS – Economics, Operational, Natural Resources, and Social
EPS – Expanded Polystyrene
ETS – Environmental Tobacco Smoke
F45 – North Palm Beach County General Aviation Airport (Florida)
FAA – Federal Aviation Administration
FSC – Forest Stewardship Council
GHG – Greenhouse Gas
GGBF – Ground Granulated Blast Furnace
GPS – Global Positioning System
HCFC – hydrochlorofluorocarbon
HDPE – High Density PolyEthylene
HECA – Cairo International Airport
HEPA – High Efficiency Particulate Air
HPS – High Pressure Sodium
HNL – Honolulu International Airport
HVAC – Heating, Ventilating, and Air Conditioning
IAQ – Indoor Air Quality
ICF – Insulating Concrete Form
ID – Innovation in Design
IEQ – Indoor Environmental Quality
LAX – Los Angeles International Airport
LCA – Life Cycle Assessment
LED – Light-Emitting Diode
LEED® – Leadership in Energy and Environmental Design
LEED® AP – LEED Accredited Professional
LGAV – Athens (Eleftherios Venizeolos) International Airport
LNA – Palm Beach County Park Airport (West Palm Beach, Florida)
MBE – Minority Business Enterprise
MERV – Minimum Efficiency Reporting Value
MH – Metal Halide
MKE – General Mitchell International Airport
MR – Materials and Resources
MSDS – Material Safety Data Sheets
MSP – Minneapolis-St. Paul International Airport
NESHAP – National Emissions Standards for Hazardous Air Pollutants
NiCad – Nickel-Cadmium
NOx – Nitrogen oxides
ONT – Ontario International Airport
ORD – O'Hare International Airport
OSB – Oriented-Strand Board
OSHA – Occupational, Health and Safety Administration
PBI – Palm Beach International Airport
PBT – Persistent, Bioaccumulative, and Toxic
PCB – Polychlorinated biphenyl
PCCP – Prestressed Concrete Cylinder Pipe
PDX – Portland International Airport
PMD – Los Angeles/Palmdale Regional Airport
PVC – Polyvinyl Chloride
RBD – Dallas Executive Airport
RFP – Request for Proposal
RFQ – Request for Qualifications
RMA – Rubber Modified Asphalt
RR – Rapidly Renewable
SCAQMD – South Coast Air Quality Management District
SCDA – Soundless Chemical Demolition Agents
SESC – Soil Erosion and Sediment Control
SFO – San Francisco International Airport
SIP – Structural Insulated Panels
SLC – Salt Lake City International Airport
SPCC – Spill Prevention Control and Countermeasure Plan
SRI – Solar Reflectance Index
SS – Sustainable Sites
STL – Lambert-St. Louis International Airport
SWPPP – Stormwater Pollution Prevention Plan
TDF – Tire-Derived Fuel
TMA – Transportation Management Association
TPO – Thermoplastic Olefins
TVY – Bolinder Field-Tooele Valley Airport (Utah)
U42 – South Valley Regional Airport (Utah)
ULSD – Ultra Low Sulfur Diesel
USDOE – U.S. Department of Energy
USEPA – U.S. Environmental Protection Agency
USGBC – U.S. Green Building Council
VCP – Vitrified Clay Pipes
VNY – Van Nuys Airport
VOC – Volatile Organic Compounds
WBDG – Whole Building Design Guide
WE – Water Efficiency
WRAP – Waste Resource Action Programme
XPS – Extruded Polystyrene
YYZ – Toronto Pearson International Airport

APPENDIX B

Collection Sorted by Construction Implementation Stage Categories

Appendix B. Sustainable construction practices organized by construction implementation phase.

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Sustainability Goals								
Create and follow a sustainable vision/mission statement that incorporates construction practices.				Widely varies on detail and goals.	Establishes that a project/airport has an environmental focus.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program.	2
Establish an airport-specific rating/ranking system in conjunction with the airport sustainability guidance manual. Provide rewards (certificates of achievement, financial incentives, etc.) for contractors who meet and or exceed sustainability goals.			LAX, ONT, VNY, PMD	Could be tied to cost savings generated by practices employed.	Helps achieve environmental objectives. Encourages other contractors to improve their sustainability efforts to achieve recognition.	Determined by goals. May have operational and/or cost implications.	Markets the specific sustainable practices and related EONS benefits on a local, national, and international level.	55
Require that conceptual plans/criteria documents outline sustainability goals, objectives, and potential achievements.				If anticipated early on, costs may be reduced.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program. May affect the ability for minority/DBE contractors to meet requirements.	3
Pursue USGBC LEED® Certification as applicable. Anticipate the LEED® process early-on.	LEED®	*General*	SFO, BOS, ORD	May increase initial costs of a project. If anticipated early on, costs may be reduced. Achievement of LEED® Certification may result in the identification of additional sustainable practice opportunities and provide positive life cycle economic benefits.	Provides third-party verification of sustainable practice achievements.	Pursue as early on in the project planning process as possible. Determined by goals. Facilitates documentation and progress tracking.	May help improve the community's view of the airport; good for public relations.	64

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Sustainability Goals								
Establish project goals for recycled content materials and identify material suppliers that can achieve this goal. Consider the following major building components: aggregate in cast in place concrete; fly ash in cast in place concrete; 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 furnishes; equipment; sheet metal ductwork; site lighting.	LEED®	MR Credit 4	ORD, SLC, U42, TVY	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	May help improve the community's view of the airport if part of an outreach program.	2
To identify recycled content materials available and common percentages, include contact information in project specifications for reference and search tools such as the Guide to Resource-Efficient Building Elements from the Center for Resourceful Building Technology (www.crbt.org), the Recycled Content Product Directory from the applicable state integrated waste management board and Oikos (www.oikos.com).	LEED®	MR Credit 4	LAX, ONT, VNY, PMD	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Sustainability Goals								
Establish a goal for the minimum percentage of local/regional materials and products that are manufactured regionally within a radius of 500 miles. Identify the value of local/regional materials so that they can be compared with of the total value of the materials in the task/project. (Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen).	LEED®	MR Credit 5	ORD	Regional building materials are more cost effective for projects due to reduced transportation costs. Consider early on in the design process, if possible, since research may be required to determine what products can be sourced locally and realistically be expected to be purchased for the project.	Reduces the environmental impacts resulting from transportation. It is also important to discuss the source of raw materials used to manufacture building products.	Identify and specify materials and material suppliers that can achieve the regional materials goal.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	19, 64
Establish an appropriate project goal for renewable materials utilization.	LEED®	MR Credit 6	LAX, ONT, VNY, PMD	Since rapidly renewable materials may be harvested more quickly, they tend to give a faster payback on investment for manufacturers. As demand increases, they are expected to become cost-competitive with conventional materials.	Rapidly renewable materials are made from plants and typically harvested within a ten-year cycle. Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	Percent of rapidly renewable materials = total cost of rapidly renewable materials / total materials cost.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	39, 64
Apply for national, state, and local competitive grants to support the selected sustainable construction practices.			LAX, ONT, VNY, PMD	Grant opportunities vary widely by state/federal and over time; may help offset costs.	May enable further environmental initiatives.	Could impact the timing of initiatives and reporting requirements.	May involve DBE or community organizations.	39
Policies, Contracts, and Specifications								
Plans								
Require contractors to submit sound reduction construction plans to mitigate construction noise and vibration impacts.			LAX, ONT, VNY, PMD	May have cost and schedule implications; widely varies on detail and goals.	May reduce noise impacts on adjacent noise sensitive land uses and help reduce vibration impacts.	May restrict type and timing of construction operations. May minimize impacts on airport activities and landside passenger traffic.	May reduce noise impacts on adjacent noise sensitive land uses. May reduce complaints from the local community and/or improve the community's view of the airport.	39
Develop and implement an underground and/or above ground storage tank management plan.				Helps avoid unexpected costs.	Helps meet regulatory requirements and protects the natural environment.	Establishes procedures.	Improves safety and awareness.	2

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Pre-Construction								
Policies, Contracts, and Specifications								
Plans								
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building.	LEED®	IEQ Credit 3.1	ORD	Additional time and labor may be required to protect and clean ventilation systems and building spaces. Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use. If contaminates remain they may lead to expensive and complicated clean up procedures.	Reduces IAQ problems resulting from the construction process.	No applicable Research Team Consideration.	Helps sustain the comfort and well-being of construction workers and building occupants.	19, 64
Develop and implement a Construction Dust Control Plan. The plan should document wind patterns including direction and velocity; show locations of disturbed soil; include BMPs that will be used for each disturbed soil location during each phase of construction; provisions for BMP inspections and personnel training; and inspection and record keeping forms, to be kept on-site with the Dust Control Plan. The plan should also include a tracking protocol for implementation of the Dust Control Plan.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Promotes awareness.	Adjust BMPs for dust control based on meteorological conditions and the activity level of disturbed soil.	Improves road safety and reduces dust. Protects air quality in the local community.	39
Develop and implement an energy conservation/efficiency plan.				Depending on scope, may require some up-front cost to implement (e.g., new equipment); typically results in operational savings, reducing energy costs.	Reduces energy consumption. Environmental benefits will vary based on local source of electricity, i.e., coal, natural gas, nuclear, renewable, etc.	Depending on scope, may require operational changes and training of employees and contractors.	May reduce energy demand and costs in the local community.	2
Establish a hazardous waste management plan for all storage and operational use of hazardous materials, including battery collection.			MKE	May help avoid expensive costs associated with hazardous waste accidents. Address regulatory requirements.	Minimizes contamination of soil, water, and other resources.	May require specialized containment and operational conditions; requires staff training.	May minimize construction worker exposure to hazardous wastes.	24
Develop and maintain a Soil Erosion and Sedimentation Control (SESC) plan consistent with EPA Document No. EPA 832/R-92-005 (Sept. 1992), Stormwater Management for Construction Activities, Chapter 3.	LEED®	SS Prerequisite 1	HNL, ORD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures. Can avoid unexpected and potentially large costs.	Ensures that soil, sand, gravel, and other materials are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	May protect water quality in the local community.	2, 38

(continued on next page)

Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Plans								
Perform an erosion control study for the stabilization of soils.			DEN	May require additional upfront costs; may keep operations costs to a minimum. May avoid future costs associated with non-compliance as regulated by local governmental agencies.	May help prevent erosion and protect water quality.	May require additional staff training. Can help streamline operations if soil conditions are thoroughly studied.	Promotes internal awareness, communication and education. May protect water quality in the local community.	9
Develop and implement a Stormwater Pollution Prevention Plan (SWPPP) for construction activities. Inspect the site frequently to ensure compliance.	LEED®	SS Credit 6.1	BOS	Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Helps meet regulatory requirements and protects the natural environment. Ensures that contaminates/debris/materials are not carried off-site through stormwater.	Helps meet regulatory requirements.	Protects the water quality in the local community.	2
Prepare a spill prevention and countermeasure control (SPCC) plan for construction activities.			BOS	Widely varies on detail and goals; less so as it becomes part of standard operating procedures. Can avoid unexpected and potentially large contamination costs.	Can help to minimize exposure of harmful substances/contamination to the environment.	Can avoid unexpected delays due to spill cleanup.	Protects the water quality in the local community. May minimize worker's exposure to potentially harmful chemicals.	2
Develop a site-specific health and safety plan that identifies all potential hazards and steps taken to mitigate accidents.			LAX, ONT, VNY, PMD	May increase project costs but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Develop a balanced earthwork plan and keep as much excavated earth on-site as possible to reduce off-site hauling. Develop an inventory of topsoil for potential re-use.			ORD	May reduce hauling, disposal, and fuel costs.	Conserves natural resources. Reduces roadway congestion, energy use and emissions. May avoid having to haul new material to the site.	Consider the reuse of earthwork/soil for another project. Avoid 'double-hauling' of materials. Inventory of soils may streamline the reuse of soil airport-wide. Site management to avoid erosion and dust is essential.	Excess airport earthwork could be donated or sold at a reduced cost to the community. Reduced off-site hauling could reduce temporary construction-related traffic in the surrounding community.	18
Require detailed site access plans for all milestone stages of work that minimize impervious site effects during construction.				Costs are minimized as it becomes part of standard operating procedures.	Minimizes site impacts.	May require staff training.	Promotes internal awareness, communication and education.	55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Plans								
Develop a detailed lay-down/sequencing plan.			LAX, ONT, VNY, PMD	Better material management. May reduce hauling, disposal, and fuel costs.	Reduces the demand for raw materials.	Facilitates project staging of materials, and material sharing. Could reduce construction-related temporary impacts surface transportation as vehicles would make fewer trips off-site.	Reduced off-site hauling could reduce traffic in the surrounding community.	39
Require contractors to submit a pre-construction plan to use recycled oil, nontoxic lubricants, and other environmentally friendly maintenance agents during construction. The plan should also stipulate when and how used oil can be recycled.			HNL; LAX, ONT, VNY, PMD	Cost widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Reduces requirement for disposal of used oil. Reduces environmental impact associated with drilling, pumping, transporting and refining crude oil.	Must educate employees and contractors, establish procurement policy and procedures, implement procedures for recycling oil.	May help improve the community's view of the airport if part of an outreach program.	2, 38, 39
Require contractors to develop a waste management plan that contains waste targets; an estimate of the waste to be generated on site; actions to reduce waste; and actions to avoid waste going to a landfill.	LEED®	MR Credit 2	HECA, ORD, LAX, ONT, VNY, PMD, EGGD, EGKK, LGAV	Potential cost savings from reduced material hauling, disposal fees, and fuel costs.	Conserves natural resources. Reduces materials that are sent to the landfill and the environmental impacts of producing new construction products and materials. The reuse of materials on-site may reduce off-site hauls, decreasing emissions, energy consumption, and traffic.	May streamline the quantification and organization of materials on-site, potentially reducing impacts to airport operations. Essential for quantifying and organizing materials on-site during demolition. Facilitates resource sharing among projects.	Reduced off-site hauling could reduce temporary construction-related traffic in the surrounding community. Salvageable and/or recyclable waste could be donated or sold at a reduced cost to the local community.	39, 64
Policies, Contracts, and Specifications								
Request for Proposals/Request for Qualifications								
Use web directories and links; web based document sharing; web based procurement process – Request for Qualifications/ Request for Proposals (RFQ/RFP), notices/ advertisements; electronic submittal forms/templates; and electronic/digital document processes to reduce paper needs.				Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May reduce printing, postage, and administrative costs.	Reduces paper usage.	Make documents/resources available online and/or part of the bid advertisement process. Improves the flow of information. Facilitates tracking and reporting; maximizes teamwork, transparency, and information sharing.	Enables flow of information to additional persons.	2

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Request for Proposals/Request for Qualifications								
Send the selected contractor the sustainability requirements (guidance, specifications, tracking forms, LEED® requirements, etc.) prior to the pre-construction and/or project kickoff meeting(s).				If anticipated early on, costs may be reduced.	Incorporates environmental aspects into each project.	May help streamline the project process.	Improves internal communication and awareness. Facilitates tracking and reporting to the public.	3
Conduct contractor job fairs for upcoming airport projects. Publish updates on the airport's website.				Facilitates a competitive bid process. Creates project awareness.	Creates awareness, especially on the contractor level, of environmental goals and objectives.	Facilitates the flow of information and may help expedite the selection process.	Provides job opportunities for the local and regional community. Promotes awareness, communication, and educational opportunities.	3
Conduct contractor open houses to describe upcoming projects and sustainability requirements.				Facilitates a competitive bid process. Creates project awareness. Helps make sure procurement requirements are met for MBEs and DBEs.	Creates awareness, especially on the contractor level, of environmental goals and objectives.	Facilitates the flow of information and may help expedite the selection process.	May help provide opportunities for the involvement of MBEs, small and/or local businesses.	3
Use contractor open houses to survey attendees about their sustainability knowledge, experience, and ability to comply with sustainability provisions.				Ensures contractors can comply with project provisions.	Ensures contractors can achieve the environmental objectives (e.g., Tier compliance of construction equipment).	Facilitates the flow of information and may help meet sustainability requirements.	May help provide opportunities for the involvement of MBEs, small and/or local businesses.	3
Employ local construction workers to decrease disruption caused to local communities by commuters and to provide local economic benefits.				Utilize community job fairs and contractor open houses to ensure a local pool of construction workers. Reduces expenses from having to travel long distances.	Reduces emissions, noise, and roadway congestion.	No applicable Research Team Consideration.	Provides job opportunities for the local and regional community. Promotes awareness, communication, and educational opportunities.	20
Contract with a mix of general contractors and subcontractors with sustainability experience and/or knowledge (e.g., LEED®-accredited staff). Sustainability consulting services shall be provided by an organization with a minimum of 3-5 years experience on projects of similar size and scope.			LAX, ONT, VNY, PMD	Could result in additional project costs, but may be worthwhile if extensive sustainable practices are being implemented.	Contractor should be familiar with Environmental Management Systems (EMSs) (ISO 14001 Standard) and have familiarity with the USGBC-LEED® green building rating program and a successful history of completed LEED® projects.	This will help create an appropriate sustainable attitude amongst all contractors. A list of contractors who are members of the USGBC can be found at www.usgbc.org.	May help improve the community's view of the airport; good for public relations.	39, 43, 55
Require that contractors have a published corporate sustainability policy. Evaluate the policy during the RFP/RFQ process.				Selecting contractors that understand the concepts of sustainability may facilitate the achievement of sustainability requirements, reducing project costs.	Creates awareness of environmental focus; helps ensure that selected contractors are passionate about sustainability.	Ensures that contractors have some familiarity with sustainability concepts.	May help improve the community's view of the airport; good for public relations.	3

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Request for Proposals/Request for Qualifications								
Use subcontractors with "in house" fabrication capabilities to increase the awareness of waste reduction and provide more control over delivery schedules.				Could result in additional upfront project costs if the capabilities are specialized with few competitors, but may reduce life cycle costs.	May reduce environmental impacts.	May improve operational issues with delivery of materials.	May reduce number of deliveries and waste haul trips, reducing impacts to surrounding community.	55
Use only design-build contractors with performance based fee incentives to encourage innovative sustainability solutions.				May increase project costs, but could also be tied to cost savings generated by any innovative practices employed.	Encourages contractors to actively pursue and implement sustainable practices, which may result in environmental benefits.	Design-build contracts and/or performance based fee incentives may not be allowed by the contracting agency(ies). Encourages contractors to actively pursue and implement sustainable practices, which may result in operational benefits.	Encourages contractors to actively pursue and implement sustainable practices, which may result in social benefits.	55
Include recycling requirements and other sustainable practices in technical specifications to help convey expectations to contractors; this may include providing environmental planning checklists to contractors.			HNL, DEN, LAX, ONT, VNY, PMD, ORD	Increased recycling efforts may reduce disposal costs. Clearly specifies contractor responsibilities.	May enhance recycling activities and thus reduce the emissions from hauling, the traffic impacts, and the consumption of fossil fuels.	May require additional staff training to explain procedures and requirements to contractors.	Educates construction workers and identifies that sustainability is a priority at the airport.	2, 9
Incorporate commissioning requirements into construction documents. Have a contract in place to implement best practice commissioning procedures and tie payment to completion of the contract.	LEED®	EA Prerequisite 1	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	64
Include in all contract documents the minimum quantities of excess materials that will be accepted for return by the vendor and the required conditions of such material.			LAX, ONT, VNY, PMD	Helps to avoid unexpected costs associated with over-ordering materials; may reduce costs of hauling to landfills.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	The contractor should avoid under-ordering materials, which could result in operational delays.	Reduced material hauling could reduce traffic in the surrounding community.	39
If using a waste contractor, verify that their waste licenses are relevant and up to date.				Work with contracts administration; ensures contractors are familiar with current standards and practices.	Ensures contractors are aware and up-to-date on current regulatory practices and requirements.	Ensures contractors are familiar with current standards and practices.	Stresses that construction waste management is a priority at the airport; helps ensure contractors are honest and experienced.	66

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Pre-Construction								
Policies, Contracts, and Specifications								
Request for Proposals/Request for Qualifications								
Require electronic submittals to minimize or eliminate printed copies of reports and other submittals. Negotiate electronic/paperless submittals and change orders into construction contracts (require electronic submittals).			LAX, ONT, VNY, PMD	Reduces costs from storage and handling multiple copies of documents; facilitates access and distribution; facilitates record keeping.	Substantially reduces paper used in multiple submittals.	Can still maintain printed copies in a central location to facilitate use/review.	Facilitates access/transparency and distribution.	39
Establish an FSC-certified wood products goal and identify suitable suppliers. This includes, but is not limited to: structural framing and general dimensional framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers. Wood-based materials and products should be compared with the total value of the materials in the task/project.	LEED®	MR Credit 7	SFO, ORD	Cost of FSC-certified wood is equal to or higher than conventional wood products and varies by region.	Encourages environmentally responsible forest management. Irresponsible forest practices result in destruction of forests and wildlife habitat, soil erosion and stream sedimentation, water and air pollution, and waste generation.	No applicable Research Team Consideration.	Respects indigenous people's rights and adheres to applicable laws and treaties. Preserves forestland for future generations. Benefits responsible forest workers and forest-dependent communities.	2, 64
Policies, Contracts, and Specifications								
Training and Human Resources								
Identify sustainability reporting (submittal) and performance requirement milestones (e.g., at project start-up, monthly, and at project completion).				Widely varies on detail and goals; less so as it becomes part of standard operating procedures. Compliance ensures realization of economic benefits established in contracts.	Compliance ensures realization of environmental benefits established in contracts.	Compliance ensures realization of operational benefits established in contracts. Clarifies requirements upfront.	Compliance ensures realization of social benefits established in contracts.	3
As part of the pre-construction meeting (or other similar meeting), hire an inspector/construction sustainability liaison to the owner (potentially a LEED® AP) to work on sustainability training in conjunction with project and site managers. Introduce the selected inspector to the construction team and allow them to have an introductory question and answer session. Require regular meetings (weekly or monthly) with the sustainability liaison.	LEED®	ID Credit 2	LAX, ONT, VNY, PMD	Could result in additional project costs, but may be worthwhile if extensive sustainable practices are being implemented.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Pre-Construction								
Policies, Contracts, and Specifications								
Training and Human Resources								
Include educational training on sustainability objectives established for the project team as part of the initial project planning meeting and throughout the project.			ORD, LAX, ONT, VNY, PMD	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures project team members are incorporating sustainability requirements in their daily responsibilities and assignments.	Promotes awareness and internal communication.	19, 39
Provide posters, flyers, and exhibit boards displaying LEED®/sustainability requirements and processes for contractors.	LEED®	*General*		Creates awareness at a minimal initial cost; may help achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	May help streamline the project process.	Promotes awareness and internal and external communication.	35
Assign one or more project team members on the construction team to take the LEED® Professional Accreditation Exam, if not already accredited.	LEED®	ID Credit 2	SFO, BOS, ORD	Creates awareness; helps achieve cost objectives. Requires an upfront cost for the exam and preparatory materials. Helps achieve LEED® points.	Creates awareness of environmental focus and benefits.	Expedites the LEED® process. Pursue early on in the project planning process.	Promotes internal awareness of LEED® requirements on the project team.	39
Provide training on the airport's sustainable planning, design and construction guidelines, including their basis, the parties responsible for using the guidelines, and the sustainable rating system.			ORD	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures project team members are incorporating sustainability requirements in their daily responsibilities and assignments. Utilize these forums to capture ideas on how to further improve sustainability performance.	Promotes awareness and internal communication.	19
Develop a strategic human capital retention and development plan in conformance with the overall project plan, organizational needs, and changing business needs.			LAX, ONT, VNY, PMD	Reduction in employee turnover and identification of skilled labor needs early on will reduce project delays and costs.	No applicable Research Team Consideration.	Reduction in employee turnover and identification of skilled labor needs early on will help ensure construction proceeds according to schedule.	Provides job opportunities for the local and regional community. Promotes awareness, communication, and educational opportunities.	39
Make sure that all contractors and subcontractors have been briefed on access road and staging area locations.			LAX, ONT, VNY, PMD	May help prevent costly site disturbance; briefings/meeting may have minor cost implications.	Ensures that construction traffic follows designated routes to minimize unnecessary site disturbance and traffic congestion.	Promotes site safety and establishes traffic patterns for the construction site.	Promotes site safety and establishes traffic patterns; may reduce off-site traffic congestion and impacts to surrounding roads.	39
Provide training for construction workers and signage for facility users instructing them on how they can help reduce water use.			LAX, ONT, VNY, PMD	Costs of training and signage are minimal; education may lower water use bills.	Promotes awareness. Conserves water.	Requires staff training.	Promotes internal awareness and communication.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Pre-Construction								
Policies, Contracts, and Specifications								
Training and Human Resources								
Identify an individual to lead the commissioning process early on. The commissioning authority should review and oversee the completion of commissioning process activities, have documented experience in at least 2 building projects, and should be independent of the project design and construction management team.	LEED®	EA Prerequisite 1	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	64
Allocate personal responsibility for on-site waste reduction (e.g. appoint a Waste Manager).				Consistent and knowledgeable application of standards and specifications across all projects.	Consistent knowledge and understanding of environmental across all projects.	Applies consistent and knowledgeable understanding of applicable standards, practices, tracking and reporting across all projects.	Reduced off-site hauling could reduce traffic in the surrounding community.	66
Provide fact sheets to designers that include available recycled content materials and the organization's target for each material.	LEED®	MR Credit 4	LAX, ONT, VNY, PMD	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	39
Ensure that the construction manager understands the demolition requirements and properly sets up the demolition process to identify and organize materials according to how they can be reused and/or recycled.				May reduce hauling, disposal, and fuel costs.	May reduce materials/components that are sent to the landfill. The reuse of materials on-site may eliminate off-site transportation and thus decrease construction vehicle emissions and energy consumption.	Could reduce temporary negative impacts to surface transportation if vehicles make fewer trips off-site.	Reduced off-site hauling could reduce traffic in the surrounding community.	52
Policies, Contracts, and Specifications								
Meetings								
Conduct preconstruction and/or project kickoff meetings with sustainability requirements included on the agenda. Communicate sustainability goals and requirements at pre-bid, bid, and project start.				Creates awareness; helps achieve cost objectives. Helps contractors understand and comply with sustainability requirements.	Creates awareness; helps achieve environmental objectives.	Ensures sustainability is considered at the start and continued through the project.	Improves internal communication and awareness; facilitates compliance with tracking requirements.	3

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Establish industry peer review groups to provide input and experiences of sustainable construction practices.				Potential cost savings from sharing information and learning from others.	Provides environmental benefits from sharing information and learning from others.	Provides operational benefits from sharing information and learning from others.	Promotes awareness, communication, and educational opportunities.	3
Pre-Construction								
Policies, Contracts, and Specifications								
Meetings								
Share construction equipment with other contractors. List equipment available for use on a communal website, display boards/posters, and/or hold a meeting with all contractors to discuss available equipment.				May reduce equipment leasing costs or the number of contractors required to own or lease equipment, who would pass that cost on to the airport. Reduces transportation requirement, reducing costs. Must consider cost sharing agreements and liability issues.	Reduces transportation requirement, reducing emissions and requirement for fossil fuels.	Requires greater logistical coordination between contractors, which could negatively impact schedule. Consider liability issues.	Reduces the impact of delivery vehicles on local streets. May negatively impact jobs at equipment manufacturers.	55
Establish a "green meetings" policy that minimizes the use of printed materials.			LAX, ONT, VNY, PMD	Minimal or negligible costs to implement.	Reduces use of paper and other materials.	Establishes consistent protocols.	Include as part of community outreach program.	39
Use conference calls, web-based conferences and programs instead of in-person meetings when possible to reduce printed materials and to reduce emissions from transportation.			ORD	Reduces costs for materials and travel.	Conserves natural resources and reduces energy use and emissions from travel.	Examples include: NetMeetings, LiveMeetings, GoToMeetings, Webinars, and others.	Reduces emissions from air travel.	19
Policies, Contracts, and Specifications								
Marketing and Community Outreach								
Conduct an industry forum/conference to share and learn about sustainable construction practices (engage other contractors, the local community, and construction and aviation industries). Conduct tours of the construction site.			LAX, ONT, VNY, PMD	Raises awareness; potential cost savings from learning from others.	Creates awareness of environmental focus and benefits.	Use industry conferences, annual reports, websites, presentations, press releases, articles in trade journals, etc.	Markets the specific sustainable practices and related EONS benefits on a local, national, and international level.	3, 39
Create and implement a policy or code of practice regarding considerate behavior. At a minimum it should cover: relations with neighbors; communications to neighbors; good housekeeping; presentation of the site; relations with other stakeholders; and complaints procedures.				Facilitates compliance; may help avoid potentially expensive project delays and legal issues.	Emphasizes the importance of meeting sustainability requirements.	Ensure this policy is communicated to all of the appropriate people working on the project.	Creates internal and external communication.	20

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
As a courtesy, notify neighbors prior to starting a job that will create noise. Communication with neighbors can prevent complaints from arising and resolve concerns before there is a problem. Provide a phone number where the foreman can be reached prior to the start of the job.				Facilitates compliance; may help avoid potentially expensive project delays.	Emphasizes the importance of meeting noise level requirements.	Ensure this policy is communicated to all of the appropriate people working on the project.	Facilitates communication and awareness with adjacent land owners; may reduce overall noise complaints.	17
Pre-Construction								
Policies, Contracts, and Specifications								
Marketing and Community Outreach								
Implement an unrestricted flow of traffic control information between the contractor(s), the Construction Coordination Office, and the public.			LAX, ONT, VNY, PMD	Costs are minimized as it becomes part of standard operating procedures.	Minimizes site impacts.	Communicate with all of the appropriate people working on the project.	Minimizes impact to local traffic and congestion; promotes awareness.	39
Coordinate with the appropriate state/local transportation services to evaluate potentially vulnerable roadway areas and avoid damage from construction.			LAX, ONT, VNY, PMD	Costs are minimized as it becomes part of standard operating procedures.	Minimizes site impacts.	No applicable Research Team Consideration.	Promotes awareness and protects local roadways.	39
Work with local radio affiliates to include construction updates during morning and afternoon traffic alerts. Announce construction traffic reports on local AM radio stations.			ORD	Costs are minimized as it becomes part of standard operating procedures.	Increases awareness and compliance with noise and traffic control measures.	Requires close coordination between contractors, the airport, and the public.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27
Release a construction project outlook report at the start of the construction season to local media outlets to provide advanced notice of any modifications to existing streets and intersections and provide information regarding truck haul routes in use.			ORD	Costs are minimized as it becomes part of standard operating procedures.	Increases awareness and compliance with noise and traffic control measures.	Minimal time requirements.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27
Publish a landside construction awareness brochure for construction-related roadways closures, access routes, detours, etc.			ORD	Marginal as compared to the risk of negative public perception.	Increases awareness and compliance with noise and traffic control measures.	Minimal time requirements.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27
Policies, Contracts, and Specifications								
Construction Worker Health and Safety								
Appoint a health and safety manager for the construction site.			LAX, ONT, VNY, PMD	May increase project costs but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Require that all construction workers have proper safety certifications.			LAX, ONT, VNY, PMD	May result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Pre-Construction								
Policies, Contracts, and Specifications								
Construction Worker Health and Safety								
Establish an emergency notification program. Identify and display phone numbers and driving directions to the nearest hospital or emergency care provider.			LAX, ONT, VNY, PMD	Increases awareness and preparedness for emergency situations, which may result in financial benefit.	No applicable Research Team Consideration.	Increases awareness and preparedness for emergencies.	Increases awareness and preparedness for emergencies.	39
Determine conclusively if toxic dusts or fumes exist or will enter breathing space during construction, especially during renovation of buildings; take corrective action if necessary.			LAX, ONT, VNY, PMD	Reduces potential of harm to construction workers.	Identifies and reduces emissions of toxic substances.	May cause some delays to work, but improves safety of work environment.	Reduces potential of harm to construction workers, site personnel, customers, and public.	39
Provide signs reminding workers of long term health risks due to exposure to particulates and the unknown toxics attached to particulates.			LAX, ONT, VNY, PMD	Reduces potential of harm to construction workers.	Increases awareness and compliance with dust control measures.	Increases awareness and compliance with proper dust control measures.	Reduces potential of harm to construction workers, site personnel, customers, and public.	39
Communicate the hazards of IAQ during health and safety meetings.			LAX, ONT, VNY, PMD	May contribute to lowering health insurance rates and healthcare costs.	Promotes awareness.	Communicate with all of the appropriate people working on the project.	Promotes awareness and internal communication.	39
Ensure that interior construction operations aren't scheduled when indoor air quality levels may be unacceptable.				May contribute to lowering health insurance rates and healthcare costs.	Improves IAQ during construction.	May extend the duration of the project.	May minimize worker's exposure to hazardous indoor air pollutants.	43
Publish an airfield construction awareness brochure highlighting runway and taxiway closures due to construction activity.			ORD	Marginal as compared to risk of negative public perception and impact to air traffic/airlines, on-time departures and arrivals.	Provides advanced notification of airfield closures, potential delays, and construction noise.	Provide alternatives to assist air traffic with operating as efficiently as possible within the constraints imposed by construction.	Minimize impact to air traffic. Allows airlines and ground crews to plan ahead.	27
Display construction traffic information on signage near the airport.			ORD	Marginal as compared to risk of negative public perception.	Creates awareness; reduces traffic congestion.	Ensure proper placement of signage to provide advanced notification so that motorists can plan accordingly.	Minimizes impact to local traffic and congestion. Communication helps to prepare the community, reducing negative consequences of public backlash.	27
Clearly identify refueling stations for demolition equipment, material haulers, and material lifts.				May reduce fuel costs. Consider distributing/presenting a map of the location and the desired route.	Creates awareness.	May reduce minor refueling delays and avoid confusion.	Minimizes traffic impacts on and/or off the airfield.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Pre-Construction								
Policies, Contracts, and Specifications								
Construction Worker Health and Safety								
Designate a hazardous waste containment area and have a hazardous waste inspector periodically analyze the site. Also designate special construction waste containment areas (medical, industrial, pollution).	LEED®	MR Credit 2	STL	May reduce hauling, disposal, and fuel costs.	Reduces construction worker and community exposure to waste.	May involve several regulatory requirements.	May minimize construction worker and community exposure to wastes.	2
Policies, Contracts, and Specifications								
Compliance/Performance Monitoring								
Develop and implement a program to track and report sustainable construction goals and progress achieved (e.g., a sustainability management system).			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program.	39
Establish a document management system so that project files can be submitted and archived electronically by employees, consultants, and contractors.				Initial start-up costs; saves costs by reducing the demand for paper.	Reduces the use of paper.	Establishes consistent document control protocols, improves record keeping, access and distribution.	No applicable Research Team Consideration.	2
Develop and implement an environmental management system (EMS) that includes construction projects.			DFW, DEN; SFO, SLC	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps meet regulatory requirements and in assigning responsibilities, and helps with tracking and reporting.	May help improve the community's view of the airport; good for public relations.	2
Prepare internal and external communication reports on sustainability performance of construction projects.			LAX, ONT, VNY, PMD	Widely varies on detail and goals.	Helps meet sustainability goals and facilitates additional sustainable practices.	Helps ensure that the contractor is following sustainability requirements.	May help improve the community's view of the airport; good for public relations. Helps promote awareness.	39
Ensure that those directly responsible in the project have been informed of the environmental impacts and associated social issues of their part and/or stage of the project.				Widely varies on detail and goals.	Helps meet sustainability goals and facilitates additional sustainable practices.	Communicate sustainability goals and requirements at pre-bid, bid, and project start. Inform contractors of the environmental issues and social impacts during the pre-construction meeting.	May help improve the community's view of the airport; good for public relations.	20
Develop detailed technical specifications and standards to implement sustainable construction practices; include these sustainability specifications as part of contracts.				Widely varies on detail and goals.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program. May affect the ability for minority/DBE contractors to meet requirements.	2

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Compliance/Performance Monitoring								
Use web-based, independent industry resources in project specifications to maximize the use of sustainable materials and products.	LEED®	MR Credit 4		Rapidly evolving field makes it difficult to know what's available - utilize available unbiased information. Examples include: GreenSpec from Building Green, Inc. (www.buildingreen.com) and Oikos (ww.oikos.com).	For product benefits, seek unbiased research and reviews.	Many online directories and databases list product descriptions of environmentally preferable products, and independent research to ensure that product descriptions contain unbiased information. Check for third party independent validations of sustainable materials.	Consider working with local communities or non-profit organizations to develop, collect reliable product information.	3
Develop construction specifications for the airport using publicly accessible or "free" tools and resources such as the National Institute of Building Sciences, Whole Building Design Guide (WBDG) Green Building Specs (www.wbdg.org) and the Port of Portland's Master Construction Specifications website (www.portofportland.com).			ORD	Utilize available/existing free resources to minimize cost.	Incorporates environmental aspects into each project.	Determined by goals. May have operational and/or cost implications.	May help improve the community's view of the airport if part of an outreach program. May affect the ability for minority/DBE contractors to meet requirements.	43, 53
Photographically document site conditions prior to start of construction operations (include aerial photographs). Take weekly photographs throughout the entire project. Photographs shall be provided for unrestricted use by Owner.				Submit (or require the contractor to submit) a minimum (e.g., 20 photographs on CD, formatted to ISO 9660) with each application for payment.	Indicate photographs demonstrating compliance with environmental and/or sustainable procedures.	Promotes awareness and documents compliance with sustainable practices.	Promotes awareness and internal communication.	43
Establish a regular meeting schedule to discuss sustainability progress (either as separate meetings or as an agenda item on other meetings).			ORD	Incorporate into the overall sustainability management program.	Creates awareness.	Engage the airport's construction and maintenance, tenants, airlines, local regulators, and/or FAA and US EPA representatives as appropriate.	Promotes awareness of sustainability objectives/goals, especially if part of an outreach program.	19
Create a "construction sustainability coordinator" position or an "office of sustainability" within the organization.			LAX, ONT, VNY, PMD	Could result in additional project costs, but may be worthwhile if extensive sustainable practices are being implemented (e.g., may expedite the LEED® process).	Establishes that a project/airport has an environmental focus.	Assigns responsibility.	Promotes awareness.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Policies, Contracts, and Specifications								
Compliance/Performance Monitoring								
Form a "Green Team" responsible for managing the integration of selected sustainable construction practices.			ORD	Can help identify potential cost savings.	Provides third-party verification of sustainable practice achievements. Helps achieve environmental goals.	Include members from across the organization to facilitate integration and implementation.	Helps promote internal awareness.	19
Tie sustainability reporting and performance requirements to monthly and project completion payments (invoices).			ORD	Negative cost implications for non-compliance.	Emphasizes the importance of meeting sustainability requirements.	Compliance ensures realization of operational benefits established in contracts. Clarifies requirements upfront.	Compliance ensures realization of social benefits established in contracts.	18
Establish penalties for contractors who don't comply with sustainability reporting and performance requirements.			ORD	Negative cost implications for non-compliance.	Emphasizes the importance of meeting sustainability requirements.	Compliance ensures realization of operational benefits established in contracts. Clarifies requirements upfront.	Compliance ensures realization of social benefits established in contracts.	18
Assign or hire a LEED® AP to review information regarding sustainable concepts, practices, and submittals.	LEED®	ID Credit 2	SFO, BOS, ORD	Can help identify potential cost savings.	Creates awareness of environmental focus and benefits.	Facilitates the flow of information and helps meet submittal requirements.	Helps promote internal awareness.	39
Document all sustainable construction activities to track progress at several stages throughout the construction process (e.g. checklists and progress reports). Prepare interim progress reports to track and document any gaps that may occur in construction or documentation. Provide continual feedback on sustainability performance.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39
Establish and monitor compliance with a specified construction equipment operation schedule. For example, prohibit operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work between weekday hours of 7 p.m. and 7 a.m., and 8 p.m. and 9 a.m. on weekends or holidays to prevent noise disturbances across a residential or commercial real property line.				May have cost and schedule implications.	May reduce noise impacts on adjacent noise sensitive land uses.	May restrict type and timing of construction operations.	May reduce noise impacts on adjacent noise sensitive land uses; may reduce noise complaints.	17

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Flag or otherwise mark all areas not to be disturbed by construction.			LAX, ONT, VNY, PMD	Reduces areas of site disturbance and potential mitigation requirements.	Reduces areas of site disturbance and potential environmental impacts.	Establishes limits of construction.	Reduces areas of site disturbance and potential dust emissions.	39
Pre-Construction								
Policies, Contracts, and Specifications								
Compliance/Performance Monitoring								
Establish construction vehicle speed limits to minimize noise and dust.				No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise sensitive land uses and minimize dust emissions.	May improve safety of construction operations.	Creates a safer work site and may reduce noise impacts on adjacent noise sensitive land uses.	2
Specify strict site lighting criteria and update periodically in conjunction with seasonal daylight fluctuations to maintain safe light levels while avoiding off-site lighting and night sky pollution.	LEED®	SS Credit 8	LAX, ONT, VNY, PMD	Reduces energy costs.	Reduces light emissions and energy consumption.	Requires that employees and contractors are trained on lighting and are incentivized (if necessary) to follow procedures.	Reduces light emissions on surrounding communities and adjacent land uses.	39
Provide contractors with a list of local companies that reuse and recycle materials.				May reduce hauling, disposal, and fuel costs.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Update through periodic construction open houses.	May help provide opportunities for the involvement of MBEs, small and/or local businesses.	46
Conduct an emissions inventory for all construction activities based on known emissions sources, or based on land use if details are not available.			LAX, ONT, VNY, PMD	Depending on scope of project, emissions inventory may be fairly costly to conduct.	Helps identify emission sources and where mitigation efforts should be concentrated to reduce emissions.	No applicable Research Team Consideration.	Helps identify emission sources and where mitigation efforts should be concentrated to reduce emissions.	39
Develop a Tier compliant and retrofit program for construction vehicles (e.g., retrofit all pre-Tier, Tier 1 and Tier 2 construction vehicles).			LAX, ONT, VNY, PMD	May require investment to upgrade vehicles and equipment.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHGs.	39
Provide incentives to encourage that a minimum of 5 percent of construction workers use bicycles for all or part of their daily commute.	LEED®	SS Credit 4.2		Use airport funds raised from permit or fee parking to encourage bicycle usage.	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Provide signs near the construction site that indicate bicycling facilities are available and display their location.	Minimizes impact to local traffic and congestion.	64
Appoint an IAQ manager who will identify problems and methods of mitigation.	LEED®	IEQ Credit 3.1	LAX, ONT, VNY, PMD	May require additional staff training.	Raises awareness.	Ensures comprehension of tasks; allows for streamlined operations - identifying problems and providing quick mitigation will avoid delays.	May improve air quality within buildings. May minimize worker's exposure to potentially harmful chemicals.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Install an Engineered Materials Arresting System (EMAS) bed to meet FAA Runway Safety Area requirements instead of impacting sensitive natural resources or existing infrastructure/facilities.			ELM	May have cost implications.	The EMAS concrete bed has to be periodically maintained to ensure its integrity, and reconstructed if damaged by weather events or aircraft incidents – this may result in emissions and material requirements.	EMAS beds require periodic maintenance and may need reconstructed if subjected to flooding.	Provides increased aircraft safety on runway ends where it is impossible or difficult to provide a standard Runway Safety Area.	23
Pre-Construction								
Initial Project Scheduling								
General								
Plan the phases or stages of construction to minimize exposure. Before site disturbance occurs, perimeter controls, sediment traps, basins, and diversions should be in place to control runoff and capture sediments.			LAX, ONT, VNY, PMD	Can avoid costs of fines from violating regulations from permitting agencies or governments.	Can control runoff and capture sediments as site disturbance occurs. Minimizes runoff into nearby water resources.	Consider the local climate and geology.	May reduce impacts to water quality in the local community.	39
Evaluate projects and components on a life cycle basis. Perform a life cycle assessment (LCA) to assess the environmental aspects and potential impacts associated with a product, process, or service, by: 1) compiling an inventory of relevant energy and material inputs and environmental releases; 2) evaluating the potential environmental impacts associated with identified inputs and releases; and 3) interpreting the results to make a more informed decision. See the EPA's website at www.epa.gov for information on managing and conducting a LCA.				May reduce total life cycle costs (construction, operation, maintenance, and decommissioning).	Consideration of the environmental costs and benefits of the project may reduce overall environmental impacts.	Careful selection of products may reduce project waste and minimize maintenance.	May reduce the frequency and duration of future construction projects (minimizing temporary construction impacts on the local community; e.g., noise levels and traffic impacts).	20
Coordinate recyclable collection infrastructure with hauler capability.			LAX, ONT, VNY, PMD	May reduce hauling, disposal, and fuel costs.	May reduce materials/ components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	May require flexibility to provide on-site staging, storage, containment areas. Helps avoid delays during the removal of materials.	May facilitate use of local, small businesses.	39
Adopt a "first-in, first-out" policy to prevent finish materials from becoming out-dated. The first materials delivered to the site are the first ones used on-site.				Avoids cost of replacing spoiled or out-dated materials.	Reduces waste from spoilage. Reduces transportation impacts of removing spoiled materials and delivering replacement materials.	Consider placement of materials and workflow to ensure compliance with policy.	Reduced transportation lowers the impact of delivery vehicles and waste haulers on local communities.	55

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Pre-Construction								
Initial Project Scheduling								
General								
Closely coordinate deliveries of construction materials with scheduled installation times to minimize vehicles queue times.			HNL, LAX, ONT, VNY, PMD	Planning and coordinating the materials ordering processes on site prevents cumulative over-ordering. May reduce time-based delivery fees. It may reduce costs associated with installing or replacing damaged materials, but could be more expensive since items are not ordered in bulk.	Can increase transportation related emissions if materials are not ordered in bulk (e.g., several trips).	Consider potential weather restraints (e.g., snow) or terrain hazards and the delays they may cause. May also reduce the size of the staging area and materials storage areas.	May add to local community traffic levels if this practice increases the number of deliveries made on a project level.	39
Locate construction laydown areas and stockpiles on areas that will be paved as part of the construction.			LAX, ONT, VNY, PMD	Helps avoid water contamination cleanup costs.	May help avoid unnecessary soil compaction and prevent erosion. Ensures that soil, sand, gravel, and other materials are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	May protect water quality in the local community.	39
Establish a schedule for when construction lighting is required and develop a policy to reduce lighting when not needed.			LAX, ONT, VNY, PMD	Reduces energy costs.	Reduces light emissions and energy consumption.	Requires that employees and contractors are trained on lighting and are incentivized (if necessary) to follow procedures.	Reduces light emissions on surrounding communities and adjacent land uses.	39
Identify efficient construction scheduling and operations to mitigate air emissions.			LAX, ONT, VNY, PMD	May have schedule implications.	May reduce total emissions over varying periods of time (daily or annual)	May result in extending construction schedule to minimize emissions on a daily or annual basis.	May reduce total emissions.	39
Ensure construction activities do not require significant of vehicle idling times.			LAX, ONT, VNY, PMD	Lowers fuel costs.	Reduces emissions, fuel consumption, and the environmental impact of drilling, pumping, transporting, and refining crude oil.	Plan construction activities to reduce staging time of construction equipment.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHGs.	39
Limit traffic and staging locations to areas that will be paved.			LAX, ONT, VNY, PMD	Helps avoid water contamination cleanup costs and landscaping repairs.	May help prevent soil compaction and erosion. Ensures that soil, sand, gravel, and chemicals are not carried away via runoff.	Communicate with all of the appropriate people working on the project.	Minimizes health impacts caused by dust and particulate matter.	39
Provide a transportation plan to and from the construction site that lists available public transportation options, directions, fares, and any available discounts or airport incentives.	LEED®	SS Credit 4.1	LAX, ONT, VNY, PMD	Reduces land requirements; minimizes the number of construction employee spaces required (keeping spaces open for fee-based customer parking).	Post display boards that illustrate public transportation connection opportunities, routes, fares, and directions.	Post display boards that illustrate public transportation connection opportunities, routes, fares, and directions.	Minimizes impact to local traffic and congestion.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Pre-Construction								
Initial Project Scheduling								
General								
If possible, locate the construction staging area (or shuttle bus locations) within a 0.5 mile walking distance of an existing commuter rail or subway/elevated train station and/or within a 0.25 mile walking distance of one or more stops for two or more bus lines.	LEED®	SS Credit 4.1		If possible, work with a local Transportation Management Association (TMA) to develop alternative transportation access options.	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Post display boards that illustrate the available shuttles and public transportation connection opportunities, routes, fares, and directions.	Transit use decreases congestion on site and decreases traffic disruption and congestion in neighboring areas.	64
Coordinate with local and regional transit authorities to advance multiple transit connection opportunities to the construction site.	LEED®	SS Credit 4.1	LAX, ONT, VNY, PMD	If possible, work with a local Transportation Management Association (TMA) to develop alternative transportation access options.	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Post display boards that illustrate the available shuttles and public transportation connection opportunities, routes, fares, and directions.	Transit use decreases congestion on site and decreases traffic disruption and congestion in neighboring areas.	39
Coordinate carpooling to construction sites by setting up schedules and incentives (such as preferential parking) based on locations. Use website schedules, meetings, and/or displays boards in common areas.	LEED®	SS Credit 4.4	LAX, ONT, VNY, PMD	Reduces land requirements; minimizes the number of construction employee spaces required (keeping spaces open for fee-based customer parking).	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Use website schedules, meetings, and/or displays boards in common areas.	Decreases congestion on site.	2, 39
Deconstruction/Demolition								
Planning For Future Use								
Plan for potential uses for the structure and building components (consider future value of materials and systems during selection).			ORD	Can reduce future building costs by avoiding need to purchase new components or having to remodel buildings.	Can reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Can reduce generation of future waste; facilitates flexible use of space.	Reusing materials may reduce the frequency and duration of future construction projects (minimizing temporary construction impacts on the local community; e.g., noise levels and traffic impacts).	2
Evaluate potential future uses for mechanical, electrical, and plumbing systems.			ORD	Can reduce future building costs by avoiding need to purchase new components.	Can reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Can reduce generation of future waste; facilitates flexible use of space.	Reusing materials may reduce the frequency and duration of future construction projects (minimizing temporary construction impacts on the local community; e.g., noise levels and traffic impacts).	2

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Design the HVAC system so that it is easy to expand or downsize depending on the future need of the space. Specify flexible components of HVAC, electrical and fiber optics, and other wiring.				May decrease operational costs (e.g. energy) and capital costs (e.g. equipment) by optimizing for current use.	May decrease energy consumption by not over-sizing components.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Pre-Construction								
Deconstruction/Demolition								
Planning For Future Use								
Design and install AC roof units so that additional units may be placed if necessary in the future.				May avoid additional costs associated with expanding AC roof units.	May reduce environmental impacts by eliminating need for expansion of structures.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Design for current needs with the ability to expand into the future. Do not oversize components during the initial design phase to account for future build-out.				May decrease operational costs (e.g. energy), maintenance costs and capital costs (e.g. equipment) by optimizing for current needs.	May ensure efficient energy consumption by not over-sizing components.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce future temporary construction impacts on the local community; e.g., noise levels and traffic impacts.	2
Design for additional temperature, electrical, sprinklers and communication zones in a large space so that future renovation work will have adequate services.				May minimize future costs to meet changing needs.	May reduce need for future construction material.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Place entrances and corridors to spaces in such a way that future uses may utilize existing egresses.				May decrease future rehabilitation costs.	May reduce need for future construction material.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Place windows in new construction projects with appropriate spacing for future placement of dividers or permanent walls.				May decrease future renovation costs to meet changing needs.	May reduce need for future construction material.	May allow for easier expansion, reducing future impacts to airport operations.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Evaluate the structure and component life cycle prior to purchasing materials/equipment.				May reduce total life cycle costs (construction, operation, maintenance, and decommissioning).	Consideration of the environmental costs and benefits of the project may reduce overall environmental impacts.	Careful selection of products may reduce project waste and minimize maintenance.	May reduce the duration of future projects (minimizing temporary impacts on the local community; e.g., noise levels and traffic impacts).	2
Create touchdown spaces or other flexible and diverse workspaces to enable expansion as well as ad-hoc collaborations and enhance opportunities for efficient use of facilities.				May reduce the cost of future expansion projects.	May reduce need for future construction material.	Flexible workspaces may increase efficient use of spaces.	No applicable Research Team Consideration.	2

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Identify salvage opportunities prior to demolition activities to encourage salvaged materials re-use (e.g., fencing, kiosks, parking curbs, signage, lighting, benches, floor tile, doors, windows, carpeting, HVAC, etc.).	LEED®	MR Credit 3		Potential cost-savings from re-use on other projects or sale.	Conserves natural resources.	Identify at outset, organize and monitor during construction, and establish staging and storage areas. Explore salvage markets local to the site for use in acquiring salvaged materials.	Becomes potential asset to local community - consider sale or donation.	2

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Policies and Regulations								
Sustainability Training and Tracking								
Establish an airport-specific rating/ranking system in conjunction with the airport sustainability guidance manual. Provide rewards (certificates of achievement, financial incentives, etc.) for contractors who meet and or exceed sustainability goals.			LAX, ONT, VNY, PMD	Could be tied to cost savings generated by practices employed.	Helps achieve environmental objectives. Encourages other contractors to improve their sustainability efforts to achieve recognition.	Determined by goals. May have operational and/or cost implications.	Markets the specific sustainable practices and related EONS benefits on a local, national, and international level.	55
Require regular sustainability progress reports during construction projects (quarterly or at construction milestones) that indicate sustainability goals, accomplishments, and lessons learned.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39
Provide sustainable construction training and awareness programs, presentations, workshops, and/or meetings for contractors, airport staff, the media, and the community.			DEN	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Use internal workshops or workshops available through other organizations; for example, LEED® training workshops are available across the U.S. throughout the year. Visit www.usgbc.org.	Promotes awareness and internal and external communication.	15
Provide posters, flyers, and exhibit boards displaying LEED®/sustainability requirements and processes for contractors.	LEED®	*General*		Creates awareness at a minimal initial cost; may help achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	May help streamline the project process.	Promotes awareness and internal and external communication.	35
Document all sustainable construction activities to track progress at several stages throughout the construction process (e.g. checklists and progress reports). Prepare interim progress reports to track and document any gaps that may occur in construction or documentation. Provide continual feedback on sustainability performance.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39
Link achievement of the construction team's sustainability goals to performance reviews of key personnel.			LAX, ONT, VNY, PMD	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures project team members are incorporating sustainability requirements in their daily responsibilities and assignments.	Promotes awareness and internal communication.	39

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Policies and Regulations								
Community Outreach								
Conduct community partnering programs by developing partnerships with community groups, schools, and local businesses.			LAX, ONT, VNY, PMD	Raises awareness; enhances the airport so that it can continue to be an economic generator and create additional economic benefits for the community. Sharing resources may provide cost savings for both the airport and the community (e.g., sharing of excess construction materials).	Creates awareness of environmental focus and benefits.	No applicable Research Team Consideration.	This will reduce delays during planning application, reduce the risk of environmental protest during site works, enhance site community relations and provide greater acceptance of the completed scheme.	2, 39
Coordinate with local schools to arrange for field trips or presentations for education on sustainable construction practices.			ORD, LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	Establishes that a project/airport has an environmental focus.	Carefully plan and coordinate airfield tours to ensure they would not delay (or be delayed by) airport operations and/or construction projects.	Promotes awareness, communication, and educational opportunities to the local community.	39
Partner with universities and research centers to evaluate, demonstrate, and potentially market new sustainable airport construction practices.			SFO	Improves economic efficiency. May help attract grant and industry funding.	Improves environmental efficiency.	Improves operational efficiency.	Promotes awareness, communication, and educational opportunities.	16
Establish sustainable airport construction internships, stewardships, and/or public education programs (focus on low-income and diverse populations).				Provides added staff assistance and creates research and educational opportunities.	Establishes that a project/airport has an environmental focus.	No applicable Research Team Consideration.	Helps assure the community is involved in the project. Provides job opportunities and career training for the local community. Promotes awareness, communication, and educational opportunities.	3
Conduct an industry forum/conference to share and learn about sustainable construction practices (engage other contractors, the local community, and construction and aviation industries). Conduct tours of the construction site.			LAX, ONT, VNY, PMD	Raises awareness; potential cost savings from learning from others.	Creates awareness of environmental focus and benefits.	Use industry conferences, annual reports, websites, presentations, press releases, articles in trade journals, etc.	Markets the specific sustainable practices and related EONS benefits on a local, national, and international level.	3, 39
Establish industry peer review groups to provide input and experiences of sustainable construction practices.				Potential cost savings from sharing information and learning from others.	Provides environmental benefits from sharing information and learning from others.	Provides operational benefits from sharing information and learning from others.	Promotes awareness, communication, and educational opportunities.	3

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Policies and Regulations								
Health and Safety								
Participate in the Occupational Safety and Health Administration's (OSHA's) Voluntary Protection Programs.			LAX, ONT, VNY, PMD	May increase project costs but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Conduct safety observations to ensure workers are abiding by the health and safety plan.			LAX, ONT, VNY, PMD	May increase project costs but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Record and submit weekly reports summarizing all safety incidences as well as all events which may have resulted in an accident and an evaluation of what steps can be taken to prevent those events in the future.			LAX, ONT, VNY, PMD	May increase project costs but could result in cost savings from fewer injuries and increased safety awareness.	No applicable Research Team Consideration.	Increases safety awareness, which should reduce injuries.	Increases safety awareness, which should reduce injuries.	39
Use personal air monitoring systems to inform construction workers of hazardous environments. This technology can improve occupational safety and health in the construction workplace.				Reduces potential of harm to construction workers.	Identifies and reduces emissions of toxic substances.	May cause some delays to work, but improves safety of work environment.	Reduces potential of harm to construction workers and site personnel.	55
Provide reusable or ventilated masks/respirators for worker comfort and health. Require construction workers to wear them when dust emissions are visible.			LAX, ONT, VNY, PMD	Reduces potential of harm to construction workers.	Increases awareness and compliance with dust control measures.	Increases awareness and compliance with proper dust control measures.	Reduces potential of harm to construction workers and site personnel.	39
Monitor the site's daily and/or historic air quality index level(s) via the EPA's MyEnvironment Webpage. The desired location is keyed in from the EPA Home Page (www.epa.gov) under the section called "MyEnvironment." Water quality and health risk updates can also be accessed via this website.				Reduces potential of harm to construction workers.	Increases awareness and compliance with dust control measures.	Increases awareness and compliance with proper dust control measures.	Reduces potential of harm to construction workers and site personnel.	3

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Policies and Regulations								
Environmental Tobacco Smoke (ETS) Control								
Require all parts of the construction sites to be non-smoking.	LEED®	IEQ Prerequisite 2		May reduce site cleanup costs.	Removes tobacco smoke as a potential emission from the construction site.	Increases site safety. Depending on local regulations, the contracting agency(ies) may or may not have the authority to ban smoking on-site.	Increases site safety and eliminates exposure to tobacco smoke.	2
Prohibit smoking within structures under construction and restrict smoking on-site during construction.	LEED®	IEQ Prerequisite 2	LAX, ONT, VNY, PMD	May reduce site cleanup costs and prevent damage of installed building components.	Limits exposure to tobacco smoke.	Increases site safety. Depending on local regulations, the contracting agency(ies) may or may not have the authority to ban smoking on-site.	Increases site safety and limits exposure to tobacco smoke.	39
Provide a designated exterior smoking area (protected from the elements) that is sufficiently distant from construction activities. Locate any exterior designated smoking areas away from entries and operable windows.	LEED®	IEQ Prerequisite 2	LAX, ONT, VNY, PMD	May reduce site cleanup costs and prevent damage of installed building components.	Limits exposure to tobacco smoke.	Increases site safety. Depending on local regulations, the contracting agency(ies) may or may not have the authority to ban smoking on-site.	Increases site safety and limits exposure to tobacco smoke.	39
If an interior smoking area is necessary, provide a designated smoking room designed to effectively contain, capture, and remove ETS from the building using a separate ventilation system.	LEED®	IEQ Prerequisite 2		Increases costs but limits exposure to ETS; may prevent damage to installed building components.	Limits exposure to tobacco smoke.	Increases site safety.	Increases site safety and limits exposure to tobacco smoke.	2
Establish zero exposure of non-smokers to ETS.	LEED®	IEQ Prerequisite 2	ORD	No applicable Research Team Consideration.	Limits exposure to tobacco smoke.	Increases site safety. Depending on local regulations, the contracting agency(ies) may or may not have the authority to ban smoking on-site.	Limits exposure to tobacco smoke.	19
Construction Methods								
Scheduling and Sequencing								
Expedite the completion of the building envelope to minimize moisture exposure to interior surfaces, thus minimizing the potential for mold.			LAX, ONT, VNY, PMD	Helps avoid additional costs associated with installing or replacing damaged materials.	Can reduce landfill hauls of damaged materials/components. Also reduces the environmental impacts of producing new construction products and materials.	May minimize temporary airport activity delays and landside passenger traffic delays.	By preventing mold from growing, worker and occupant health can be preserved. Reduced temporary traffic delays would benefit the community.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Construction Methods								
Scheduling and Sequencing								
Use "lean construction" project management practices (e.g., minimal inventory and "cradle to grave" project delivery). A lean construction production system delivers a custom product instantly on order but maintains no intermediate inventories.				Reduces extra handling and excessive labor. Can reduce material costs by ordering only what is needed but may also increase transportation costs if supplies are not ordered in bulk; the personnel in charge of ordering construction materials should identify which materials make the most economic sense to be ordered in bulk and which should be ordered "just in time."	Reduces waste associated with inventories and defective products. Can increase transportation related emissions if supplies are not ordered in bulk (e.g. several trips). Reduces the environmental impacts of having to produce and haul re-ordered materials or to return excess materials.	By reducing pressures to keep construction running at maximum production, extensive intermediate inventories or "the waste of over production" can be reduced. Requires tight coordination between the construction process and the arrival of parts from supply chains.	May add to local community traffic levels if this practice increases the number of deliveries made on a project level.	34, 62
Construction Methods								
Deconstruction/Disassembly								
Use homogeneous material whenever possible. Homogeneous material means a unit that cannot be mechanically disjointed in single materials. Homogeneous materials include individual types of plastics, ceramics, glass, metals, alloys, paper, board, resins and coatings.			ORD	Use of homogeneous material may reduce complexity, cost, and maintenance.	No applicable Research Team Consideration.	Reduces the duration of deconstruction.	May reduce the duration of deconstruction, minimizing temporary impacts on the local community such as traffic.	2
Provide instructions and ensure that connections are accessible to expedite the disassembly process.				Providing disassembly instructions helps to ensure that components can be disassembled and potentially reused with minimal cost. Accessible connections allow disassembly to occur faster than otherwise might be possible.	May reduce duration and area of disturbance during disassembly.	Detailed instructions may decrease necessary staff training. May reduce impacts to airport operations in terminals during future rehabilitation projects.	May enhance worker's safety.	2
Minimize the use of chemical (adhesive) connectors; instead use friction-based connectors.				Some friction-based connectors may be more expensive than chemical connectors.	Reduces exposure to hazardous chemical products.	May be easier to maintain.	May minimize worker's exposure to potentially harmful chemicals.	2
Select fittings, fasteners, adhesives and sealants that allow for quicker disassembly and facilitate the removal of reusable materials. Material reuse is highly dependent upon the connections.				May decrease disassembly labor costs.	May reduce duration and area of disturbance during disassembly.	May allow for easier disassembly, reducing impacts to airport operations during future projects.	May enhance worker's safety.	55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Methods								
Deconstruction/Disassembly								
Strategically locate and provide appropriate identification of load-bearing walls.				May decrease future building costs to meet changing needs. Properly identifying load-bearing walls reduces costs associated with having to re-identify walls or creating unsafe renovations.	No applicable Research Team Consideration.	May allow for easier expansion, reducing future impacts to airport operations.	Properly identifying load-bearing walls enables safe structural modifications.	2
Use a raised floor system to reduce data and communication installation costs during initial build-out and allow for easier, more economical moves and space reconfiguration.				Reduces data and communication installation costs and allows for more economical moves and space reconfiguration. Compare incremental cost of raised floor to reduced costs of installation and maintenance (materials and labor) for data and communication cabling.	Minimizes noise impacts in occupied areas. May require less data and communication wiring.	May allow for easier expansion or deconstruction, reducing future impacts to airport operations.	May improve employee productivity by reducing noise distractions.	55
Site Disturbance Minimization								
Compliance and Safety								
Photographically document site conditions prior to start of construction operations (include aerial photographs). Take weekly photographs throughout the entire project. Photographs shall be provided for unrestricted use by Owner.				Submit (or require the contractor to submit) a minimum (e.g., 20 photographs on CD, formatted to ISO 9660) with each application for payment.	Indicate photographs demonstrating compliance with environmental and/or sustainable procedures.	Promotes awareness and documents compliance with sustainable practices.	Promotes awareness and internal communication.	43
Flag or otherwise mark all areas not to be disturbed by construction.			LAX, ONT, VNY, PMD	Reduces areas of site disturbance and potential mitigation requirements.	Reduces areas of site disturbance and potential environmental impacts.	Establishes limits of construction.	Reduces areas of site disturbance and potential dust emissions.	39
Use clean-cut or trenchless technology for installing and rehabilitating underground utility systems.			LAX, ONT, VNY, PMD	Excavation is typically more cost-effective when placement is shallow and traffic is not a major constraint. Cost is dependent of site characteristics and circumstances.	This creates minimal surface disruption and can eliminate the need to remove sections of streets, sidewalks, and lawns, and can avoid tree loss and tree root damage.	Reduces site disturbance. Construction often takes less time.	Reduces traffic congestion, including traffic associated with culvert excavation. Reduces safety concerns associated with steep excavation slopes, work inside trench boxes, and worker exposure to traffic. May be susceptible to fire damage.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Immediately repair any construction related roadway damage.			LAX, ONT, VNY, PMD	Left untreated, roadway damage will cost more to repair later. Minimizes risk of vehicle damage and personal injury.	May temporarily increase vehicle emissions and noise but could reduce the potential for more complex repairs.	Provide appropriate signage before and during repairs.	Enhances roadway safety; prevents damage to vehicles.	39
During Construction								
Site Disturbance Minimization								
Compliance and Safety								
Install an Engineered Materials Arresting System (EMAS) bed to meet FAA Runway Safety Area requirements instead of impacting sensitive natural resources or existing infrastructure/facilities.			ELM	May have cost implications.	The EMAS concrete bed has to be periodically maintained to ensure its integrity, and reconstructed if damaged by weather events or aircraft incidents - this may result in emissions and material requirements.	EMAS beds require periodic maintenance and may need reconstructed if subjected to flooding.	Provides increased aircraft safety on runway ends where it is impossible or difficult to provide a standard Runway Safety Area.	23
Site Disturbance Minimization								
Water Quality Protection								
Develop and implement a Stormwater Pollution Prevention Plan for construction activities. Inspect the site frequently to ensure compliance.	LEED®	SS Credit 6.1	BOS	Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Helps meet regulatory requirements and protects the natural environment. Ensures that contaminates/debris/materials are not carried off-site through stormwater.	Helps meet regulatory requirements.	Protects water quality in the local community.	2
Train on-site personnel in pollution prevention procedures and always make the SWPPP available at the construction site (and available online) for review.				May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Raises awareness.	Ensures comprehension of tasks; allows for streamlined operations.	Promotes awareness and communication; protects water quality in the local community.	2
Monitor water quality impacts before and during construction, especially after significant storm events; address issues of concern (based on data from monitoring) as soon as possible.			ORD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May avoid unexpected and potentially large costs.	Ensures that construction activities have not impacted water quality in the area.	Address issues of concern (based on data from monitoring) as soon as possible.	Protects water quality in the local community.	2
Install slurry walls and/or bedrock grouting during construction to prevent commingling of aquifers. These practices reduce the amount of ground water penetrating detention basins, which would require additional energy to pump.			ORD, LAX, ONT, VNY, PMD	Cost-effective for many groundwater control and groundwater remediation problems. Cost is dependent on the depth, length, and width of wall; site geological and hydrological characteristics; available workroom; etc.	Protects against groundwater contamination; may save energy from pumping. May require the use of heavy construction equipment.	Slurry wall/cutoff wall excavations can be performed in all types of soils and below the groundwater table. Excavation deeper than 100 feet requires a crane and clam bucket.	Protects water quality in the local community.	39

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Store waste in areas sheltered from rain and runoff.				Helps avoid water contamination costs.	Can help to minimize exposure of harmful substances/contamination to the environment.	Can avoid unexpected delays due to spill cleanup.	Protects water quality in the local community.	2
Use non-toxic waste materials in landscaping applications such as brick nuggets - a byproduct of brick manufacturing.	LEED®	MR Credit 4		Potential cost savings; brick nuggets are very durable.	Useful application of a waste product.	Brick nuggets are useful for walkways, landscaping, and ground covering needs.	Various colors, shapes, and sizes can be used to enhance the aesthetic value of the landscape.	55
During Construction								
Site Disturbance Minimization								
Water Quality Protection								
Limit the number of designated concrete washout areas to avoid the expense of cleaning and maintaining several small washout areas. Make sure washouts are sized appropriately for adequate storage capacity. Use clear visible signs and educate the contractor to ensure the designate areas are used.				Avoid the expense of cleaning and maintaining several small washout areas; may require training costs.	Limits the distribution and impacted areas.	Consider locations in reference to job site to minimize transportation and schedule impacts to reach designated washout area.	Protects water quality in the local community.	55
Site Disturbance Minimization								
Erosion and Sedimentation Control								
Incorporate BMPs such as temporary sedimentation basins, temporary ditch checks, diversion dikes, temporary ditches, sediment traps, silt fences, water quality swales, rain gardens, dry wells and/or pipe slope drains into construction plans.	LEED®	SS Prerequisite 1	ORD, LAX, ONT, VNY, PMD	May have a high upfront cost but may avoid unexpected and potentially large costs.	Ensures that soil, sand, gravel, and other materials are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water quality in the local community.	64
Incorporate temporary and permanent soil stabilization techniques, including: compost, hydraulic mulch, hydroseeding, soil binders, straw mulch, wood mulch, and rolled mats.	LEED®	SS Prerequisite 1	LAX, ONT, VNY, PMD	May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Ensures that soil, sand, gravel, and other materials are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water quality in the local community.	39
To prevent erosion, minimize the extent and duration of bare ground surface exposure.			LAX, ONT, VNY, PMD, ORD	Temporary seeding/composting on bare surfaces may increase costs.	Can minimize erosion and runoff into nearby water resources. May also help with dust control.	No applicable Research Team Consideration.	May increase employee welfare by the reduction of dust. May reduce impacts to water and air (dust) quality in the local community.	39
Maintain mulch stockpiles for use as needed to control erosion and conserve irrigation water.			SLC, U42, TVY	Reduces the demand for irrigation, saving costs.	Conserves irrigation water and reduces erosion.	Maintaining a stockpile on-site will keep operations timely.	Protects water quality and supply in the local community.	58

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Utilize compost for erosion control and moisture retention.			LAX, ONT, VNY, PMD	May reduce disposal fees of construction waste.	Using compost can improve soil quality, reduce runoff, conserve water and minimize the need for landscaping chemicals.	Food waste should not be used on or near airport property to prevent a potential wildlife hazard. Consider the site topography and geology.	Protects the water supply in the local community.	39
During Construction								
Site Disturbance Minimization								
Erosion and Sedimentation Control								
Use lime as an aid for the modification and stabilization of soil beneath road and similar construction projects. Lime can modify almost all fine-grained soils, but the most dramatic improvement occurs in clay soils of moderate to high plasticity.			ORD	The structural contribution of lime-stabilized layers in pavement design can create more cost-effective design alternatives. Potentially more economical than importing aggregate for the same thickness of base course.	Using lime can substantially increase the stability, impermeability, and load-bearing capacity of the sub-grade. Lime could leach into groundwater, contaminating nearby water sources.	Increasing stability and reducing erosion can minimize delays due to unforeseen events. Placing the wrong kind or wrong amount of lime additive or improperly incorporating the additive into the soil can have devastating results.	Protects water quality in the local community.	44
Use biodegradable rolled mulch mats/natural fiber geotextiles (permeable fabrics) to reduce erosion. Ensure they conform to site contours.			LAX, ONT, VNY, PMD	Biodegradable mats don't require pick-up from the construction site and/or disposal, reducing labor costs.	Provides an alternative to plastic mats or other non-biodegradable materials. Ensures that soil, sand, gravel, and other materials are not carried away via runoff - affecting plants and animals in receiving waterbodies. Minimizes dust and helps establish vegetation quickly.	Increasing stability and reducing erosion can minimize delays due to unforeseen events. Non-biodegradable textiles don't require removal.	Protects water quality in the local community.	39
Minimize disturbance to landscape areas and attempt to maintain existing topography, terrain, tree and vegetation population (non-wildlife attracting).			LAX, ONT, VNY, PMD	Can avoid costs associated with land clearing/leveling. May avoid repurchasing landscaping elements.	Protects the natural environment; vegetation can reduce erosion and filter sediment.	No applicable Research Team Consideration.	May prevent complaints from surrounding communities and maintain an aesthetic appeal.	39
Achieve permanent soil stabilization in seeded areas by covering over 80% of soil surface with vegetation; make sure a layer of topsoil and compost is present to support growth.			LAX, ONT, VNY, PMD	Helps avoid water contamination cleanup costs.	Protects the natural environment; vegetation can reduce erosion and filter sediment.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	May enhance aesthetics and protect water quality in the local community.	39
Construct stabilized construction entrances on level ground where possible. Grade the entrance to prevent runoff from leaving the construction site and provide ample turning radii.			HNL	Helps avoid water contamination cleanup costs.	May help avoid unnecessary soil compaction and prevent erosion. Ensures that soil, sand, gravel, and other materials are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Accidental depositions must be swept up immediately and may not be washed down by rain or by any other means.	Protects water quality in the local community.	13, 38

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Site Disturbance Minimization								
Erosion and Sedimentation Control								
If a wash rack is provided at the construction vehicle entrance, washing is to be done on a paved or crushed stone pad that drains into a properly constructed sediment trap or basin. Liquids from these activities shall be collected, managed as contaminated wastewater, and properly disposed.			HNL	May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Ensures that soil, sand, gravel, and chemicals are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Multiple steps may require more time.	Protects water quality in the local community.	38
Stabilize access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes immediately after grading and maintain them frequently to prevent erosion and control dust.			HNL	Helps avoid water contamination cleanup costs.	May help avoid unnecessary soil compaction and prevent erosion. Ensures that soil, sand, gravel, and chemicals are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Increasing stability and reducing erosion can minimize delays due to unforeseen events.	Protects water and air (dust) quality in the local community and reduces the exposure of workers to dust.	38
Establish provisions to retain concrete wastes on-site until they can be appropriately disposed of or recycled. Excess or waste concrete must not be washed into the public way or any drainage system.				Hardened waste concrete may be crushed and reused on-site, reducing costs of bringing new materials on-site.	Ensures that concrete wastes are not carried away via runoff.	May require additional space in order to accommodate concrete wastes.	Protects water quality in the local community.	13
For tenant improvement projects, ensure construction entrances are properly maintained and routine clean up is enforced; ensure that construction entrances are protected from public walkways.			HNL	Helps avoid cleanup costs.	Ensures that soil, sand, gravel, and chemicals are not carried away via runoff - affecting plants and animals in receiving waterbodies.	Maintaining stability and preventing erosion can minimize delays due to unforeseen events.	Maintains public safety. Protects water quality in the local community.	38
Clearly identify refueling stations for demolition equipment, material haulers, and material lifts.				May reduce fuel costs. Consider distributing/presenting a map of the location and the desired route.	Creates awareness.	May reduce minor refueling delays and avoid confusion.	Minimizes traffic impacts on and/or off the airfield.	55
To minimize soil compaction, use construction equipment with longer reaches (i.e., equipment that can remain stationary but operate over a larger radius/area).			LAX, ONT, VNY, PMD	May have cost implications (use of larger equipment).	May reduce site disturbance and dust emissions.	May increase construction schedule/time to complete tasks.	May reduce areas of site disturbance and potential dust emissions.	39
Limit traffic and staging locations to areas that will be paved.			LAX, ONT, VNY, PMD	Helps avoid water contamination cleanup costs and landscaping repairs.	Minimizes site impacts. Minimizes dust and particulate matter.	Communicate with all of the appropriate people working on the project.	Minimizes health impacts caused by dust and particulate matter.	39

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Appendix B. (Continued).

Sustainable Practice	LEED® LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Site Disturbance Minimization								
Erosion and Sedimentation Control								
Require hand excavation around existing underground utilities.				May require more time and increase labor costs. May help avoid costs and project delays associated with utility pipe/cable disruptions.	May help prevent erosion and protect water quality, minimizing disturbance.	May require more time, but can prevent project delays associated with breaking of utility pipes and cables.	May prevent power/water failures in the community and injuries to construction workers.	55
Site Disturbance Minimization								
Tree and Plant Protection								
Require each contractor to provide a plan to protect existing vegetation during all construction activities.				Widely varies on detail and goals; less so as it becomes part of standard operating procedures. May help prevent fines for removal of trees off-airport.	Promotes awareness and protects the natural environment. May help prevent erosion and filter stormwater runoff.	Reduces site disturbance, minimizing unforeseen project delays.	Promotes internal awareness. Helps maintain aesthetic appeal.	55
Provide temporary fencing, barricades, and guards during construction to protect trees from damage above and below grade.			PDX	May cost less than removing trees and hauling them to landfills.	Protects the natural environment. May help prevent erosion and filter stormwater runoff.	Reduces site disturbance, minimizing unforeseen project delays.	Helps maintain aesthetic appeal.	53
Protect root systems of trees from the following: damage due to noxious materials in solution caused by run off or spillage during mixing and placement of construction materials, or drainage from stored materials; flooding, erosion or excessive wetting resulting from dewatering operations and compaction; unauthorized cutting, breaking, or skinning roots and branches, skinning, and bruising of bark.			PDX	May cost less than removing trees and hauling them to landfills. May be a part of a SPCC and/or a SWPPP.	Protects the natural environment. May help prevent erosion and filter stormwater runoff.	Reduces site disturbance, minimizing unforeseen project delays.	Helps maintain aesthetic appeal.	53
Where trenching for utilities is required within drip lines, tunnel under or around roots by hand digging or boring. Do not cut main lateral roots or tap roots over 1 inch diameter. If necessary, cut smaller roots with sharp pruning instruments; do not break or chop.			PDX	May require more time and increase labor costs. May help avoid costs and project delays associated with removing trees and hauling them to landfills and utility pipe/cable disruptions.	May help prevent erosion and protect water quality, minimizing disturbance.	May increase time requirements due to care around existing trees. Will vary based on the number of trees located within the project area.	Helps maintain aesthetic appeal.	53

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Site Disturbance Minimization								
Tree and Plant Protection								
Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover, or pack with peat moss and wrap with burlap. Water exposed roots, maintain them in a moist environment, and temporarily support and protect them from damage until they are permanently relocated and covered with backfill.			PDX	May require more time and increase labor costs. May help avoid costs and project delays associated with removing trees and hauling them to landfills.	Protects the natural environment. May help prevent erosion and filter stormwater runoff.	May increase time requirements due to care of existing trees. Will vary based on the number of trees located within the project area.	Helps maintain aesthetic appeal.	53
Donate healthy plants and trees removed during construction to the community.			LAX, ONT, VNY, PMD	May cost less than hauling plants and trees to landfills.	Prevents carbon dioxide from being released into the environment.	No applicable Research Team Consideration.	May help improve the community's view of the airport.	39
Prohibit burning of landscape waste. Require that all vegetation that has to be removed because of construction be chipped for mulching and composting or used for process fuel (if the full plant or tree cannot be relocated, sold, or donated intact).			SLC	May reduce hauling, disposal, and fuel costs for the contractor and reduce costs associated with purchasing and hauling topsoil on-site.	Prevents carbon dioxide from being released into the environment; may be reused on site to improve plant/tree health and reduce irrigation needs. May reduce erosion and off-site hauling. May avoid the need for mulch/erosion control materials to be brought on-site.	To reduce on-site haul distances, chip vegetation at the site or near the site of future use. Replant disturbed vegetation as soon as possible.	Protects air quality in the local community. Mulch could be donated to local residents/parks near the airport for use in landscaping.	2, 54, 58
Indoor Air Quality								
Indoor Air Quality (IAQ) Management								
Protect stored on-site or installed absorptive materials, such as insulation, carpeting, ceiling tile, and gypsum wallboard, from moisture damage. Sequence the installation of materials to avoid contamination.	LEED®	IEQ Credit 3.1	HNL, ORD, LAX, ONT, VNY, PMD	Can help avoid purchasing new components due to moisture damage. If contaminated materials are installed, they may lead to expensive and complicated clean up procedures.	Can reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Accomplished by traditional coverings/shelter and packaging (if necessary). May reduce delays associated with the ordering/ transportation of new materials. Sequencing may require additional time and could delay the date of initial occupancy.	Keeping materials pristine may reduce the duration of construction projects, minimizing temporary noise and traffic impacts on the local community.	2, 64
Limit or do not operate air-handling equipment during construction.	LEED®	IEQ Credit 3.1	ORD, LAX, ONT, VNY, PMD	Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	Filtration media used during construction should be replaced prior to building occupancy.	May improve air quality within buildings.	19, 39, 64

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Indoor Air Quality								
Indoor Air Quality (IAQ) Management								
If permanently installed 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.	LEED®	IEQ Credit 3.1		Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	Replace all filtration media immediately prior to occupancy.	May improve air quality within buildings. May minimize worker's exposure to potentially harmful chemicals.	2
During construction, isolate areas of work to prevent contamination of clean or occupied spaces.	LEED®	IEQ Credit 3.1	LAX, ONT, VNY, PMD	Avoids costs associated with re-cleaning spaces or buying new materials. Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	Avoids time associated with re-cleaning spaces or ordering/transporting new materials.	May improve air quality within occupied areas, minimizing occupant's exposure to poor IAQ.	39, 64
Use ventilation systems overnight to purge the work area.			LAX, ONT, VNY, PMD	May increase energy costs.	Reduces IAQ problems resulting from the construction process.	If construction hours are during the day, purging the area at night will not interfere with operations.	May minimize worker's exposure to hazardous indoor air pollutants.	39
Communicate the hazards of IAQ during health and safety meetings.			LAX, ONT, VNY, PMD	May contribute to lowering health insurance rates and healthcare costs.	Promotes awareness.	Communicate with all of the appropriate people working on the project.	Promotes awareness and internal communication.	39
Increase air movement in facilities by using ceiling fans during construction.			ORD	Ceiling fans may be of additional cost to purchase and install.	Improves IAQ during construction.	If ceiling fans are not part of the construction scope, additional time may be needed to install and remove them.	May minimize worker's exposure to hazardous indoor air pollutants.	19
Use a desiccant dehumidifier to control moisture levels during installation of interior finishes. This technology employs a desiccant material to remove humidity from the surrounding space.				Can help avoid purchasing new components due to moisture damage. If contaminated materials are installed, they may lead to expensive and complicated clean up procedures.	Can reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	May reduce delays associated with the ordering/transportation of new materials.	Keeping materials pristine may reduce the duration of construction projects, minimizing temporary noise and traffic impacts on the local community.	55
Use additional filtration to protect fresh air intake sources to keep construction dust from entering the building.			BWI	May increase energy costs but may extend the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use.	Reduces IAQ problems resulting from the construction process.	May reduce delays associated with the ordering/transportation of new materials.	May improve air quality within buildings. May minimize worker's exposure to hazardous indoor air pollutants.	60

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Indoor Air Quality								
Indoor Air Quality (IAQ) Management								
Prohibit "bake-out" or "superheating" of spaces to accelerate the release of gaseous emissions.				May damage building parts, requiring the purchase of new materials and additional labor costs.	Can reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials. Moisture from the air, and some volatile gases, can condense on cooler surfaces.	A "bake-out" may damage parts of the building (e.g., moving concrete floor slabs, causing carpet and vinyl flooring to buckle, cracking windows, warping wood doors warped, etc.) May reduce delays associated with the ordering/transportation of new materials.	Keeping materials pristine may reduce the duration of construction projects, minimizing temporary noise and traffic impacts on the local community.	13
Indoor Air Quality								
Indoor Chemical and Pollutant Source Control								
Use non-absorptive flooring, walls, and finish materials to resist mold growth.			ORD	May have higher upfront costs; helps avoid additional costs associated with installing or replacing materials damaged from mold. May help contribute to lowering health insurance rates and healthcare costs.	Can reduce landfill hauls of damaged materials/components. Also reduces the environmental impacts of producing new construction products and materials.	May reduce future delays associated with building maintenance and the ordering/transportation of new materials.	Protects worker and occupant health.	2, 19
Only use non-toxic cleaning agents for cleaning activities.				Minimal costs; may help contribute to lowering health insurance rates and healthcare costs.	Non-toxic cleaning supplies are less harmful to the natural environment. Biodegradable and bio-based concrete cleaning agents are available.	Specifications may need to be established in project standards and procedures.	Protects worker and occupant health.	2
Provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs.			ORD	May avoid future costs associated with cleanup or non-compliance, as regulated by local governmental agencies.	Helps prevent chemicals from entering groundwater.	No applicable Research Team Consideration.	Protects worker and occupant health.	19
Ensure that interior construction operations aren't scheduled when indoor air quality levels may be unacceptable.				May contribute to lowering health insurance rates and healthcare costs.	Improves IAQ during construction.	May extend the duration of the project.	Minimizes exposure to hazardous indoor air pollutants.	43
Ensure proper ventilations, such as fume hoods, for activities that produce hazardous gasses.			LAX, ONT, VNY, PMD	May have higher upfront costs but may contribute to lowering health insurance rates and healthcare costs.	Reduces IAQ problems resulting from the construction process.	No applicable Research Team Consideration.	Limits the worker's exposure to hazardous or noxious fumes, vapors or dusts.	39
During construction, prohibit the indoor use of combustion engine-based devices without direct exterior exhaust and make-up air.			LAX, ONT, VNY, PMD	May require renting or purchasing electrical or non-combustion equipment.	Reduces IAQ problems resulting from the construction process.	No applicable Research Team Consideration.	May minimize worker's exposure to hazardous indoor air pollutants.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Indoor Air Quality								
Indoor Chemical and Pollutant Source Control								
Within interior spaces, do not use solvents that may penetrate and be retained in absorptive materials such as concrete, gypsum board, wood, cellulose products, fibrous material, and textiles.				Can help avoid purchasing new components due to moisture damage. If contaminated materials are installed, they may lead to expensive and complicated clean up procedures.	Can reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Specifications may need to be established in project standards and procedures. May reduce future delays associated with building maintenance and the ordering/transportation of new materials.	May minimize worker's exposure to hazardous indoor air pollutants.	13
Pre-ventilate packaged dry products at least 48 hours prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.				May have minor cost implications due to energy use.	Reduces IAQ problems resulting from the installation of materials.	Provide a temperature range of 60 to 90°F continuously during the ventilation period. Do not ventilate within limits of work unless otherwise approved by the architect.	May minimize worker's exposure to hazardous indoor air pollutants.	13
Dust Control								
General								
Develop and implement a Construction Dust Control Plan. The plan should document wind patterns including direction and velocity; show locations of disturbed soil; include BMPs that will be used for each disturbed soil location during each phase of construction; provisions for BMP inspections and personnel training; and inspection and record keeping forms, to be kept on-site with the Dust Control Plan. The plan should also include a tracking protocol for implementation of the Dust Control Plan.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Promotes awareness.	Adjust BMPs for dust control based on meteorological conditions and the activity level of disturbed soil.	Improves road safety and reduces dust. Protects air quality in the local community.	39
For soil stockpiles or areas under active construction, cover soil during rainfall, high winds, and at night with plastic sheets or other cover that can be easily removed.			LAX, ONT, VNY, PMD	Minimal cost for covering materials.	Helps control dust.	Minimal time requirements; may require additional staff training.	Improves road safety and reduces dust. Protects air quality in the local community.	39

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Dust Control								
General								
Water down loose materials and exposed earth (using non-potable water) to reduce the potential for dust. Use water from on-airport detention basins, cisterns, or creeks.			ORD, LAX, ONT, VNY, PMD	May have minor cost implications due to water use and labor.	Can prevent erosion and the contamination of nearby water sources. Helps control dust.	Consider the site topography and geology.	Protects air quality in the local community. Reduces demand for potable water.	2
Spray down truck wheel wells (using non-potable water) and use rumble strips before exiting the construction site.				Minimal additional costs.	Helps prevent toxins, pollutants, and/or sediment from traveling off-site and contaminating groundwater.	Use water from on-airport detention basins, cisterns, or creeks.	Protects air quality in the local community.	2
Perform regular street sweeping during construction.				Minimal additional costs for equipment and labor.	Helps prevent toxins, pollutants, and/or sediment from traveling off-site and contaminating groundwater. May temporarily increase dust.	To avoid temporary dust exposure, schedule sweeping before or after regular work hours.	Improves road safety and reduces dust.	2
Install temporary fencing (covered) around the perimeter of the construction site to prevent fugitive dust emissions.				Installing fencing with covering may have cost implications.	Helps control dust.	Minimal time requirements; may require additional staff training.	Improves road safety and reduces dust. Protects air quality in the local community.	2
Require haulers to cover truck beds or maintain at least two feet of freeboard for dust suppression.				Minimal cost for covering materials. May reduce the size of hauls, potentially requiring additional vehicle trips.	Helps control dust.	Minimal time requirements; may require additional staff training.	Protects air quality in the local community.	2
Restrict traffic flows to stabilized construction roads.			LAX, ONT, VNY, PMD	Reduces areas of site disturbance and potential mitigation requirements.	Minimizes the amount of dust generated; promotes awareness.	May allow for safer operations.	Improves road safety and reduces dust. Protects air quality in the local community.	39
Use integral dust collection systems on drywall sanders, cut-off saws, and routers.				May have higher upfront costs but may contribute to lowering health insurance rates and healthcare costs.	Minimizes the accumulation of dust and other contaminants.	May require additional staff training.	Improves worker health. Protects air quality in the local community.	55
Use wet rags, damp mops, and vacuum cleaners with high efficiency particulate absorbing (HEPA) filters to clean dust.				May contribute to lowering health insurance rates and healthcare costs. May require additional labor.	Minimizes the accumulation of dust and other contaminants.	May be time consuming.	Protects worker and occupant health.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Water/Wastewater								
Reduce Potable Water Use								
Use non-potable water or graywater for concrete mixing and aggregate wash down.			LAX, ONT, VNY, PMD	Storage tanks and cisterns may have a high upfront cost; reduces the cost of potable water use.	Conserves potable water.	Requires the approval of a licensed structural engineer.	May improve the community's view of the airport if part of an outreach program. Conserves local and regional potable water supplies.	39
Use non-potable water or graywater for consolidation of backfill material around potable/non-potable pipelines.			LAX, ONT, VNY, PMD	Storage tanks and cisterns may have a high upfront cost; reduces the cost of potable water use.	Conserves potable water.	Requires the approval of a licensed structural engineer.	May improve the community's view of the airport if part of an outreach program. Conserves local and regional potable water supplies.	39
Use non-potable water or graywater for irrigation of landscaping on construction sites.	LEED®	WE Credit 1	LAX, ONT, VNY, PMD	A separate tank, filter, and special emitters may be necessary. Storage tanks and cisterns may have a high upfront cost.	Conserves potable water.	No applicable Research Team Consideration.	May improve the community's view of the airport if part of an outreach program. Conserves local and regional potable water supplies.	39
Consult state water recycling criteria to ensure that recycled water undergoes the recommended treatment processes to achieve the appropriate level for the respective tasks.			LAX, ONT, VNY, PMD	May avoid future costs associated with non-compliance as regulated by local governmental agencies.	Helps prevent toxins, pollutants, and/or sediment from traveling off-site and contaminating groundwater.	May require additional staff training.	Ensures public safety.	39
If temporary irrigation is required, use drip or bubbler systems and utilize rain sensor overrides.	LEED®	WE Credit 1		Higher initial cost; helps reduce water bills. Have lower maintenance requirements. Municipalities may offer rebates or incentives for water-efficient irrigation systems, dedicated water meters and rain or moisture sensors.	Conserves potable water.	No applicable Research Team Consideration.	Conserves local and regional potable water resources.	55, 64
Plant landscaping (non-wildlife attracting) that is native to the region, consistent with a xeriscaping approach.	LEED®	WE Credit 1	DEN	Saves costs on landscaping (no watering labor or irrigation system is required). Require less maintenance and fertilizer than turf grass.	Conserves water. Native species require less fertilizer and pesticides, protecting water quality.	Less maintenance is required for irrigation.	Creates an aesthetically pleasing building site integrated with its natural surrounding. Conserves local and regional potable water resources.	55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Water/Wastewater								
Water Use Reduction								
Collect and use reclaimed graywater and/or harvested stormwater for non-potable needs like sewage conveyance, vehicle maintenance and washing, urinal and toilet flushing, custodial uses, etc.	LEED®	WE Credit 2	ORD	Collection and use of rainwater for non-potable water applications has fewer code requirements and associated costs than for graywater. Storage tanks and cisterns may have a high upfront cost.	Reduces runoff.	No applicable Research Team Consideration.	May improve the community's view of the airport if included in an outreach program.	19
Install metering networks to facilitate accurate measurement of water use.			LAX, ONT, VNY, PMD	Requires an additional upfront cost. Promotes awareness which may reduce utility bills.	Promotes awareness. Conserves water.	No applicable Research Team Consideration.	Promotes internal awareness, communication, and education.	39
Use and install high-efficiency products certified by the U.S. EPA WaterSense program (toilets, urinals, faucets, sinks, and washing machines).	LEED®	WE Credit 3	LAX, ONT, VNY, PMD	Helps reduce water bills; may have a higher upfront cost.	Conserves water.	No applicable Research Team Consideration.	Conserves local and regional water resources. May improve the community's view of the airport if included in an outreach program.	39
Designate truck and vehicle cleaning areas but limit washdown of vehicle and equipment service pads and other work areas. Liquids from these activities shall be collected, managed as contaminated wastewater, and properly disposed.				Helps avoid water contamination cleanup costs.	Promotes awareness; prevents toxins, pollutants, and sediment from traveling off-site and contaminating groundwater.	May allow for safer operations.	Protects local and regional water resources.	53
Limit steam cleaning and high pressure washing of vehicles and equipment.			PDX	Helps reduce water bills.	Conserves water.	No applicable Research Team Consideration.	Conserves local and regional water resources.	53
Water/Wastewater								
Stormwater Management and Treatment								
Install biological filtration systems/constructed wetlands for stormwater management that also function as ecological features and provide aesthetic benefits.	LEED®	WE Credit 2	LAX, ONT, VNY, PMD	Helps prevent damage from flooding.	Prevents toxins, pollutants, and sediment from traveling off-site and contaminating groundwater.	Must be designed/installed to not attract wildlife.	Provides aesthetic benefits. Protects water quality in the local community.	39
Construct dry wells, dry basins, and/or perforated drain pipes to avoid creating inundated areas, which attract wildlife.			LAX, ONT, VNY, PMD	Helps prevent damage from flooding.	Helps reduce the potential for flooding; prevents toxins, pollutants, and sediment from traveling off-site and contaminating groundwater.	Helps minimize the presence of wildlife that may be hazardous to airport operations.	Reduces wildlife hazards.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Water/Wastewater								
Stormwater Management and Treatment								
Install 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.	LEED®	WE Credit 2	ORD	May minimize wastewater treatment costs and help avoid water contamination costs.	Prevents toxins, pollutants, and sediment from traveling off-site and contaminating groundwater.	May require additional time/labor needs in order to install tanks underground.	Protects water quality in the local community.	19
Install detention basins, detention ditches, and ditch checks for effective first flush treatment.	LEED®	WE Credit 2	ORD	Helps avoid water contamination costs.	Prevents toxins, pollutants, and sediment from traveling off-site and contaminating groundwater.	Must be designed/installed to not attract wildlife.	Protects water quality in the local community.	2
Install bioswales along roadways and parking areas to encourage groundwater infiltration of stormwater runoff. On airside projects, these strategies must be designed so that they do not provide habitat for wildlife.	LEED®	WE Credit 2		May minimize wastewater treatment costs and help avoid water contamination costs.	Helps treat stormwater; prevents toxins, pollutants, and sediment from traveling off-site and contaminating groundwater.	Must be designed/installed to not attract wildlife.	Provides aesthetic benefits. Protects water quality in the local community.	2
Plant nitrogen-fixing vegetation (e.g., legumes) in fertilized areas.			LAX, ONT, VNY, PMD	May minimize wastewater treatment costs and help avoid water contamination cleanup costs.	Helps fertilize soil to support plant life and prevent erosion.	Must not attract wildlife.	Provides aesthetic benefits.	39
Install curb breaks and drainage ditches where possible.				Helps avoid water contamination costs. Helps prevent damage from flooding.	Improves drainage.	Helps minimize the presence of wildlife that may be hazardous to airport operations.	Protects water quality in the local community.	2
Protect storm sewer inlets during construction by installing flexible inlet filters to fit a wide array of drainage structures and offer various levels of infiltration (e.g., FLEXSTORM inlet filters).				Helps avoid fines and water contamination cleanup costs.	Prevents siltation and pollution of rivers, lakes, and ponds. Helps satisfy the EPA's NPDES Phase II directives.	Reduces jobsite flooding and keeps projects running. Resists clogging and are easy to install and remove. Filter bags should typically be removed when they are more than half filled with sediment and debris.	Prevent hazardous road icing conditions by eliminating ice buildup at curb inlets.	1

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Logistics								
Scheduling								
Closely coordinate deliveries of construction materials with scheduled installation times to minimize vehicle queue times.			HNL, LAX, ONT, VNY, PMD	Planning and coordinating the materials ordering processes on site prevents cumulative over-ordering. May reduce time-based delivery fees. It may reduce costs associated with installing or replacing damaged materials, but could be more expensive since items are not ordered in bulk.	Can increase transportation related emissions if materials are not ordered in bulk (e.g., several trips).	Consider potential weather restraints (e.g., snow) or terrain hazards and the delays they may cause. May also reduce the size of the staging area and materials storage areas.	May add to local community traffic levels if this practice increases the number of deliveries made on a project level.	39
Use "just in time" delivery of construction materials to reduce staging requirements and to prevent re-ordering of materials.			LAX, ONT, VNY, PMD	May avoid damage that comes from storage or moving of materials. Saves costs associated with the re-ordering of supplies. Can reduce material costs by ordering only what is needed but may also increase transportation costs if supplies are not ordered in bulk; the personnel in charge of ordering construction materials should identify which materials make the most economic sense to be ordered in bulk and which should be ordered "just in time."	Can increase transportation related emissions if supplies are not ordered in bulk (e.g. several trips). Reduces the environmental impacts of having to produce and haul re-ordered materials or to return excess materials.	Consider potential weather restraints (e.g., snow) or terrain hazards and the delays they may cause. May also reduce the size of the staging area and minimize impacts on airport activities.	May add to local community traffic levels if this practice increases the number of deliveries made on a project level.	39
For trades or materials where “just in time” deliveries cannot be set up, provide suitable, safe and secure storage so that damage during storage and moves is avoided.				The cost of safe and protected storage space is potentially offset by preventing the re-ordering of damaged materials.	May increase the amount of impervious surface. Consider using and/or modifying existing spaces if the duration of storage is minimal.	May reduce delays associated with the ordering/transportation of new materials.	No applicable Research Team Consideration.	66
Logistics								
Packaging/Delivery Methods								
Reduce packaging waste through vendor participation using bulk packaging techniques or choose products with minimal or no packaging.				May reduce product/material costs due to less packaging materials. Consider additional transportation requirements, material handling, storage requirements, and costs/risk of damage.	Reduces packaging waste, reduces environmental impacts from transportation of waste, and reduces impacts to landfills.	Consider storage requirements and material handling requirements to reduce damage.	Reduced transportation of materials/products and packaging waste lowers the impact of delivery vehicles on local communities.	55

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Appendix B. (Continued).

Sustainable Practice	LEED® LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Logistics								
Packaging/Delivery Methods								
Ask suppliers to deliver supplies using reusable delivery containers or sturdy returnable pallets and containers. Have suppliers pick up pallets and empty containers.				May reduce product/material costs due to less packaging materials. Consider additional transportation requirements, storage requirements, and costs/risk of damage.	Consider trade-off of reduced packaging impacts to increase transportation impacts.	Consider storage requirements and material handling requirements to reduce damage.	No applicable Research Team Consideration.	55
Purchase precut and prefabricated components when available and order materials to size.				Component costs may be higher but may allow for just-in-time construction processes, reducing construction schedule and reducing costs. Reduces material transportation costs.	Reduces raw material waste at the construction site. Reduces material hauls, reducing emissions and requirement for fossil fuels.	Enables just-in-time construction techniques.	Reduces the impact of delivery vehicles on local streets.	55
Use easily stackable units such as cladding systems, curtain walls, steel beams, and etc.				Reduces transportation costs.	Reduces environmental impacts of transportation impacts. Reduces packaging waste, reduces environmental impacts from transportation, and reduces impacts to landfills.	Consider storage requirements and material handling requirements to reduce damage.	Reduced transportation of materials/products and packaging waste lowers the impact of delivery vehicles on local communities.	55
Encourage alternative sustainable packaging techniques (e.g. metal strapping in preference to shrink-wrap, paper packaging instead of plastic, and shredded paper as opposed to foam).				Alternative packaging may reduce costs. Consider additional transportation requirements, material handling, storage requirements, and costs/risk of damage.	May reduce packaging waste or environmental impact of packaging waste (i.e., packaging waste can be recycled, reused, or is biodegradable), reduces environmental impacts from transportation of waste, and reduces impacts to landfills.	Consider storage requirements and material handling requirements to reduce damage.	Reduced transportation of materials/products and packaging waste lowers the impact of delivery vehicles on local communities. Reduces impact on local landfills by using recyclable or biodegradable products.	55
Use an overland conveyor system in construction to transport materials from stockpile areas; if possible, use communal conveying systems.				Trade-off with costs associated with transportation of materials by truck.	Reduces transportation requirement, reducing emissions and requirement for fossil fuels. Helps minimize energy consumption during construction and reduces site traffic and noise.	Use a conveyance system for projects requiring significant grading changes.	May improve logistics and security.	2, 18, 55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Noise Minimization and Monitoring								
Require mufflers on all construction equipment so that noise levels are below the Construction Equipment Noise Levels and Ranges listed in Appendix A of the U.S. Department of Transportation's *Special Report: Highway Construction Noise: Measurement, Prediction, and Mitigation.*				May have cost implications.	May reduce noise impacts on adjacent noise sensitive land uses.	Communicate with all of the appropriate people working on the project.	May reduce noise impacts on adjacent noise sensitive land uses.	2, 28
Establish and monitor compliance with a specified construction equipment operation schedule. For example, prohibit operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work between weekday hours of 7 p.m. and 7 a.m., and 8 p.m. and 9 a.m. on weekends or holidays to prevent noise disturbances across a residential or commercial real property line.				May have cost and schedule implications.	May reduce noise impacts on adjacent noise sensitive land uses.	May restrict type and timing of construction operations.	May reduce noise impacts on adjacent noise sensitive land uses; may reduce noise complaints.	17
Establish construction vehicle speed limits to minimize noise and dust.				No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise sensitive land uses and minimize dust emissions.	May improve safety of construction operations.	Creates a safer work site and may reduce noise impacts on adjacent noise sensitive land uses.	2
Locate mechanical equipment and other sources of noise away from areas of occupancy (or vice-versa).			LAX, ONT, VNY, PMD	May have cost and schedule implications and may be impractical or impossible to implement depending on construction project.	May reduce noise impacts on adjacent noise sensitive land uses.	May restrict type and timing of construction operations and may be impractical or impossible to implement depending on type of construction project.	May reduce noise impacts on adjacent noise sensitive land uses. May improve employee productivity by reducing noise distractions.	39
Install portable and permanent noise barriers.			LAX, ONT, VNY, PMD	May have cost and schedule implications.	May reduce noise impacts on adjacent noise sensitive land uses.	No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise sensitive land uses; may reduce noise complaints.	39
Replace noisy construction equipment with quieter units.			LAX, ONT, VNY, PMD	May have significant cost implications.	May reduce noise impacts on adjacent noise sensitive land uses.	No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise sensitive land uses; may reduce noise complaints.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Noise Minimization and Monitoring								
Use lower settings on power equipment whenever possible.				May have schedule implications.	May reduce noise impacts on adjacent noise sensitive land uses, but may also increase emissions.	May have schedule implications.	May reduce noise impacts on adjacent noise sensitive land uses; may reduce noise complaints.	17
Use rubber tired equipment in lieu of track equipment to reduce noise levels.			LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	May reduce noise impacts on adjacent noise sensitive land uses; may result in less ground disturbance and minimize dust emissions.	May be impractical or impossible to utilize track equipment depending on topography and soil conditions.	May reduce noise impacts on adjacent noise sensitive land uses; may reduce noise complaints.	39
Have a designated airport compliance representative certify and randomly inspect all internal combustion, mobile portable, stationary, and power actuated construction equipment to ensure compliance with noise reduction measures.			LAX, ONT, VNY, PMD	Could result in additional project costs, but inspection ensures compliance and may help avoid potentially expensive project delays.	May reduce noise impacts from construction equipment.	May cause brief interruptions in construction schedules for testing and corrective measures.	May reduce noise impacts on adjacent noise sensitive land uses; may reduce noise complaints.	39
Follow the OSHA's noise exposure rules regarding how long a worker may be exposed to a noise level before hearing protection is required: a worker is allowed to be unprotected up to 8 hours at a noise level of 90 dB; up to 4 hours at 95 decibels; up to 1 hour at 105 dB.				May have minor cost implications for earpieces, headsets, mufflers, and/or a compliance inspector.	No applicable Research Team Consideration.	No applicable Research Team Consideration.	Promotes worker safety and awareness, and creates a safer work environment.	17
Use soundless demolition chemical agents as a substitute for explosives.				The relatively high cost of soundless chemical demolition agents makes traditional explosives more cost-effective in many applications.	Does not cause noise, ground vibrations, or dust. Powders used are non-toxic, consisting of oxides of calcium, silicon, and aluminum.	Safer than traditional explosives, which pose the threat of premature explosion and which may misfire; can be used near inhabited areas, natural gas lines, roadways, etc. where explosives would pose a safety risk.	Traditional explosion techniques involve risks posed by shock waves and fly rock. Reduces noise in the surrounding community and may prevent phone calls to emergency services.	6, 55
Use rubberized pavements or innovative pavement treatments to reduce noise resulting from traffic.			LAX, ONT, VNY, PMD	Consider additional costs of installation of treatments and maintenance of surfaces.	Minimizes noise impacts in occupied areas. Consider environmental impacts as treatments deteriorate.	No applicable Research Team Consideration.	May improve employee productivity by reducing noise distractions.	7, 39

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Construction Vehicles and Equipment								
Vehicle Emissions Reduction								
Use ultra low sulfur diesel (ULSD) in all construction vehicles.			ORD	May increase fuel costs due to lower fuel economy during transition period. Older vehicles may require additional maintenance.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	Stipulate that the use of ULSD is a mandatory airport practice. On older vehicles, monitor vehicle performance for potential fuel system leaks or premature fuel filter plugging during the change-over to ULSD fuel.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	2, 18
Use biodiesel and/or other alternative fuels in construction vehicles.			STL	Fuel costs may be higher. May also increase fuel costs due to lower fuel economy. Retrofits may be required depending on alternative fuel selected. Incentives may be offered.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	Ensure an adequate, local supply of selected fuel alternative. On older vehicles, monitor vehicle performance for potential fuel system leaks or premature fuel filter plugging. Biodiesel should not be used in vehicles manufactured pre-1993. A blend of at least 20 percent biodiesel, 80 percent diesel can be partially counted as an alternative fuel under the Energy Policy Act of 1992.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	2
Require that a portion (at least) of the construction vehicle fleet is hybrid/electrical and/or incorporate clean air technologies; also consider alternative fuels in shuttles buses and other on-road vehicles.			LAX, ONT, VNY, PMD	May reduce overall fuel costs due to lower fuel consumption. Alternative fuel costs may be higher. Alternative fuels also increase fuel costs due to lower fuel economy. Retrofits may be required depending on alternative fuel selected.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	Ensure adequate, local supply of selected fuel alternative. Maintain an inventory of all installed retrofit equipment/emissions reductions to ensure goals/guidelines are achieved and for documentation and/or marketing purposes.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Vehicle Emissions Reduction								
If appropriate, use diesel-electric hybrid bulldozers to burn less fuel and consume fewer parts and fluids over its lifetime.			ORD	An electric drive system enables the operator to move approximately 25 percent more material per gallon of fuel consumed compared to conventional mid-sized bulldozers. The electric drive train configuration has fewer moving parts, requiring less service and replacement than conventional transmissions, extending the drive train component life and reducing lifetime operating costs.	Diesel-electric bulldozers consume 10-30% less fuel per hour than conventional mid-sized bulldozers, reducing GHG's by 10-30 percent. Movement of the cab is also quieter.	The engine is beltless which helps reduce the frequency of maintenance; oil and filter change intervals are twice as long. Ensure that operators are properly trained on the new technology.	Improves local air quality.	25, 36
Replace aging construction equipment with new low emission models when available and technically feasible.			LAX, ONT, VNY, PMD	Consider lower operating costs of new equipment and payback in relation to remaining useful life of older equipment.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	Maintain an inventory of all installed retrofit equipment/emissions reductions to ensure goals/guidelines are achieved and for documentation and/or marketing purposes.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39
Install retrofits on existing construction equipment that allow for the use of alternative fuels.			ORD	Initial cost for retrofit may be offset by lower lifecycle costs.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	10
Install low emission engines (re-engine) into old equipment chassis.			LAX, ONT, VNY, PMD	Lower investment than a new vehicle.	Keeps the chassis from entering the waste stream. New engines are typically more fuel efficient with lower emissions.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Vehicle Emissions Reduction								
Install particulate filters and/or diesel oxidation catalysts (DOC) on construction vehicles. The equipment should be included on the EPA Verified Retrofit Technology List (www.epa.gov/otaq/retrofit/retroverifiedlist.htm) or verified by the California Air Resources Board (CARB) (www.arb.ca.gov/diesel/verdev/verdev.htm).			SLC, ORD	May require investment to upgrade vehicles and equipment.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	18
Develop a vehicle inspection program to ensure pollution control devices are in place.			SLC, LAX, ONT, VNY, PMD	Establish penalties for non-compliance and present guidelines to contractors prior to project start. Consider cost of inspection process, offset by risk of non-compliance.	Emphasizes the importance of meeting sustainability requirements. Compliance ensures realization of requirements established in contracts. Reduces emissions.	Clarify requirements upfront. Maintain an inventory of all installed retrofit equipment/emissions reductions to ensure goals/guidelines are achieved and for documentation and/or marketing purposes.	Compliance ensures realization of air quality benefits established in contracts.	2, 39
Perform routine maintenance and engine rebuilds to maintain original construction vehicle emission levels.			LAX, ONT, VNY, PMD	Should be considered part of normal operating cost, not incremental. Routine maintenance and rebuilds maximizes useful life of the vehicle, and maintains operating efficiency.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39
Require all construction vehicles to meet the state's voluntary or future low emission vehicle standards.			LAX, ONT, VNY, PMD	May require investment to upgrade vehicles and equipment that don't meet the standards.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	Provide retrofit allowances for construction equipment.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39
Implement proposed Tier 4 emission standards to encourage the use of newer and/or retrofitted non-road diesel equipment.			LAX, ONT, VNY, PMD	Consider cost of inspection process, offset by risk of non-compliance.	Reduces emission of air quality pollutants such as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	Maintain an inventory of all installed retrofit equipment/emissions reductions to ensure goals/guidelines are achieved and for documentation and/or marketing purposes.	Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Vehicle Emissions Reduction								
Place signage (magnetic stickers) on alternative/ULSD fuel and retrofitted construction vehicles (e.g., "Low-Impact Construction Vehicle," or "This Construction Vehicle Runs on Biofuels").			ORD	Marginal costs for signage.	Creates awareness of environmental focus and benefits.	Develop procedures for verifying and inspecting vehicles.	Creates awareness in the community of specific actions the airport is taking to reduce the impact of airport construction.	3
Encourage contractors to carry double hauls when leaving the site.			MSP	May reduce hauling costs.	Ensure that roadways can support the additional weight and the potential for erosion is negligible.	No applicable Research Team Consideration.	No applicable Research Team Consideration.	30
Construction Vehicles and Equipment								
Reduced Vehicle Idling								
Install anti-idling technology to reduce/eliminate idling such as Temp-A-Start (www.tempastart.com) automatic engine start/stop technology for diesel engines.			LAX, ONT, VNY, PMD	Technology may have an initial cost, however, less idling reduces fuel consumption and costs. May reduce required maintenance service.	Reduces emissions, fuel consumption, and the environmental impact of drilling, pumping, transporting, and refining crude oil.	Temp-A-Start maintains engine oil temperature and provides for driver comfort. Ensure operators are properly trained on anti-idling technologies.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39, 57
Ensure that no construction vehicle idling occurs within 100 feet of a sensitive receptor area, such as air intakes.			LAX, ONT, VNY, PMD	Lowers fuel costs.	Reduces IAQ pollution.	In coordination with public works, post signage for no idling areas in construction areas. Implement Vehicle Idling Program inspection logs.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	39
In coordination with public works, post signage for no idling areas in construction areas.			DEN, LAX, ONT, VNY, PMD	Marginal costs for signage.	Reduces emissions, fuel consumption, and the environmental impact of drilling, pumping, transporting, and refining crude oil.	Implement Vehicle Idling Program inspection logs.	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	9, 39

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Reduced Vehicle Idling								
Turn off construction vehicles if they will be left idle for over an established time limit, such as 3 minutes.			BWI, ORD	Lowers fuel costs. In general, 10 seconds of idling uses more fuel than restarting a car.	Reduces emission of such air quality pollutants as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide. Reduces fuel consumption and environmental impact of drilling, pumping, transporting, and refining crude oil.	An idling engine does not run at peak efficiency, which results in incomplete combustion of fuel, residue on spark plugs and dirty engine oil. According to the U.S. DOE, fuel injection engines do not need to be warmed up for more than 30 seconds except on extremely cold days (below 0° F).	Reduces noise pollution. Improves local air quality. Reduces health impacts associated with diesel particulate matter including asthma, bronchitis, and heart and lung disease. Reduces emission of GHG's.	19, 41, 60
Place air fresheners in construction vehicles promoting an "engines-off" campaign. The air fresheners could be mounted after performing routine maintenance.			DEN	Marginal cost to build awareness. Easily offset by fuel savings.	Reduces emission of such air quality pollutants as particulate matter, dirt, nitrous oxides, hydrocarbons, carbon monoxide and carbon dioxide.	No applicable Research Team Consideration.	Reduces health impacts associated with diesel particulate matter.	9
Construction Vehicles and Equipment								
Energy Efficiency								
Install freight elevators as early as possible and coordinate building enclosure at the elevator shafts to minimize temporary hoisting needs.				Minimizes cost associated with leasing temporary hoisting equipment.	No applicable Research Team Consideration.	Consider timing of change-over from using temporary hoisting equipment to freight elevators.	No applicable Research Team Consideration.	55
Use alternating current gearless elevators.				Saves electricity by lowering power consumption by about 40%.	Reduces power consumption, reducing emissions.	No applicable Research Team Consideration.	May reduce energy demand and costs in the local community.	55
Install Energy Star certified products for temporary and permanent building equipment. Categories include appliances, electronics, office equipment, lighting, food services and other commercial products.	LEED®	EA Credit 1		Depending on scope, may require some up-front cost to implement (e.g., new equipment); typically results in operational savings, reducing energy costs.	Reduces energy consumption. Environmental benefits will vary based on local source of electricity, i.e., coal, natural gas, nuclear, renewable, etc.	No applicable Research Team Consideration.	May reduce energy demand and costs in the local community.	55
Use localized hot water equipment rather than centralized equipment; localized equipment is typically more efficient than centralized equipment.				Eliminates long piping runs and heat losses associated with recirculation piping. May require higher initial costs for localized equipment, but may provide cost savings in materials and energy use.	Reduces energy consumption due to heating losses; uses fewer materials and resources.	Domestic hot water for general plumbing fixtures should be designed for a temperature between 120°F and 140°F.	May reduce energy demand and costs in the local community.	55

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Appendix B. (Continued).

Sustainable Practice	LEED® LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Construction Vehicles and Equipment								
Energy Efficiency								
Use solar hot water heat or instantaneous hot water heat in construction trailers for heating and cooling.				Eliminates cost associated with running pipes from centralized hot water systems. Eliminates cost associated with heating water even at times it is unused.	Reduces energy consumption due to heating losses; uses fewer materials and resources.	Instantaneous or "demand" water heaters heat water directly without the use of a storage tank in order to avoid the standby heat losses associated with conventional storage tank water heaters.	May reduce energy demand and costs in the local community.	18, 48
Use a global positioning system (GPS) based earthmover to enable machines to get to grade with fewer passes.				Requires less fuel and incurs less wear, reducing costs.	Limits ground disturbance to intended and specified areas.	More efficient use of labor and equipment, reducing project duration.	Improves safety.	55
Prior to placing concrete or asphalt, create a “spatial image” or “digital scan” of the area, plotting three-dimensional points every few millimeters. Laser scanning helps obtain accurate pre-and post-construction terrain models for determination of earthwork quantities, monitoring pavement smoothness and adherence to grade design, and monitoring ground movement near excavations, large embankments, or pile-driving operations.			ORD	Increases the accuracy of measurements, improving productivity and layout work.	Helps determine the amount of earthwork required, reducing unnecessary haul trips and the associated emissions.	Helps meet specified requirements for levelness and flatness. A scan typically takes 5 to 20 minutes to complete. Scanned images can also be imported into computer assisted drawing software to aid in design work. To obtain more accurate information, the instrument can be placed higher off the ground or even on an aircraft. Scans can be completed in total darkness.	May enhance safety by improving precision and reducing the duration of construction projects.	45
Use a machine-integrated laser infrastructure system that provides precise elevation information on an in-cab display to achieve accurate blade positioning.				Helps achieve grade faster and in fewer passes, reducing fuel consumption and operating costs. Does not require the expense of grade stakes, grade checkers, or stake-setting surveyors.	May reduce fuel consumption, reducing construction vehicle emissions.	Reduces delay times associated with airfield construction.	May enhance safety by improving precision and reducing the duration of construction projects.	14
Use digital imaging and ground penetrating radar signal analysis to help predict the initiation and propagation of reflective pavement cracking.				May have a high upfront cost but may avoid unexpected and potentially high costs and operational delays.	Improves mapping accuracy of underground voids and the groundwater table.	Helps identify the severity of pavement cracking and the level of maintenance required to improve the surface. Helps predict future repaving and restructuring projects.	May improve safety by preventing deep surface penetrations and weak pavement areas.	4

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Energy Efficiency								
Install a reinforcing and stress absorbing membrane interlayer system under the asphalt overlay to delay reflective cracking. Interlayer systems are typically comprised of geosynthetics, geocomposite, steel reinforcement netting, and polymer-modified fine hot-mix asphalt.				Provides cost savings over the life cycle of the pavement; reduces pavement maintenance costs.	Less frequent maintenance reduces energy and emissions from repaving/resurfacing equipment.	Reduces the severity and rate of reflective cracking, reducing the frequency of pavement resurfacing and restructuring; reduces delay times associated with airfield construction.	May improve safety by preventing deep surface penetrations and weak pavement areas.	4
Install pipes with acoustic measuring devices to detect vibrations and/or sound waves in pipelines, indicating defects. Three types of acoustic technologies are used for pipeline assessment: leak detectors, which are used to detect the acoustic signals emitted by pipeline leaks; acoustic monitoring systems, which are used to evaluate the condition of pre-stressed concrete cylinder pipe (PCCP) by detecting the signals emitted by breaking pre-stressed wires; and sonar, or ultrasonic systems, which emit high frequency sound waves and measure their reflection in order to detect a variety of pipe defects.				This technology works on all pipes including plastic/PVC, and eliminates the high cost and difficulty of use traditionally associated with leak noise correlators. May incur higher initial costs, however, this offsets the risk of damage created by defective pipes.	Reduces risk of water loss, or contamination due to damaged or faulty pipes.	Helps identify pipeline defects and the level of maintenance required; enhances safety and prevents delays from pipeline failure.	May help avoid pipeline failures that could cause air and/or water pollution in the local community.	55
Use appropriately sized equipment for the project. Lease if not currently owned.				Oversized equipment may cost more than is necessary for the job.	Oversized equipment uses more energy than is required for the job and may cause erosion.	Fully understand job requirements, with appropriate contingency, to properly specify equipment requirements.	May reduce noise impacts on surrounding land uses.	10
Use alternative fuels (biodiesel, ethanol, compressed natural gas, propane, hydrogen) in an on-site batch plant.				Costs vary based on local availability. It may be necessary to install retrofits for specific types of fuels.	Alternative fuels have fewer emissions than gas or diesel. Emissions from gas and diesel are the leading causes of air quality issues, leading to heart and lung disease, asthma, etc.	Consider retrofit and maintenance requirements associated with the selected alternative fuel.	May help improve air quality, decreasing health impacts on local communities. Use of alternative fuels helps reduce carbon emissions and climate change.	7

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Construction Vehicles and Equipment								
Energy Efficiency								
Use solar-powered flashers instead of ones requiring batteries. They require no maintenance, are automatically powered, and save money by eliminating the need to recycle batteries. Solar powered flashers cost approximately $6 more than regular flashers, but the payback period may be only 2 months.			DAL, RBD	Initial costs may be higher than battery-powered flashers, however, solar-powered flashers require minimal maintenance, are automatically recharged, and reduce costs by eliminating the need to recharge or replace.	Reduces the need to replace non-rechargeable batteries and the environmental impact of battery disposal. Eliminates the need to use the grid to recharge batteries.	Eliminates labor to recharge and/or replace batteries. Depending on the environment, may require occasional cleaning to ensure proper charging. May not be appropriate for environment receiving little sunlight due to weather conditions or geography.	No applicable Research Team Consideration.	51
Construction Vehicles and Equipment								
Lighting								
Require the use of energy efficient lamps for temporary lights and temporary emergency lighting that can be turned off during non-working hours to conserve energy.				May incur higher initial costs, however, bulbs typically last longer requiring less frequent changes and cost less to operate.	Longer lasting bulbs mean less waste and disposal. However, some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs and creates better lighted work environments. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	Better lighting may improve safety.	55
Reduce construction at night to minimize lighting impacts and improve safety. If construction at night is necessary, focus lighting toward the earth.	LEED®	SS Credit 8	LAX, ONT, VNY, PMD	Reducing nighttime construction typically reduces project costs.	Reduces nighttime light emissions.	Reduces the complexity of the construction site.	Reduces light emissions on surrounding communities and adjacent land uses.	39
Monitor interior and exterior lighting systems regularly during construction to maintain proper illumination and minimize off-site impacts. Ensure that the maximum candela value of all interior lighting falls within the building (not out through windows) and the maximum candela value of all exterior lighting falls within the property.	LEED®	SS Credit 8	ORD	May reduce lighting costs.	Reduces light emissions and energy consumption.	Proper illumination improves construction worker safety and site security.	May reduce light emissions on surrounding communities and adjacent land uses.	19
Use full cutoff luminaries, low-reflectance, non-specular surfaces, low-angle spotlights, and or shielding for roadway and building lighting.	LEED®	SS Credit 8	ORD	May require higher initial costs.	Reduces light emissions on adjacent land uses.	Proper illumination improves construction worker safety and site security.	May reduce light emissions on surrounding communities and adjacent land uses.	19
Designate specific recycling areas for light bulbs that contain mercury.				No applicable Research Team Consideration.	Ensures that mercury from spent light bulbs is captured and properly recycled.	Communicate recycling procedures with all of the appropriate people working on the project.	Ensures that mercury from spent light bulbs is captured and properly recycled.	3

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Construction Vehicles and Equipment								
Lighting								
Install recyclable lamps and provide recycling information for all luminaries.			LAX, ONT, VNY, PMD	May increase costs of temporary construction lighting.	Reduces environmental impact of temporary construction lighting.	Communicate recycling procedures with all of the appropriate people working on the project.	Promotes awareness and may help improve the community's view of the airport; good for public relations.	39
Where acceptable, use High Pressure Sodium (HPS) lamps instead of Metal Halide (MH) lamps; HPS Lamps produce more lumens per watt, have less mercury content per lamp, and have a greater average rated life expectancy than MH lamps.			LAX, ONT, VNY, PMD	May incur higher initial costs, however, bulbs typically last longer requiring less frequent changes and cost less to operate.	Longer lasting bulbs reduce waste. Some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs and creates better lighted work environments. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	Better lighting may improve safety.	39
Use and install high frequency electronic ballasts with fluorescent 2, 4, and 8-foot Tubular lamps.			LAX, ONT, VNY, PMD	May incur higher initial costs.	No applicable Research Team Consideration.	Proper illumination improves construction worker safety and site security.	Better lighting may improve safety.	39
Use and install compact fluorescent light bulbs in lieu of incandescent lamps, especially in areas with low ceiling heights and minimal light requirements.			LAX, ONT, VNY, PMD	May incur higher initial costs, however, bulbs typically last longer requiring less frequent changes and cost less to operate.	Longer lasting bulbs reduce waste. Some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs and creates better lighted work environments. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	Better lighting may improve safety.	39
Avoid using fluorescent, compact fluorescent, and LED lights that contain mercury (as well as electrical switches and thermostats).				May reduce disposal costs.	Mercury is highly toxic and could cause poisoning if ingested or inhaled.	No applicable Research Team Consideration.	Improves health and safety of installers and building occupants.	55
Use and install metal halide lamps, low-temperature fluorescents and/or solar powered fixtures for exterior lighting.				May incur higher initial costs, however, bulbs typically last longer requiring less frequent changes and cost less to operate.	Longer lasting bulbs reduce waste. Some energy efficient lamps contain trace amounts of mercury and must be disposed of properly.	Reduces the need to change bulbs. Solar fixtures can be installed in remote locations. Must train employees and contractors on proper disposal of lighting. Be sure that lighting is properly enclosed in work areas to reduce breakage.	No applicable Research Team Consideration.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Vehicles and Equipment								
Maintenance								
Contain and clean all chemical spills properly and dispose of clean up supplies properly.			LAX, ONT, VNY, PMD	Initial costs to establish safeguards offsets risks and cost associated with clean-up of chemical spills.	Reduces risk of soil and groundwater contamination from chemical spills.	Must educate employees and contractors and implement procedures for clean-up of chemical spills and proper disposal of clean-up supplies.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	39
Conduct maintenance activities under cover from precipitation.			LAX, ONT, VNY, PMD	Initial cost associated with maintenance hanger mitigates risk of soil and groundwater contamination.	Reduces risk of soil and groundwater contamination from chemical spills.	No applicable Research Team Consideration.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	39
Maintain current Material Safety Data Sheets (MSDS) on-site.			LAX, ONT, VNY, PMD	Minimal cost to distribute MSDS offsets risks and cost associated with clean-up of chemical spills.	Reduces risk of soil and groundwater contamination from chemical spills.	Create awareness of existence and purpose of MSDS.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	39
Have floor drains in vehicle maintenance areas discharge into an oil-water separator to capture oil and other contaminants. The separator should be periodically pumped, and the oil processed for recycling.			SLC	Initial cost associated with drainage and separators; mitigates the risk of soil and groundwater contamination.	Reduces risk of soil and groundwater contamination from chemical spills.	Educate employees and contractors. Establish procedures and a schedule for cleaning the separator.	Reduces risk of negative impact on surrounding communities caused by contamination of soil and groundwater.	58
Send end-of-life diesel engines to a remanufacturing plant to be reconstructed into methane-fueled generator sets. These generator sets convert methane from animal waste into usable energy.				Remanufacturing plants may offer to pick up old engines for free, saving costs associated with the transport and/or landfill of end-of-life equipment.	May reduce landfill waste, consumption of iron ore, and reduce GHG emissions caused by disposing end-of-life equipment. Methane generator sets provide renewable electricity and reduce GHG emissions.	No applicable Research Team Consideration.	May help improve the community's view of the airport if part of an outreach program.	49
Alternative Transportation								
Public Transportation Access and Carpooling								
Provide incentives such as discounted fares to encourage the use of public transportation.	LEED®	SS Credit 4.1	LAX, ONT, VNY, PMD	Obtain airport funds raised from permit or fee parking to subsidize mass transportation passes for construction workers.	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Post display boards that illustrate public transportation connection opportunities, routes, fares, and directions.	Minimizes impact to local traffic and congestion.	39
Provide consolidated construction employee private vehicle parking/staging areas with regular shuttles during construction.				Minimizes the number of construction employee spaces required (keeping spaces open for fee-based customer parking).	Commute trips via alternative transportation modes produce less air pollution than single occupant vehicle commuting.	Post display boards that illustrate the shuttle routes and public transportation connection opportunities, routes, fares, and directions.	Decreases congestion on site.	2

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Alternative Transportation								
Public Transportation Access and Carpooling								
Coordinate carpooling to construction sites by setting up schedules and incentives (such as preferential parking) based on locations. Use website schedules, meetings, and/or displays boards in common areas.	LEED®	SS Credit 4.4	LAX, ONT, VNY, PMD	Reduces land requirements; minimizes the number of construction employee spaces required (keeping spaces open for fee-based customer parking).	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Use website schedules, meetings, and/or displays boards in common areas.	Decreases congestion on site.	2, 39
Alternative Transportation								
Bicycle Access/Use								
Provide centralized facilities for secure bicycle storage.	LEED®	SS Credit 4.2		Use airport funds raised from permit or fee parking to encourage bicycle usage.	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Include bike racks at construction staging locations and provide signs near the construction site that indicate bicycling facilities are available and display their location.	Minimizes impact to local traffic and congestion.	2
Provide convenient changing/shower areas for bikers.	LEED®	SS Credit 4.2		Use airport funds raised from permit or fee parking to encourage bicycle usage.	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Provide signs near the construction site that indicate bicycling facilities are available and display their location.	Minimizes impact to local traffic and congestion.	2
Provide incentives to encourage that a minimum of 5% of construction workers use bicycles for all or part of their daily commute.	LEED®	SS Credit 4.2		Use airport funds raised from permit or fee parking to encourage bicycle usage.	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Provide signs near the construction site that indicate bicycling facilities are available and display their location.	Minimizes impact to local traffic and congestion.	64
Develop and implement a "ZipBike" or other bike sharing program for construction workers to travel between facilities.			LAX, ONT, VNY, PMD	Use airport funds raised from permit or fee parking to encourage bicycle usage.	Commute trips via alternative transportation produce less air pollution than single occupant vehicle commuting.	Include bike racks at construction staging locations and provide signs near the construction site that indicate bicycling facilities are available and display their location.	Decreases congestion on site.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Construction Waste Management								
Goals and Policies								
To ensure compliance with waste management and recycling goals, submit updated site waste recycling forms on a monthly basis, including the amounts of construction or demolition materials recycled or salvaged.	LEED®	MR Credit 2	PDX	Increased recycling efforts may reduce disposal costs; however, the cost of monitoring the recycling efforts may outweigh the benefits if not part of everyday practice.	Conserves natural resources. May enhance recycling activities and thus reduce the emissions from hauling, the traffic impacts, and the consumption of fossil fuels.	May require additional staff training to explain procedures and requirements to contractors. Essential to become part of everyday practice.	Educates construction workers and identifies that sustainability is a priority at the airport.	53
Allocate personal responsibility for on-site waste reduction (e.g. appoint a Waste Manager).				Consistent and knowledgeable application of standards and specifications across all projects.	Consistent knowledge and understanding of environmental across all projects.	Applies consistent and knowledgeable understanding of applicable standards, practices, tracking and reporting across all projects.	Reduced off-site hauling could reduce traffic in the surrounding community.	66
Provide financial incentives to contractors who substantially exceed requirements of the construction waste management plan.				May reduce hauling, disposal, and fuel costs.	Conserves natural resources.	Contractual requirements to be specified; perhaps difficult to monitor.	Stresses that construction waste management is a priority at the airport.	66
Do not remove protective packaging from materials before they are needed to prevent spoilage and to allow for the return of unused materials.				Usually unused materials can be sold back to the supplier at a 50% restocking fee.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Consider on-site staging and storage requirements.	No applicable Research Team Consideration.	67
Provide contractors with a list of local companies that reuse and recycle materials.				May reduce hauling, disposal, and fuel costs.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	Update through periodic construction open houses.	May help provide opportunities for the involvement of MBEs, small and/or local businesses.	46

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Waste Management								
Storage and Collection of Recyclables								
Recycle aluminum, glass, plastics, paper, and corrugated cardboard.				Requires initial start-up costs and the use of dedicated storage/containment areas; potential for cost-savings or offsets.	Keeps materials out of the waste stream and conserves natural resources by reusing materials.	Expand the type of recyclables as applicable.	Consider partnering with local communities.	2
Recycle gas and oil filters, waste gasoline, motor oil, anti-freeze, scrap metal, tires, electrical wiring, deicing fluid, grease, sludge, hazardous materials, and spent solvents.				Reduces disposal and waste handling costs.	Keeps hazardous materials out of the waste stream.	Requires storage and containment areas, and staff training.	Consider partnering with local communities.	2
Recycle batteries, light bulbs, toner cartridges, and electronics (including monitors).				Reduces disposal and waste handling costs.	Keeps hazardous materials out of the waste stream.	Requires storage and containment areas, and staff training.	Consider partnering with local communities.	2
Determine the disposal costs, hauling costs, and revenue generated for reusing materials; compare them with the cost of purchasing/constructing new items.	LEED®	MR Credit 3	ORD	Helps identify cost saving opportunities.	A credit under USGBC LEED® criteria.	May require a tracking system and coordination amongst contractors.	Quantify and include as part of a public outreach plan.	19
Use cardboard balers, aluminum can crushers, recycling chutes, and other technologies to enhance recycling activities and to reduce the number of waste hauls.				Reducing material volumes reduces handling and hauling costs.	Reduced volumes reduce truck hauling trips, reducing energy use and emissions.	Reduced material volume reduces on-site storage and containment requirements.	Reduced off-site hauling could reduce traffic in the surrounding community.	2
Ensure that recycling bins are full and packed before moving onto new ones.				Reduces handling and hauling costs.	Reduces energy use and emissions from transport.	Requires sufficiently sized and organized storage area. Ensure that such areas do not become wildlife attracting.	May help minimize traffic impacts.	55
Charge a fee to contractors who contaminate recycling bins.				Creates financial incentive for contractors to recycle material properly and provides a mechanism to recover costs if material has to be sorted before a recycler will accept it.	Encourages contractors to recycle material properly.	Encourages contractors to recycle material properly.	Stresses that construction waste management is a priority at the airport.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Waste Management								
Materials Reuse								
To facilitate the reuse of materials, track and evaluate the following waste for recycling (at a minimum): land-clearing debris, cardboard, metal, brick, concrete, asphalt, plastic, clean wood, glass, gypsum wallboard, carpet, and insulation.	LEED®	MR Credit 2	ORD	Helps offset construction-demolition costs. May minimize or avoid the cost of bringing new materials on-site.	Conserves natural resources.	Make a part of everyday practice. Streamline the re-use of materials, and encourage materials/products with recycled content.	Facilitates material reuse and sharing programs both on-site and within the community.	2
Re-use project waste as a resource to another project. This may include concrete, asphalt, land and clearing debris, small ancillary buildings or structures, and building components. List materials available for use on a communal website, display boards/posters, and/or hold a meeting with all contractors to discuss available materials.			ORD	May reduce hauling, disposal, and fuel costs.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials.	List materials available for use on a communal website, display boards/posters, and/or hold a meeting with all contractors to discuss available materials.	If the waste cannot be reused on site, consider sharing opportunities with the local community and/or nearby projects, minimizing haul distances and emissions.	2
Use an on-site batch plant (or on-site rock crusher) to crush concrete and reuse it on-site.			PBI, LNA, F45, DAL, RBD, MSP, BWI	May reduce hauling, disposal and fuel costs for the airport/contractor and minimize or avoid the cost of bringing new materials on-site.	May help extend the life of existing landfills and reduces the need for new landfills through the reduction of total waste generated. Reduces the demand for raw materials.	Requires storage and containment areas, and staff training.	Reduced off-site hauling could reduce traffic in the surrounding community.	60
Use a "rubbleizer" machine that performs multiple tasks in a single step - sending vibrations into concrete to break into usable <4" pieces.				May reduce labor and fuel costs for the airport/contractor and save costs associated with purchasing new concrete and masonry.	May reduce emissions and allow for enhanced on-site recycling of concrete, reducing the environmental impacts of producing and hauling new construction products and materials. May reduce off-site transportation and thus decrease construction vehicle emissions and energy consumption.	Expedites the removal of concrete, reducing delays.	May help minimize traffic impacts.	59
If no local markets exist for recycling drywall in the area, recycle non-contaminated drywall by grinding and spreading on open land at the airport at a rate of approximately 5 tons per acre and then tilling into the soil.				May reduce hauling, disposal, and fuel costs. The airport/contractor should also factor in the cost to grind and apply the drywall.	Ensure that the drywall is free of hazardous materials before implementing this practice. Place the grinded drywall on flat land away from water bodies to avoid runoff.	No applicable Research Team Consideration.	A unique practice that may provide education to construction workers and the local community.	54

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Waste Management								
Materials Reuse								
Donate unused paint to the city's graffiti removal program.			SLC	May decrease costs by donating the material rather than sending it to a disposal service.	Finding a use for unused waste reduces the chance of improper disposal and contaminating the environment.	Requires education and instruction to workers/staff to achieve; consider appointing a community liaison.	Resource sharing with the community; improves community relations.	58
Minimize the use of temporary wood structures.				May decrease costs if reusable formwork is used on multiple projects.	Using reusable formwork instead can reduce the amount of materials send to the landfill and conserves natural resources.	No applicable Research Team Consideration.	May help minimize traffic impacts.	55
Use ultra screen sight and sound barriers (lightweight panels with no special equipment for installation, maintenance or replacement) instead of traditional sight and sound barriers.				May decrease installation and maintenance costs.	May reduce sight and sound impacts compared to traditional barriers.	Typically requires less time and labor for installation and maintenance than for traditional sight and sound barriers.	No applicable Research Team Consideration.	55
Use chain clamps as alternatives to traditional methods of pipe fit-up as each clamp can fit-up elbows, tees, flanges, and other pipe fittings.				Although chain clamps can be expensive compared to traditional pipe fit-up methods, they may reduce labor costs and disassembly costs.	Chain clamps may reduce the quantity of pipe fit-up materials used, including plastics.	May allow for easier disassembly, reducing impacts to airport operations during future projects.	No applicable Research Team Consideration.	55
Reuse existing runway pavement (e.g., for taxiways).	LEED®	MR Credit 3	ORD	Determined through facility planning efforts. May reduce costs associated with hauling, disposal, fueling, and purchasing new pavement.	May reduce the amount of pavement sent to the landfill and the environmental impacts of producing new pavement.	As part of EONS, determine cost savings of not demolishing and reconstructing.	Reduced off-site hauling could reduce traffic in the surrounding community.	2
Use excess asphalt paving to fix surrounding roads, drives, parking lots, and etc.				May reduce hauling, disposal, and fuel costs and save costs associated with purchasing new asphalt.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	Utilizes construction crews already in place; may require contract modification or flexibility.	Reduced off-site hauling could reduce traffic in the surrounding community.	55
Use concrete chunks, old bricks, broken block and other masonry rubble for backfill along foundation walls where permitted.				May reduce hauling, disposal, and fuel costs and save costs associated with purchasing new concrete and masonry.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	May reduce temporary negative impacts to surface transportation since vehicles would make fewer trips off-site.	Reduced off-site hauling could reduce traffic in the surrounding community.	55
Recycle crushed, unreinforced concrete by using it in swales, fill, rip-rap and drainage.	LEED®	MR Credit 4		Minimizes the cost of buying new materials and transporting them to the construction site.	Reduces landfill hauls. Reduces the environmental impacts of producing new construction products and materials.	As part of EONS, determine cost savings of not demolishing and reconstructing.	May improve the community's view of the airport if included in an outreach program. Reduces off-site hauls, reducing surface transportation congestion.	59

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Construction Waste Management								
Materials Reuse								
Utilize excess concrete for parking stops, jersey barriers, etc.				May reduce hauling, disposal, and fuel costs and save costs associated with purchasing new concrete.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing and hauling new construction products and materials. May reduce off-site transportation and thus decrease construction vehicle emissions and energy consumption.	May reduce temporary negative impacts to surface transportation since vehicles would make fewer trips off-site.	Reduced off-site hauling could reduce traffic in the surrounding community.	55
Use pre-assembled rebar cages when possible to reduce on-site rebar waste.				May achieve cost savings.	Reduces need for excess material recycling and reuse.	May require less staff training.	Reduced off-site hauling could reduce traffic in the surrounding community.	55
Separate subsoil and topsoil and ensure proper storage for re-use.				Facilitates use; minimizes 'double' and 'triple' touching.	Vegetating long-term stockpile with suitable plants may help prevent dust blow and erosion, silt run-off, and prevent the establishment of invasive and/or noxious weeds.	To avoid compaction of the soil, stockpiles must not be driven on by heavy machinery. Stockpiles should not be located with 10 meters of a watercourse.	Reduced off-site hauling could reduce traffic in the surrounding community.	20
Reuse items such as electrical boxes, breaker equipment, wall outlets and other electrical equipment where possible and practical.	LEED®	MR Credit 3		Potential cost savings from reuse on other projects or sale.	Reduces waste materials.	Make contractor aware of need to recycle these types of materials; consider code/regulatory requirements.	Include on resource database; becomes potential low-cost resource option to community.	55
Reuse empty wire spools for other purposes and tasks (e.g., stools for the break area).	LEED®	MR Credit 3		Disposal cost savings.	Reduces waste materials.	Make the contractor aware of the need to recycle these types of materials; consider code/regulatory requirements.	Creates contractor awareness.	55
Save worn out NiCad batteries from portable power tools for delivery to a specialized battery-recycling site.				Disposal cost savings.	Keeps materials out of the waste stream.	Requires temporary storage and transfer.	No applicable Research Team Consideration.	55
Use prefabricated foam insulated concrete panels.				Longer-term energy cost savings potential, but benefits during construction using prefabricated, lighter materials.	Reduced energy use and emissions during construction; longer-term energy and cost savings potential.	Prefabricated materials facilitate installation and use.	No applicable Research Team Consideration.	40
Use Insulating Concrete Forms (ICFs) for decreased waste; ICFs also optimize energy performance and reduce impacts from construction.				The use of ICFs decreases pour time and reduces the overall amount of concrete required. ICFs also provide enhanced durability.	Conserves resources. Reduces exterior noise.	Reduces installation/construction time.	May help minimize noise and traffic impacts.	2

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Construction Waste Management								
Salvaged Materials and Resources								
Coordinate with other airport projects to share salvaged materials and resources.			LAX, ONT, VNY, PMD	Potential cost-savings from re-use on other projects or sale.	Conserves natural resources.	Identify at outset, organize and monitor during construction, and establish staging and storage areas.	Reduced off-site hauling could reduce traffic in the surrounding community.	39
Donate salvaged materials (such as fencing and floor tile) to local organizations. Use a public information website or other means to list salvaged materials to offer for sale or donation.				May require minimal additional administrative and handling costs.	Conserves natural resources.	Requires establishing temporary and longer-term staging and storage areas.	Potential asset to local community; include as part of outreach program.	2
Remove elements that pose a contamination risk prior to reusing structures.			ORD	Plan for expenses; addresses regulatory requirements.	Minimizes contamination of soil, water, and other resources.	May require specialized containment, operational conditions, and contractor expertise.	Minimize construction worker exposure to hazardous wastes.	19
Use a "Construction Waste Management Database" provided by the Whole Building Design Guide at <www.wbdg.org/tools/cwm.php> to identify salvaged materials and resources, and companies that haul, collect, and process recyclable debris from construction projects.	LEED®	MR Credit 2	LAX, ONT, VNY, PMD	The Database is n online service for those seeking companies that recycle construction debris in their area. A search can be conducted by state, zip code, or material(s) recycled.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	Consider utilizing the Whole Building Design Guide at www.wbdg.org/tools/cwm.php> or similar tool.	Organizes resource reuse and waste disposal; becomes a tool for use by others.	39
Reuse forms to the greatest extent possible without damaging structural integrity of concrete and without damaging aesthetics of exposed concrete.	LEED®	MR Credit 3		Cost-savings from re-use on other projects.	May reduce materials/components that are sent to the landfill and the environmental impacts of producing and hauling new construction products and materials.	Typically part of standard operating procedures.	May help minimize traffic impacts.	43

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Sustainable Materials								
Recycled Content								
Establish project goals for recycled content materials and identify material suppliers that can achieve this goal. Consider the following major building components: aggregate in cast in place concrete; fly ash in cast in place concrete; 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 furnishes; equipment; sheet metal ductwork; site lighting.	LEED®	MR Credit 4	ORD, SLC, U42, TVY	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	May help improve the community's view of the airport if part of an outreach program.	2
Identify the value of both the post-consumer recycled content and the post-industrial content so that they can be compared with the total value of the materials in the project. Divide the weight of recycled content in the item by the total weight of all material in the item, and then multiply the resulting percentage by the total value of the item to determine the value of the recycled content portion of a material or furnishing. Mechanical and electrical components shall not be included in this calculation. Recycled content materials shall be defined in accordance with the Federal Trade Commission document, Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7 (e), available at www.ftc.gov.	LEED®	MR Credit 4	ORD	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	May help improve the community's view of the airport if part of an outreach program.	19

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Sustainable Materials								
Recycled Content								
To identify recycled content materials available and common percentages, include contact information in project specifications for reference and search tools such as the Guide to Resource-Efficient Building Elements from the Center for Resourceful Building Technology (www.crbt.org), the Recycled Content Product Directory from the applicable state integrated waste management board and Oikos (www.oikos.com).	LEED®	MR Credit 4	LAX, ONT, VNY, PMD	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	39
Use recycled crushed material from other local projects. For example, asphalt grindings and rail ballasts can be taken from nearby projects and used for haul roads or bituminous runway shoulders.	LEED®	MR Credit 4	ORD	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	Supports local projects and improves community relations. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	19
Ensure that the specified recycled content materials are installed and quantify the total percentage of recycled content materials installed.	LEED®	MR Credit 4	ORD	Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	19
Use the Waste Resource Action Programme's (WRAP) “Recycled Content Tool,” to calculate the recycled content of a project and identify quick wins and benefits to maximize the recycled content of materials used with construction.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	20

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Use recycled content material made from high-density polyethylene (HDPE) or co-mingled plastic for items such as trash receptacles, benches, tables, and bike racks.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
During Construction								
Sustainable Materials								
Recycled Content								
Use recycled plastics for roadway markers, speed bumps, parking stops and traffic signs.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
Use cold-rolled steel framing, as it typically contains 20-25 percent recycled material.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
Use hollow metal doors and frames from recycled metal content.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
Install gypsum wallboard; gypsum wallboard incorporates recycled scrap wallboard and by-product gypsum. Synthetic gypsum content in drywall helps prevent against moisture.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
Use composite boards, including paper and wood/paper building boards that utilize milling by-products, waste woods, recycled paper, and/or agricultural waste (wheat-straw board).	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
Use high recycled content cast iron for sanitary waste and vent piping.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
During Construction								
Sustainable Materials								
Recycled Content								
If using plastic electrical device wall plates, ensure that they are made of at least 20 percent recycled plastic.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
Install terrazzo materials that contain recycled content.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
For asphalt pavements, use recycled materials such as rubber, glass, asphalt roofing shingles, and blast furnace slag; this pavement can be used for access roads and non FAA regulated pavements.	LEED®	MR Credit 4		Most recycled content products exhibit performance similar to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	May help improve the community's view of the airport if part of an outreach program.	7
Use recycled rubber and plastic materials for temporary barriers and A-Frame Barricades.	LEED®	MR Credit 4		Potential cost savings.	Helps conserve natural resources.	Establish specifications in product purchasing.	No applicable Research Team Consideration.	55
Install flooring from recycled and reusable materials such as rubber, glass, agriculture fibers, and plastic, which can last longer and is easy to maintain.	LEED®	MR Credit 4		These materials are from recycled and reused materials, typically last longer, and are easier to maintain than traditional flooring materials.	Reduces the impacts from extraction and processing of virgin materials.	Recycled content goals should be established during the design phase.	No applicable Research Team Consideration.	55
Use geotextile products manufactured from recycled plastic or natural-fiber geotextiles.	LEED®	MR Credit 4		May have a higher upfront cost.	Helps conserve natural resources.	Establish specifications in product purchasing.	No applicable Research Team Consideration.	55
Use cellulose insulation made from 75-85 percent recycled newsprint.	LEED®	MR Credit 4		Most recycled content products perform similarly to products containing only virgin materials and can be incorporated into projects with minimal to no cost premium.	Reduces the impacts from extraction and processing of virgin materials.	Product availability may be limited.	No applicable Research Team Consideration.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Local/Regional Materials								
Use the following locally/regionally available materials: concrete, asphalt, structural steel, masonry, post-industrial recycled gypsum wallboard, storm system concrete pipes of all sizes, manholes and handholes, electrical duct banks, cable, gas and water piping, rail tracks, rail ties, rail ballast, landscape material and seed.	LEED®	MR Credit 5	ORD	Regional building materials are more cost effective for projects due to reduced transportation costs.	Reduces the environmental impacts resulting from transportation.	For buildings, specify mechanical, electrical and plumbing equipment and components that meet the regional material goals. The availability of regionally manufactured materials is dependent on the project location.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	2, 18, 64
Establish a goal for the minimum percentage of local/regional materials and products that are manufactured regionally within a radius of 500 miles. Identify the value of local/regional materials so that they can be compared with of the total value of the materials in the task/project. (Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen).	LEED®	MR Credit 5	ORD	Regional building materials are more cost effective for projects due to reduced transportation costs. Consider early on in the design process, if possible, since research may be required to determine what products can be sourced locally and realistically be expected to be purchased for the project.	Reduces the environmental impacts resulting from transportation. It is also important to discuss the source of raw materials used to manufacture building products.	Identify and specify materials and material suppliers that can achieve the regional materials goal.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	19, 64
During construction, ensure that the specified local materials are installed and quantify the percentage of the local materials installed based on a percentage of overall construction cost.	LEED®	MR Credit 5	ORD	Regional building materials are more cost effective for projects due to reduced transportation costs.	Reduces the environmental impacts resulting from transportation. May require hiring a LEED® AP or other professional to monitor compliance.	May require a tracking system and personnel to monitor compliance.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	19, 64
Allow contractors to suggest availability of local materials - keep lines of communication open.	LEED®	MR Credit 5		Regional building materials are more cost effective for projects due to reduced transportation costs. Consider early on in the design process, if possible, since research may be required to determine what products can be sourced locally and realistically be expected to be purchased for the project.	Reduces the environmental impacts resulting from transportation.	Consider publishing a website where contractors can indicate availability of regional material sources.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	56

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Rapidly Renewable Materials								
Use the following rapidly renewable materials for both permanent and temporary construction materials: poplar OSB and straw board or "agriboard" (formwork for temporary construction and underlayment); bamboo flooring; cork; wool carpets and fabrics; cotton-batt insulation; linoleum flooring; sunflower seed board; wheat grass or straw board cabinetry and others.	LEED®	MR Credit 6		Since rapidly renewable materials may be harvested more quickly, they tend to give a faster payback on investment for manufacturers. As demand increases, they are expected to become cost-competitive with conventional materials.	Rapidly renewable materials are made from plants and typically harvested within a ten-year cycle. Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	No applicable Research Team Consideration.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	2, 64
Install clay roof tiles which are made from abundant raw materials and carry effective heat gain characteristics (for cool climates).	LEED®	MR Credit 6		Reduce maintenance costs; clay roof tiles provided improved durability and an increased life cycle.	Require less energy to produce and have a long life cycle. Production of clay has a low environmental impact; clay can be easily recycled. Reduces the use and depletion of finite raw materials. Building-integrated solar clay tiles are also available.	Clay roof tiles are fireproof.	May enhance architectural features.	55
Use paper joint tape to reinforce joints and corners in gypsum drywall interiors in lieu of fiberglass tape.	LEED®	MR Credit 6		May result in less cracking and thus fewer call backs, saving time and money.	A potential health hazard results from the dust produced during the removal of fiberglass casts.	It provides strength to joints between plasterboard sheets. Easier to remove than fiberglass tape.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	55
Ensure that the specified rapidly renewable materials are installed.	LEED®	MR Credit 6	ORD	Since rapidly renewable materials may be harvested more quickly, they tend to give a faster payback on investment for manufacturers. As demand increases, they are expected to become cost-competitive with conventional materials.	Rapidly renewable materials are made from plants and typically harvested within a ten-year cycle. Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	May require a tracking system and personnel to monitor compliance.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	19, 64

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Rapidly Renewable Materials								
Use paper-faced compressed straw panels as an alternative for interior wall partitions.	LEED®	MR Credit 6		Straw is relatively inexpensive since it is a waste product of grains. Avoids unpredictable lumber prices.	They are a rapidly renewable waste product of grains, such as harvested wheat, rice, barley, oats, and rye. Since straw is still burned in fields in some areas, air pollution associated with burning straw is avoided. While straw provides few nutrients to the soil, it does add organic matter and helps aerate the soil.	Straw densely packed into bales is fire resistant since the tight packing keeps the available oxygen needed for combustion limited and the high silica content in straw is said to impede fire.	May reduce the risk of accidents that can occur when shifting winds blow smoke over highways and ignite straw left in fields.	26, 55
Install carpets made with bio-based materials such as cotton, jute, sisal, hemp, wool, and polylactic acid (PLA) fiber.	LEED®	MR Credit 6		Carpet made of wool is usually more expensive (although inherently flame resistant).	Reduces the use and depletion of finite raw materials and long-cycle renewable materials. Improves indoor air quality.	No applicable Research Team Consideration.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	43
Use natural cork, strawboard and recycled-content fiber board in flooring underlayment applications.	LEED®	MR Credit 6		As demand increases, they are expected to become cost-competitive with conventional materials.	Synthetic carpet fiber, backing, pad, adhesive, seam sealants, and floor preparation chemicals are all potential sources of VOC in indoor air. These natural materials don't emit harmful chemicals.	Cork floor tile should be composed of 100% natural cork bark and recycled cork granules and set in a natural or synthetic flexible resin matrix; it should be homogeneous and uniform in composition throughout the tile thickness.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	55
Use a carbon-negative, hemp-based building material from renewable sources that is several times stronger than concrete. The material can be used as a substitute for concrete for the creation of buildings, insulating walls, and insulation layers for floors and roofs.	LEED®	MR Credit 6	LAX, ONT, VNY, PMD	Produced mainly from renewable sources, hemp-based building materials are mixed on site and deliver high levels of insulation, air-tightness, and vapor permeability. The product can have a lifespan of approximately 100 years.	More carbon is absorbed through growing the hemp than creating the building material, which helps reverse the damaging effects of greenhouse gases. Hemp-based building materials can lock up approximately 110 kilograms of carbon dioxide per cubic meter of wall.	Weighs less than concrete and is less prone to cracking. May be used to create insulating walls and insulation layers for floors and roofs. Can be used to provide buildings with beneficial thermal and acoustic properties.	Creates a healthy living and working environment.	39

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Pavements and Building Structures								
Use Portland cement concrete with 25 percent fly ash (can be substituted for up to 60 percent of cement in a concrete mix) that has less embodied energy and reduces water permeability.	LEED®	MR Credit 4		May reduce material costs.	Fly ash is a byproduct of coal-fired power plants; it contains some radioactivity otherwise disposed in landfills.	Coal fly ash blended cements may range from 0-40% coal fly ash by weight, according to ASTM C 595, for cement Types IP and I(PM). 15% is a more accepted rate when coal fly ash is used as a partial cement replacement. May enhance concrete capabilities. Availability variable. Establish specifications for use/composition.	May help improve the community's view of the airport if part of an outreach program.	43
Use ground granulated blast furnace slag (GGBF slag) to replace up to 70% of the Portland cement in concrete mixtures. Most GGBF slag concrete mixtures contain between 25 and 50 percent GGBF slag by weight, providing protection against sulphate attack and chloride attack.	LEED®	MR Credit 4		GGBF slag cement is typically less expensive than Portland cement. GGBS has replaced Sulfate Resisting Portland cement on the market for sulfate resistance because of its superior performance and greatly reduced cost.	Useful application of a waste product.	Must be in compliance with ASTM C989, Grade 100 or Grade 120. Availability variable. Establish specifications for use/composition. Improves durability, reducing maintenance costs and repairs that may delay operations.	May help improve the community's view of the airport if part of an outreach program.	55
Use silica fume as a replacement for 5 to 7 percent of Portland cement to improve compressive strength, bond strength, and abrasion resistance; reduce permeability; and protect from corrosion.	LEED®	MR Credit 4		May reduce material costs. Extends the lifecycle of cement, reducing the frequency of repairs and replacement.	Silica fume is very fine pozzolanic material produced by electric arc furnaces as a byproduct of production of elemental silicon or ferro-silicon alloys.	Reduces maintenance, reducing operational delays. Replacement levels higher than 10 percent can lead to workability issues. Availability is variable. Establish specifications for use/composition.	Prevents silica fume from being discharged into the atmosphere.	43
Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement. Hardened, cured waste concrete may be used as aggregate in concrete mix (if approved by the engineer).	LEED®	MR Credit 4		May reduce material costs. May reduce disposal costs for waste as in many urban areas, concrete can no longer be accepted in landfills.	In many urban areas, concrete can no longer be accepted in landfills.	Concrete admixtures are now available that retard the setting of concrete so effectively that a partial load can be brought back to the ready mix plant for one or two days then reactivated for use. Establish specifications for use/composition.	Reduced off-site hauling could reduce traffic in the surrounding community.	43

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Appendix B. (Continued).

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Sustainable Materials								
Pavements and Building Structures								
Use scrap tires as an alternative fuel source (tire-derived fuel or TDF) in cement production kilns or purchase concrete from kilns that use recycled tires.				Tires contain 1.25 times the energy content of coal, so the savings on energy costs can be significant. The cement industry is the largest end-user of TDF. Tires have consistent and predictable properties, so TDF performance in the kiln is well understood.	Tires contain less nitrogen than coal, the higher the level at which tires are substituted for coal, the greater the reduction of NOx. Emissions demonstrate a consistent reduction in sulfur and other emissions with the use of TDF.	There is typically a limit on the use of TDF because tires also contain zinc which slows the setting time for concrete. Variable availability.	Using tires as a source of energy may not be well received due to concern over potential emissions; and the loss of a resource that use as a fuel diverts tires from higher value-added markets. In reality, the addition of TDF typically has a neutral to positive impact on air emissions.	5, 11
Use the asphalt, aggregate, fibers, and limestone filler from recycled roof shingles in hot-mix or warm-mix asphalt.				Asphalt mixes with recycled roof shingles may be more resistant to thermal cracking (undergoing further testing), reducing maintenance costs.	Reduces the demand on virgin materials. Reduces landfill-bound waste.	Must abide by NESHAP 40 CFR Part 61, Subpart M (must be asbestos free, cannot include nails or deletious material; must follow grind size and moisture content specifications). Samples should be proportioned and pre-blended prior to heating.	May help improve the community's view of the airport if part of an outreach program. Reduces landfill-bound waste in the local community, especially after large storm events.	68
Use carbon fiber reinforcement instead of rebar or steel mesh (these products corrode and are one of the weakest parts of the concrete structure).				Reduce cracking and extend life in concrete, reducing maintenance costs.	The product is lightweight and corrosion resistant making it stronger and easier to use than steel, producing lighter weight components, product developers contend.	Establish specifications for use. Extends the structure's life cycle, reducing the frequency of building repairs.	No applicable Research Team Consideration.	40
Use rubberized pavements or innovative pavement treatments to improve durability and reduce maintenance.			LAX, ONT, VNY, PMD	Reduces maintenance costs and replacement costs by extending the pavement's life cycle. May reduce the need for expensive noise barriers.	Can reduce road noise by up to 15 dB. Makes use of recycled tires.	Extends pavement life cycle, reducing the frequency of rehabilitation and maintenance.	Reduces noise in nearby communities.	7, 39
Use rubber modified asphalt (RMA) with crumb rubber content no greater than 20 percent.				RMA, specifically when used in Stress Absorbing Membranes or Stress Absorbing Membrane Interlayers, reduces the occurrence of reflective cracking because of its elastic properties, reducing maintenance costs.	Decreases noise levels (up to 5 dB). Depending on the application selected, between 500 and 2,000 scrap tires can be used in each lane mile of pavement.	Improves skid resistance.	Reduces noise in nearby communities.	8, 55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Pavements and Building Structures								
Utilize warm-mix asphalt to reduce energy needs during construction.			BOS, ORD	Uses 20 percent less energy to make, reducing production costs.	The asphalt is heated 75-50°F less than traditional 'hot-mix' asphalt, reducing GHG emissions on-site and at the production plant. Produces 20 percent fewer greenhouse gas emissions than traditional asphalt.	Some sources claim warm-mix asphalt compacts better, allowing for sturdier runways. Requires FAA coordination/approval.	Because warm-mix asphalt is not heated as high, the work environment is healthier for the crews installing the pavement.	19, 32
Install light colored/high albedo pavement for roadways (i.e., Portland cement), parking lots, sidewalks and plaza areas.	LEED®	SS Credit 7.1	LAX, ONT, VNY, PMD	Absorbs less heat, which may aid in energy savings. Reduces costs associated with cooling and HVAC equipment.	Reduces heat islands, minimizing the impact on the microclimate and human and wildlife habitat.	Improves roadway visibility, improving safety.	Reduces heat islands in the local community, reducing temperature compared to absorptive pavements.	39
Use asphalt pavements for access roads and non FAA regulated pavements.				Asphalt typically requires about 20 percent less energy to produce and construct than other pavements, consuming less fuel.	The production and installation of asphalt produces lower levels of greenhouse gasses that other pavements. Dark-colored pavement may increase the heat island effect. Consider shading and/or open-grid systems where possible.	Asphalt pavements are generally faster to construct and rehabilitate, opening to traffic as soon as it has been compacted and cooled.	Consider the amount of absorptive pavements in the local community to ensure that heat islands would not be an issue of concern.	7
Install permeable pavement (pavers or pervious concrete) for roadways, shoulders, non-traffic pavements, maintenance roads, utility yards, and airside and landside parking facilities, where possible.	LEED®	SS Credit 6.1	ORD, LAX, ONT, VNY, PMD	Permeable pavement may be similar to (or potentially higher than) the cost of traditional pavement materials. However, using permeable paving can reduce the cost of providing larger or more stormwater BMPs on-site.	Porous pavement can be used to turn runoff into infiltration; restore the hydrology of a site; improve water quality; replenish aquifers; protect streams; reduce heat islands; and clean stormwater. It should be avoided where activities generate contaminated runoff, in areas that have low soil permeability, seasonal high groundwater tables, and areas close to drinking water supply wells.	May melt together in extreme heat, filling the "permeable" voids. Sand applied to the pavement will clog the surface. Chlorides from road salt may migrate into groundwater. Plowing may be challenging because the edge of the snow plow blade can catch the edge of the blocks, damaging the surface. Infiltrating runoff below pavement may cause frost heave, although design modifications can reduce this risk. Snow melts faster on a porous surface because of rapid drainage below the snow surface.	Improves water quality and reduces flooding in the local community.	7, 18, 50, 61

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Sustainable Materials								
Pavements and Building Structures								
Provide shade for new pavement from the existing tree canopy or within 5 years of landscape installation. Landscaping (trees) should be in place at the time of occupancy.	LEED®	SS Credit 7.1		Reduces costs associated with cooling and HVAC equipment and may extend the life cycle of the covered pavement.	Reduces stormwater runoff and heat islands, minimizing the impact on the microclimate and human and wildlife habitat.	May reduce glare, enhancing safety in parking lots and roadways.	Vegetated areas provide aesthetic benefits.	64
Place a minimum of 50 percent of newly constructed parking spaces under cover. Any roof used to shade or cover parking must have a SRI ≥29 or be a vegetated green roof.	LEED®	SS Credit 7.1		Green roofs require lower maintenance than standard roofs (if native species are planted) but typically require an additional up-front investment.	Reduces heat islands, minimizing the impact on the microclimate and human and wildlife habitat. Green roofs reduce stormwater runoff.	May reduce glare, enhancing safety in parking lots and roadways.	Vegetated roofs provide aesthetic benefits.	64
Use granite aggregate as a subbase for runways.			MSP	Granite aggregates have an expected lifetime of 40-50 years, reducing maintenance costs and the frequency of restructuring/repaving.	Provides self-draining properties. An extended lifespan reduces the demand for new materials, reducing emissions from production and transportation.	Extended lifespan reduces the need for runway restructuring, reducing operational delays.	No applicable Research Team Consideration.	30
Extend the base course width of a pavement by 1-2 feet beyond the top pavement to prevent premature distress.				Edges experience the greatest stress (largely from moisture changes), so by extending the base course, the top pavement layer will have an extended life cycle, reducing maintenance costs and the frequency of restructuring/repaving.	Reduces the demand for new materials, minimizing emissions from production and transportation.	Extended lifespan reduces the need for pavement restructuring, reducing operational delays.	No applicable Research Team Consideration.	29
To prevent premature distress of pavement, use a non-fossil fuel based/non-volatile environmentally friendly prime coat to waterproof asphalt instead of a diesel based prime coat.				Prevents premature distress of pavement, reducing maintenance costs and the frequency of restructuring/repaving.	Reduces the quantity of air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers. VOCs also contribute to smog generation and outdoor air pollution.	Extended lifespan reduces the need for pavement restructuring, reducing operational delays.	Reduces air pollution in the local community.	29
During a pavement course, cut off the last foot and begin the next course from that spot to ensure good joint density. The last foot that is removed has a lower density than the rest of the course (it is weaker and leads to cracking and distress).				Prevents premature distress of pavement, reducing maintenance costs and the frequency of restructuring/repaving.	Reduces the demand for new materials, minimizing emissions from production and transportation.	Extended lifespan reduces the need for pavement restructuring, reducing operational delays.	No applicable Research Team Consideration.	29

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Pavements and Building Structures								
Use chip seals instead of slurry seals to stop pavement cracking and prevent future cracking. Once chip seals are used, then micro surfacing can be applied.				Life cycle (4 to 6 years) and cost (per square yard) is the same as for a slurry seal. Equipment to apply a slurry seal is not as common as the equipment for a chip-seal application.	An extended pavement life cycle reduces the demand for new materials, minimizing emissions from production and transportation.	Provides increased skid resistance, an anti-glare surface during wet weather, and an increased reflective surface for night driving. Cracked windshields can be reduced by using volcanic cinders or manufactured lightweight aggregate.	No applicable Research Team Consideration.	29
Use precast high performance concrete for buildings.				Prefabrication may reduce product, transport costs.	Focuses environmental controls at production facility.	Establish specifications for use.	No applicable Research Team Consideration.	40
Use "Roman concrete" instead of traditional concrete to extend the durability of a structure. Roman concrete consists of volcanic ash or 'pozzolan' (silica and small amounts of alumina and iron oxide) instead of sand and is mixed at a ratio of two parts pozzolan to one part lime.				Prevents premature distress and extends life cycle, reducing maintenance costs and the frequency of restructuring/repaving.	Prior to purchasing, consider the emissions associated with hauling the Roman concrete components large distances.	Extended lifespan reduces the need for rebuilding or restructuring, reducing operational delays.	No applicable Research Team Consideration.	21
Use recycled newspaper or waste agriculture materials in expansion joint fillers to keep them dry and clean.				Less expensive than conventional fillers. Since rapidly renewable materials may be harvested more quickly, they tend to give a faster payback on investment for manufacturers.	Reduces the use and depletion of finite raw materials and long-cycle renewable materials.	No applicable Research Team Consideration.	May sustain a community over a longer period than the steady and eventual depletion of finite resources or the degradation of a productive ecosystem.	55
For structural steel, consider metal finishing based on physical processes such as abrasive blasting, grinding, buffing, and polishing, rather than multiple coatings.				No applicable Research Team Consideration.	Avoid plated metals that use cadmium or chromium plating materials and cyanide or formaldehyde copper plating solutions.	No applicable Research Team Consideration.	Protects the health of installers and occupants.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Pavements and Building Structures								
Use fiber cement siding as a replacement for wood or typical exterior wall cladding. Fiber-cement siding is composed of cement, sand, and cellulose fiber that has been autoclaved (cured with pressurized steam) to increase its strength and dimensional stability. The fiber is added as reinforcement to prevent cracking.				Obtains the look of wood while achieving higher durability and lower maintenance costs. The installed costs are typically less than traditional masonry or synthetic stucco, equal to or less than hardboard siding, and more than vinyl siding.	It is termite-resistant, water-resistant, non-combustible, and warranted to last 50 years.	Appropriate for hot and humid climates because it is resistant to rot, fungus, and termite infestation. Manufacturers state that it has excellent weathering characteristics, strength, and impact resistance. Unless top coat is applied in the factory, siding may need to be painted every 4-5 years.	No applicable Research Team Consideration.	5, 42
Use large panel formwork systems to reduce concrete waste generated by losses due to damaged formwork, which usually accounts for 30% of the total concrete waste.				May increase material costs, however, may reduce transportation of materials. Reduces transportation and waste disposal costs.	Uses fewer raw materials, reduces material wastes, reduces transportation impacts, reduces landfill impacts, and improves air quality by reducing negative impacts related to concrete processing.	Enables just-in-time construction techniques.	Reduces the impact of delivery vehicles on local streets.	55
Use biodegradable form releasing agents.				No applicable Research Team Consideration.	Conventional form-release oils can be a major source of VOCs, soil contamination, and human health risks. Biodegradable, nonpetroleum alternatives contain just a fraction of the federally permitted VOC limit for concrete form-release agents.	May minimize exposure of workers to hazardous pollutants.	Protects the health of installers and occupants.	55
Sustainable Materials								
Roofing Materials								
Install high reflectance/high albedo roofing materials with a high solar reflectance index (SRI), as described in the ASTM E 1980 standard. Low-sloped roofs (slope <= 2:12) should have a SRI value of 78 or above; steep-sloped roofs (slope > 2:12) should have a SRI value greater than 29.	LEED®	SS Credit 7.2		Reduce costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing due to high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	64

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Roofing Materials								
Install a vegetated green roof system for at least 50 percent of the roof area to reduce the heat island effect.	LEED®	SS Credit 7.2	ORD	Provide energy saving insulation benefits and require lower maintenance than standard roofs (if native species are planted). Green roofs typically require an additional up-front investment.	Reduces stormwater runoff - typically only 25 percent of rainfall on a green roof becomes runoff. Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat. "Extensive" green roof systems with 1 to 5 inches of topsoil can be installed that improve filtration and treatment of rainwater.	No applicable Research Team Consideration.	Provide aesthetic benefits and reduce heat islands.	19
Use a combination of vegetated and high albedo surfaces.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Provide energy saving insulation benefits and require lower maintenance than standard roofs (if native species are planted). Green roofs typically require an additional up-front investment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing due to high emittance and low absorption, which may increase heating costs.	Reduces stormwater runoff and heat islands, minimizing the impact on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Provide aesthetic benefits and reduce heat islands.	39
Install a Cool Roof Rating Council (CRRC) rated roof product or an Energy Star cool roof with equivalent reluctance and emittance properties (www.coolroofs.org).	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing due to high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Roofing Materials								
Use a single ply roofing membrane with high emittance properties.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing due to high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39
Apply high reflectance coating to the surface of a conventional roof membrane.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing due to high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39
Use metal roofs with industrial grade coating that are high reflectance and high emittance.	LEED®	SS Credit 7.2	LAX, ONT, VNY, PMD	Reduces costs associated with cooling and HVAC equipment. Buildings in very cold climates may not experience year-round energy benefits from reflective roofing due to high emittance and low absorption, which may increase heating costs.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat.	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	39
For roofing shingles, use recycled steel/aluminum, photovoltaic roofing technologies, plastic shingles, natural slate shingles, certified wood shingles, and/or clay roof tiles to reduce the heat-island effect.	LEED®	SS Credit 7.2		Potential material cost savings; longer-term operational benefits.	Reduces heat islands (thermal gradient differences between developed and undeveloped areas), minimizing the impact on the microclimate and human and wildlife habitat.	Consider the regional climate, e.g., exposure to storms, tornados, hail, the solar resource potential, etc.	Reduces heat islands in the local community, reducing temperature compared to absorptive roofing.	55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Roofing Materials								
Use roofing membranes containing thermoplastic olefins (TPO) in lieu of PVC's.	LEED®	MR Credit 6		Higher cost compared to PVC.	A properly formulated membrane sheet will not pose environmental hazards and is well suited for landfill disposal, recycling or incineration. There are no environmental concerns with the base polymers and all of the raw materials and base additives are non-hazardous.	Non-halogenated materials, such as mineral hydrate, can be applied as flame-retardants. The following alternatives to PVC can also be used for roofing membranes: ethylene propylene diene monomer, nitrile butadiene polymer, and low-slope metal roofing.	PVC poses a risk in building fires since it releases deadly gases long before it ignites. PVC is manufactured near low-income communities in Texas and Louisiana. The toxic impact of pollution from these factories on these communities has made them a focus in the environmental justice movement.	55
Sustainable Materials								
Foundations								
Add polyethylene vapor retardant under the floor slab and avoid a layer of sand between the polyethylene and the concrete to reduce the occurrence of mold.				Increases floor life cycle, reducing maintenance costs and the frequency of replacement.	Reduces indoor air quality hazards associated with mold, improving employee health.	May help extend the life cycle of the floor slab, reducing building maintenance.	No applicable Research Team Consideration.	55
Install a layer of gas-permeable material under the foundation, e.g., 4 inches of gravel, covered by plastic sheeting.				Reduces ground source moisture and energy usage, saving costs. It is more cost-effective to include radon-resistant techniques while building a structure rather than installing a radon reduction system in an existing building.	Creates a physical barrier to radon entry, reducing the risk of lung cancer in occupants.	May require hiring staff experienced in radon minimization.	No applicable Research Team Consideration.	47
Seal and caulk all openings in the concrete foundation floor and install a gas-tight 3" or 4" vent pipe that runs from under the foundation through the building to the roof.				Reduces ground source moisture and energy usage, saving costs. It is more cost-effective to include radon-resistant techniques while building a structure rather than installing a radon reduction system in an existing building.	Creates a physical barrier to radon entry and a pathway for the radon to be redirected outside, reducing the risk of lung cancer in occupants.	May require hiring staff experienced in radon minimization.	No applicable Research Team Consideration.	47
Provide capillary break (damp-proofing) between the footing and foundation wall or perimeter foundation for slab-on-grade.				A non-insulated foundation can result in a large heat loss from an otherwise tightly sealed, well-insulated building. Less expensive to install than exterior insulation for existing buildings.	Reduces the demand for HVAC operation, reducing emissions.	May help extend the life cycle of the floor slab, reducing building maintenance.	No applicable Research Team Consideration.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Foundations								
Install drainage tile at foundation footings.				Reduces ground source moisture and energy usage, saving costs. Less expensive to install than exterior insulation for existing buildings.	Reduces the presence of mold, improving indoor air quality. Reduces the demand for HVAC operation, reducing emissions.	May help extend the life cycle of the floor slab, reducing building maintenance.	No applicable Research Team Consideration.	55
Use foundation anchor systems that do not require excavation.				No applicable Research Team Consideration.	Limits excavation and soil/material disposal or storage.	Establish specifications for use.	Avoids construction noise and air pollution associated with excavation.	55
Sustainable Materials								
Building Interiors								
Install carpet tiles from post industrial nylon that are reusable and recyclable.	LEED®	MR Credit 4		Potential cost savings.	Reduces land fill use, conserves use of natural resources.	Specifications may need to be established in project standards and procedures to use on a project.	No applicable Research Team Consideration.	55
Use ceramic tile containing post-consumer or post-industrial waste.	LEED®	MR Credit 4		Potential cost savings.	Reduces land fill use, conserves use of natural resources.	Specifications may need to be established in project standards and procedures to use on a project.	No applicable Research Team Consideration.	55
Use Structural Insulated Panels (SIPs) consisting of Oriented-Strand Board (OSB) for floors, walls, and/or roofs.				Provides a tighter building envelope with higher insulating properties, decreasing operating costs. Due to the standardized and 'all-in-one' nature of SIPs, construction time can be reduced and may require fewer trades for system integration.	Helps conserve natural resources.	SIPs consist of a sandwich of two layers of structural board with an insulating layer of foam in between. The board can be sheet metal or OSB and the foam either expanded polystyrene foam, extruded polystyrene foam, or polyurethane foam.	No applicable Research Team Consideration.	55
Do not use particleboard or medium-density fiberboard that contains urea formaldehyde.				No applicable Research Team Consideration.	Reduces long-term exposure in completed structure.	No applicable Research Team Consideration.	Protects the health of installers and occupants.	13
Use concrete pigments to turn plain concrete slabs into finished floors, eliminating the need for conventional finish flooring.				Uses less material to turn concrete into finished surfaces, reducing costs.	Avoids the need for additional products and coatings, eliminating the environmental impacts associated with manufacturing and maintaining those materials.	No applicable Research Team Consideration.	Enhances aesthetics; avoids traffic resulting from the transportation of finish flooring.	5

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Building Interiors								
Install moisture resistant greenboard and mold resistant purpleboard drywall.			ORD	Both have a higher cost than traditional drywall due to their advanced properties.	Greenboard has the same gypsum core as the other varieties, but is covered in a thicker, more water-resistant paper than standard drywall. The paper is coated with wax to help control moisture absorption.	Although greenboard drywall's paper covering is water-resistant, it is not waterproof. The brittle gypsum core is not suitable for wet applications or for floors or ceilings. It is installed the same way as standard wallpaper.	No applicable Research Team Consideration.	18
Use drywall clips instead of traditional metal or wood blocking to install drywall. These clips create a single or double-stud corner, versus the three or four-stud corners that the blocking provided.				With the use of drywall clips, the drywall is separated from the framing pieces, which helps minimize sound transmission through the walls. For further sound transmission control, specialized sound isolation drywall clips can be used, which are attached to the studs then nailed to the drywall.	With the use of drywall clips, the drywall is separated from the framing pieces, which helps minimize sound travel through the walls. For further sound transmission control, specialized sound isolation drywall clips can be used, which are attached to the studs then nailed to the drywall.	This provides sufficient support and backing that is comparable to and sometimes better than the traditional three or four-stud corners.	No applicable Research Team Consideration.	5
Prior to purchasing insulation products, ensure that they were not manufactured using CFC or HCFC refrigerants.	LEED®	EA Credit 4		No applicable Research Team Consideration.	CFC and HCFC deplete the ozone layer, allowing harmful ultraviolet radiation to penetrate through to the Earth's surface.	Establish product specifications.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	55
Require or recommend sleeves/sealants that ensure low transfer rates of radon.				No applicable Research Team Consideration.	Longer-term environmental considerations.	Specifications may need to be established in project standards and procedures.	Reduces exposure of workers and building occupants to radon.	55
Use biodegradable hydraulic elevator oils.				Higher cost than mineral oils, however, reduces liability and costs for oil cleanup from spills and leaks.	Reduces environmental issues caused by spills and leaks.	No applicable Research Team Consideration.	Can be domestically produced.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Building Interiors								
Provide incentives for reduced PVC use in site conduit applications and require all PVC used underground to be encased in concrete. Alternatives for piping include cast iron, steel, concrete, vitrified clay, and copper. Siding alternatives include fiber-cement board; stucco; recycled, reclaimed, or FSC certified sustainably harvested wood, oriented strand board, brick, and polypropylene.				PVC conduit is usually lower in cost than other forms of conduit.	PVC poses major hazards in its manufacture, product life and disposal. Toxic manufacturing byproducts include dioxin, ethylene dichloride and vinyl chloride, which can cause cancer, endocrine disruption, neurological damage, birth defects & impaired child development, and other hazardous health impacts. The additives required to make PVC make large scale post consumer recycling problematic for most products and interfere with the recycling of other plastics.	Alternatives: Flooring & Carpet: linoleum, bamboo, ceramic tile, carpeting with natural fiber backing or polyolefins, reclaimed or FSC wood, cork, rubber, concrete, and non-chlorinated plastic polymers. Wall Coverings & Furniture: natural fibers such as wood and wool, polyethylene, polyester, and paint. Electrical Insulation and Sheathing: halogen free, linear low-density polyethylene, and thermoset crosslinked polyethylene. Windows & Doors: recycled, reclaimed or FSC wood, fiberglass, and aluminum.	PVC poses a risk in building fires since it releases deadly gases long before it ignites. PVC is manufactured near low-income communities in Texas and Louisiana. The toxic impact of pollution from these factories on these communities has made them a focus in the environmental justice movement.	33, 55
Use vitrified clay pipes (VCP) for drain piping in lieu of more expensive cast iron pipes.				VCPs have a lifespan of 80 to 100 years due to features such as resistance to corrosion and chemical attack, abrasion, temperature, and impermeability, providing life cycle cost benefits.	The raw materials for manufacturing VCP are clay and recycled materials from the ceramic industry. The environmental impact of manufacturing of VCP is relatively small compared with most other types of sewer materials.	Benefits include impermeability, hardness, and mechanical strength. Commonly used in sewer gravity collection mains because of their resistance to domestic and industrial sewage, particularly sulfuric acid. Only hydrofluoric acid and highly-concentrated caustic wastes are known to attack VCP - wastes not permitted to be discharged into a municipal sewage collection system without adequate pretreatment.	No applicable Research Team Consideration.	12, 55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Building Interiors								
Do not use fiberglass insulation or duct liners that contain phenol formaldehyde binders. As a substitute, use loose fill or blown fiberglass insulation that requires no formaldehyde binder. Fiberglass insulation produced with acrylic binder or non-fiberglass batts made of cotton, sheep's wool, or mineral (rock or slag) wool can also be used.				All of the alternative batt insulation products are made almost entirely from recycled or renewable materials. They offer similar thermal performance as fiberglass but at a slight cost premium.	The extended use of fiberglass duct liners may result in microbial growth. A phenol-formaldehyde binder can off-gas and be a moderate indoor air quality concern. Most fiberglass insulation does have at least 30 percent recycled glass content but is made of boron, a finite recourse.	Non-fiberglass batts offer similar thermal performance as fiberglass.	Reduces exposure of workers and building occupants to formaldehyde.	55
Use a pressurized aerosol duct sealing for internally sealing existing heating and cooling HVAC ducts.	LEED®	EA Credit 1		Lawrence Berkeley National Laboratory testing demonstrated that aerosol sealing can reduce leakage by a factor of 5 to 8, saving an estimated $300 per year on the heating and cooling costs of a typical home. Aerosol duct sealing is easy to use compared with traditional methods such as applying mastic, because it eliminates the need to open wall, floor, and ceiling cavities to access hard-to-reach leaks.	An insignificant amount of adhesive particles are deposited on interior duct walls, and they have no harmful effect on the IAQ of a building.	Before aerosol sealing test ducts to determine the leakage volume. Aerosol sealing is not recommended for gaps larger than 1/4-inch.	No applicable Research Team Consideration.	42
Use duct mastics (gooey sealants that are painted on and allowed to harden) in lieu of duct tapes to minimize leakage effects.				Duct mastics provide improved sealing over duct tapes, reducing energy costs. Maintenance costs may decline due to less frequent application of duct tape.	Improved sealing results in improved energy efficiency and lower heating/cooling demand, reducing emissions caused by HVAC operation.	Duct tape does not adequately seal HVAC joints and has a short lifespan.	No applicable Research Team Consideration.	55
Sustainable Materials								
Electrical Materials								
Use and install compact fluorescent lighting (CFL).	LEED®	EA Credit 1		It consumes as little as one-fifth the power and lasts up to 13 times longer than incandescent fixtures.	Reduces carbon monoxide emissions and emissions from production and materials use due to the extended lifespan of CFL.	They produce about 90 percent less heat than incandescent bulbs while delivering more light per Watt.	Reduces energy demand and improves air quality in the local community.	55
Use and install slim-profile lighting systems.	LEED®	EA Credit 1		Can save energy costs because of better lumen output and a thinner lamp.	Reduces emissions from energy usage; consider slim profile solar lights to enable remote use and/or to provide safety lighting.	Provide a highly concentrated light source that can enhance the performance of the luminaries.	Reduces energy demand and improves air quality in the local community.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Electrical Materials								
Minimize the use of lit signage outdoors and maximize the use of photovoltaic panels for construction and warning signage where applicable.	LEED®	EA Credit 1		Reduces energy costs.	Reduces emissions from energy usage.	Photovoltaic panels can be placed in remote locations and don't require connection to a grid.	Reduces energy demand; photovoltaic signage provides visible evidence of the airport's commitment to sustainability.	55
Use and install LED lights.	LEED®	EA Credit 1		Consume less energy than incandescent lights and often pay back the additional first cost within one year through energy savings; they require less maintenance and provide improved performance. All LED products should have a warranty of at least 5 years with a recycling program provided by the manufacturer.	More energy efficient and longer lasting than incandescent lights, reducing emissions from power generation and production.	Provide improved robustness, smaller size, faster switching, and greater durability and reliability. May require more precise current and heat management than traditional light sources. Solar-powered LED lights offer additional advantages, including application in remote location without grid access or as an emergency-response application.	Reduces energy demand in the local community.	13, 55
Install photo-luminescent signage for safety pathway markings, exit signs, and egress signage.	LEED®	EA Credit 1		It requires no backup power supply, no conduit, no battery, and is easy to install. An electrician is needed to install light fixtures near the signs in order to meet manufacturer specifications and code requirements.	The signs themselves do not draw any power; thus, their use does not generate emissions.	Absorbs energy provided by visible and near-visible light and then releases that energy as light at a later time. It must be exposed to ambient light of a minimum intensity and type for a set period of time to absorb enough energy to emit useful light.	The signage may not be properly charged and functional if an emergency occurs immediately after occupants enter a building.	55
Use bio-based transformer fluids.				Bio-based oil can extend the service life of a transformer by enhancing its insulating life and performance.	Reduces waste generation by prolonging the life of old, installed transformers (retrofitted with bio-based fluids). Reduces accidental contamination in the event of a leakage by using fluid that can degrade faster than conventional dielectric coolant.	These fluids may improve equipment efficiency. Bio-based transformer fluids are not subject to Federal Regulation of Used Oils, but instead are covered by the Edible Oil Regulatory Reform Act.	The food-grade formula and higher flash point results in a less hazardous working environment, improve workers' health and safety. Reduces fire-safety hazards associated with mineral oil.	37

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Sustainable Materials								
Electrical Materials								
Do not use halogen lights.			YYZ	Four halogen downlights are needed to provide the same effective general lighting levels as one 100 watt globe in the middle of a room. They use additional energy as they require the use of a transformer that is usually located up in the ceiling above each light fitting. The transformers can use an additional 10 to 30 percent of the bulb energy.	More than 90 percent of the energy that goes into common halogen lights turns into heat; as a result, the lights use more electricity than needed, making them very inefficient.	Halogen lights may pose a fire risk if not installed properly.	Reduces energy demand and improves air quality in the local community.	31, 59
Sustainable Materials								
Polymer Concrete Surface Systems								
Use enamel waterborne epoxy and chemical-resistant waterbase methane products for architectural surface coatings.				Polymer concrete surface systems protect against freeze-thaw cycles, chemical stains, and surface penetration; this reduces associated maintenance and energy costs.	Polymer concrete surface systems reduce the heat island effect; they are about 20° cooler than light-colored concrete (available in a variety of colors).	No applicable Research Team Consideration.	Reduces heat islands in the local community, reducing temperature compared to absorptive materials.	5
Use 100 percent solids, two-component epoxy resin for crack repair.				Polymer concrete surface systems are a low-maintenance alternative to tile, hardwood, or carpet flooring and offer design flexibility. They also protect against freeze-thaw cycles, chemical stains, and surface penetration.	Polymer concrete surface systems reduce the heat island effect; they are about 20° cooler than light-colored concrete.	The epoxy resin is 5 times the strength of concrete.	Reduces the need for rehabilitation, minimizing construction noise and traffic.	5
Use pre-colored matrix mixes that require no liquid colorant additives.				Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	These pre-colored matrixes use dry pigments recovered from iron oxide run-off from coal mines, the largest single source of water pollution in the U.S.	No applicable Research Team Consideration.	Protects water quality in the local community, especially near coal mines.	5

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Sustainable Materials								
Polymer Concrete Surface Systems								
Use degreasers that are made of d-limonine, a terpene extracted from citrus peel oils.	LEED®	MR Credit 6		Cost competitive since they are an agricultural waste product.	Citrus peel oils are an agricultural waste product, as well as a rapidly renewable produce.	No applicable Research Team Consideration.	Reduces agricultural waste in local communities.	5
Use an acrylic sealer to complete the third and final part of a polymer concrete surface system.				Polymer concrete surface systems are a low-maintenance alternative to tile, hardwood, or carpet flooring and offer design flexibility. They also protect against freeze-thaw cycles, chemical stains, and surface penetration.	Resistant to ultraviolet rays and abrasions; protects surfaces from moisture penetration, staining, dirt, dust, and wear.	It provides a non-porous surface finish that protects and enhances the finished application for both vertical and horizontal installations.	Provides a non-yellowing coating and may enhance color retention, maintaining aesthetics.	5
Use an elastomeric acrylic caulk in concrete slab expansion joints, masonry perimeters, and for sealing around doors and windows.				Can be used to refurbish old or damaged floors. Polymer concrete surface systems are a low-maintenance alternative to tile, hardwood, or carpet flooring and offer design flexibility. They also protect against freeze-thaw cycles, chemical stains, and surface penetration.	The elastomer acrylic caulk should be composed primarily of natural ingredients such as calcium carbonate, potassium, and sand.	Provides a surface that is easy to clean and maintain; dries quickly, reducing down time.	Provides a paintable surface to maintain aesthetics.	5
Sustainable Materials								
Low-Emitting Materials								
For adhesives and sealants, the VOC content used must be less than the current VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #1168, AND all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.	LEED®	IEQ Credit 4.1	ORD	Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19, 64

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Low-Emitting Materials								
For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content calculated according to 40 CFR 59, Subpart D.	LEED®	IEQ Credit 4.1		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	13, 64
Do not use adhesives or sealants that use Mercury and/or Persistent, Bioaccumulative, and Toxic Pollutants (PBT).				Health concerns associated with exposure to mercury and PBT result in increased expenses and liability for building owners, operators, and insurance companies.	Mercury does not degrade in the environment. Human nervous systems are sensitive to all forms of Mercury. Methylmercury (caused by sulfate reducing bacteria) bioaccumulates in organisms as it moves through the food web, adversely effecting humans, fish, and waterfowl.	Mercury negatively affects the nervous system of installers and building occupants.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	22
Use water-based adhesives and sealants that contain no VOCs on porous or nonporous surfaces.	LEED®	IEQ Credit 4.1		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	VOCs react with sunlight and nitrogen oxides in the atmosphere to form ground-level ozone, a chemical that has a detrimental effect on human health, agricultural crops, forests and ecosystems.	No fire or explosion hazards. May require longer drying times. Use of high VOC-content materials can cause illness and may decrease occupant productivity.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	55

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Low-Emitting Materials								
Seal interior concealed joints to reduce airborne sound transmission by using nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).	LEED®	IEQ Credit 4.1		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Obtain a recommendation in writing by the ornamental formed-metal manufacturer.	Reduces noise in the local community.	13
Use nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; of type and grade required to seal joints in ornamental formed metal.	LEED®	IEQ Credit 4.1		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces noise transmission through perimeter joints and openings. Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	No applicable Research Team Consideration.	13
Use aliphatic-resin, polyurethane, or resorcinol wood glue.	LEED®	IEQ Credit 4.1		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	No applicable Research Team Consideration.	13

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Low-Emitting Materials								
Use zero- or low-VOC field applied paints and coatings.	LEED®	IEQ Credit 4.2		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	2
Follow standards and prohibitions documented in SCAQMD Rule 1113 (paints and coatings) and applicable source-specific SCAQMD standards.	LEED®	IEQ Credit 4.2	LAX, ONT, VNY, PMD	Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	39
For interior paints and coatings, VOC emissions must not exceed the VOC and chemical component limits of Green Seal's Standard GS-11 requirements.	LEED®	IEQ Credit 4.2	ORD	Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Low-Emitting Materials								
For field applications that are inside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to 40 CFR 59, Subpart D.	LEED®	IEQ Credit 4.2		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	13
For carpet systems, VOC emissions must meet or exceed the requirements of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program. Composite wood and agrifiber must contain no added urea formaldehyde resins.	LEED®	IEQ Credit 4.3	ORD	Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19
Specify low-VOC carpet systems. Ensure that VOC limits are clearly stated where carpet systems are addressed. Be attentive to carpet installation requirements.	LEED®	IEQ Credit 4.3	ORD	Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	19

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Low-Emitting Materials								
Install VOC-free natural linoleum flooring, reclaimed wood products (such as re-milled structural timbers), recycled glass tile, or ceramic tile in lieu of carpet materials that contain VOCs.	LEED®	IEQ Credit 4.3		Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	55
Do not install vinyl flooring with high polyvinyl chloride content. Carpet containing PVC can release toxic chemicals, including dioxin, into the air; PVC often contains phthalate-based softening agents, which are recognized as reproductive toxins that may contribute to indoor pollution.	LEED®	IEQ Credit 4.3		Non-polyvinyl chloride flooring has a higher cost due to the widespread use and availability of polyvinyl chloride.	Polyvinyl chloride is not biodegradable. Long-term leeching could lead to ground water contamination. If burned, it releases harmful gas. It is highly toxic during production. Recycling is difficult because of the diverse additives used.	No applicable Research Team Consideration.	Protects installers and building occupants.	55
Use natural linoleum flooring or reclaimed wood products such as re-milled structural timbers.	LEED®	IEQ Credit 4.3		Typically more expensive than vinyl flooring.	Renewable and biodegradable. Natural linoleum flooring is made from linseed oil, pine resin, wood flour, cork powder, limestone dust, natural pigments, and jute.	Durable and resilient. Has a 30-40 year lifespan compared to a 10-20 year lifespan for vinyl flooring.	Protects installers and building occupants.	55
Clean up carpet spills immediately to prevent stains and fungus. Perform extraction cleaning every 6 to 12 months, preferably with hot water or steam.				Helps ensure a long life cycle of carpeted areas, reducing costs associated with carpet replacement.	Improves indoor air quality and reduces emissions associated with the production and transport of new carpeting.	May require additional labor and/or staffing.	Protects installers and building occupants.	55
Vacuum heavily trafficked areas daily using equipment with powerful suction & a high-efficiency particulate air (HEPA) filtration bag.				Helps ensure a long life cycle of carpeted areas, reducing costs associated with carpet replacement.	Improves indoor air quality and reduces emissions associated with the production and transport of new carpeting.	May require additional labor and/or staffing.	Protects installers and building occupants from exposure to dust and other pollutants.	55

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Appendix B. (Continued).

Sustainable Practice	LEED® LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
During Construction								
Sustainable Materials								
Low-Emitting Materials								
Ensure that all shop finished material meet the VOC emission requirements. Materials to consider are: primed steel, finished metals including aluminum, finished millwork, and finished steel and wood doors and windows.				Costs for most low-VOC products are generally competitive with conventional materials but may be more expensive when they are first introduced into the marketplace. Health concerns associated with VOCs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. VOCs also contribute to smog generation and outdoor air pollution.	Use of high VOC-content materials can cause illness and may decrease occupant productivity. Consider the location of the manufacturer, durability, and performance.	Protects installers and building occupants.	2
During deconstruction, vacuum old carpets prior to removal using a certified Carpet and Rug Institute (CRI) Green Label vacuum cleaner. Also vacuum the floor immediately after old carpet is removed.				May reduce health expenses for construction workers.	Reduces the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.	May require additional labor and/or staffing.	Protects workers from exposure to dust and other pollutants.	43
Remove all equipment containing Polychlorinated Biphenyl (PCB).			HNL	Health concerns associated with PCBs result in increased expenses and liability for building owners, operators, and insurance companies.	Reduces the environmental risk from leakage due to deterioration or damaged equipment.	PCBs cause skin problems in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs do not readily break down in the environment.	Reduces the risk of exposure to hazardous combustion by-products in the case of fire. Reduce risks to occupants from exposure to PCBs.	38, 63
Sustainable Materials								
Wood								
Use FSC products in temporary and permanent construction materials and finished products; meet established FSC goals (www.fscus.org/green_building).	LEED®	MR Credit 7	SFO, ORD	The cost of FSC-certified wood is equal to or higher than the cost for conventional wood products and varies by region.	Encourages environmentally responsible forest management. Irresponsible forest practices result in destruction of forests and wildlife habitat, soil erosion and stream sedimentation, water and air pollution, and waste generation.	May require a tracking system and personnel to monitor compliance.	Respects indigenous peoples' rights and adheres to applicable laws and treaties. Preserves forest land for future generations. Benefits responsible forest workers and forest-dependent communities.	2, 64

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Wood								
Ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.	LEED®	MR Credit 7	ORD	The cost of FSC-certified wood is equal to or higher than the cost for conventional wood products and varies by region.	Encourages environmentally responsible forest management. Irresponsible forest practices result in destruction of forests and wildlife habitat, soil erosion and stream sedimentation, water and air pollution, and waste generation.	May require a tracking system and personnel to monitor compliance.	Respects indigenous peoples' rights and adheres to applicable laws and treaties. Preserves forest land for future generations. Benefits responsible forest workers and forest-dependent communities.	19, 64
Prohibit the use of creosote-coated lumber.			LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.	May reduce product life cycle.	Creosote-treated lumber emits a bad odor, can soil clothes, has vapors that are toxic to plants, and is difficult to saw, sand, and paint. Direct contact can cause skin irritation and plant damage or death.	39
Reduce the requirements for preservative-treated wood.			LAX, ONT, VNY, PMD	No applicable Research Team Consideration.	Reduces the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.	May reduce product life cycle. Any treated material shipped to the construction site should be stored out of contact with standing water and wet soil and protected from precipitation.	Preservative-treated lumber may emit a bad odor, soil clothes, have vapors that are toxic to plants, and be difficult to saw, sand, and paint. Direct contact can cause skin irritation and plant damage or death.	39
Do not use chromate copper arsenate (CCA) pressure-treated lumber. Use lumber that is treated with less toxic, borate-based chemicals for dry conditions and use Ammoniacal Copper Quaternary (ACQ) for wet conditions.			LAX, ONT, VNY, PMD	The cost of site-applied borate treatments exceeds the costs of other chemical treatments because of shipping costs (limited availability). ACQ typically has a higher cost than CCA. CCA is no longer being produced for residential or general consumer use.	Burning, mechanical abrasion, direct contact with wood, sawdust, and acidic rainfall can release arsenic in CCA-treated lumber. Use sustainably harvested wood independently certified by organizations such as the FSC, Smartwood Program of the Rainforest Alliance, and Scientific Certification Systems. ACQ is less toxic than CCA and performs similarly.	Full-scale commercial introduction of borates in the United States has slowed because of the leaching problem of borates. As borates are water soluble, water dilutes them and leaves the wood unprotected from decay after a period of time. In a location unexposed to water, they are effective in preserving wood.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	39, 55

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Appendix B. (Continued).

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED®	LEED® Credit		Economic	Environmental	Operational	Social	
During Construction								
Sustainable Materials								
Wood								
Use expanded polystrene (EPS) foam instead of extruded polystyrene (XPS) for rigid board insulation.				EPS costs less than XPS.	EPS is the only common rigid foam board stock insulation made with neither CFCs nor HCFCs. However, XPS is stronger, denser, smoother, and more water-resistant, and has a higher R-value per inch. If the correct density is chosen for the application, EPS is not affected by moisture.	EPS insulation installation is simpler; it can be molded and shaped easily. XPS is flammable and must be protected by a 15 minute thermal barrier, such as 0.5 inch of gypsum board.	Enhances safety; encourages manufacturers to produce products in a more environmentally-conscious manner.	55
Use recycled wood/plastic composite lumber in structural applications as an alternative to synthetic wood materials.	LEED®	MR Credit 4		Cost-competitive with high-end materials such as finger jointed pine and redwood, but more expensive than standard treated products.	Uses recycled plastic trash bags and waste wood fibers. Contains none of the toxic chemicals used in conventionally treated lumber. Reduces the amount of virgin materials used in production.	Manufacturers claim it is more durable than conventional preservative-treated lumber because the wood fibers act as reinforcement; the plastic encapsulates and binds the wood together to resist moisture penetration. May weigh more than standard lumber products.	Encourages manufacturers to produce products in a more environmentally-conscious manner.	42, 55

Sustainable Practice	LEED®		Example(s)	Research Team Considerations				Source (see reference below)
	LEED@	LEED® Credit		Economic	Environmental	Operational	Social	
Commissioning/Post-Construction								
Systems Commissioning								
Develop and use a systems commissioning plan. Establish systems commissioning requirements consistent with sustainable design to ensure optimal performance of systems and complete a summary systems commissioning report.	LEED®	EA Prerequisite 1	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Most effective when begun at project inception since it involves the owner, users, occupants, operations and maintenance staff, design professionals, and contractors. Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	39, 64
Identify an individual to lead the commissioning process early on. The commissioning authority should review and oversee the completion of commissioning process activities, have documented experience in at least 2 building projects, and should be independent of the project design and construction management team.	LEED®	EA Prerequisite 1	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	64
Incorporate commissioning requirements into construction documents. Have a contract in place to implement best practice commissioning procedures and tie payment to completion of the contract.	LEED®	EA Prerequisite 1	LAX, ONT, VNY, PMD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	64
Review the design intent and the basis of design documentation for proper systems commissioning.	LEED®	EA Prerequisite 1	ORD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	19
Provide the airport owner with a single manual that contains the information required for recommissioning systems.	LEED®	EA Prerequisite 1	ORD	Lowers costs for recommissioning, expediting the process.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Expedites recommissioning.	Promotes internal awareness.	19
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.	LEED®	EA Prerequisite 1	ORD	Reduces energy use, improves building documentation, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	May improve occupant productivity.	19

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Appendix B. (Continued).

Sustainable Practice	LEED®	LEED® Credit	Example(s)	Research Team Considerations				Source (see reference below)
				Economic	Environmental	Operational	Social	
Commissioning/Post-Construction								
Systems Commissioning								
Establish and follow systems commission requirements for runway lighting and illuminated signage, runway NAVAIDS, runway site lighting systems, traffic signals, pump stations, and oil/water separators.			ORD	Reduces energy use, lowers operating costs, and reduces contractor callbacks.	Improves energy efficiency, reducing emissions from use of fossil fuels.	Helps verify that the systems perform in accordance with the owner's project requirements.	No applicable Research Team Consideration.	19
Indoor Air Quality								
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building.	LEED®	IEQ Credit 3.1	ORD	Additional time and labor may be required to protect and clean ventilation systems and building spaces. Extends the lifespan of the HVAC system, improving ventilation efficiency and reducing energy use. If contaminates remain they may lead to expensive and complicated clean up procedures.	Reduces IAQ problems resulting from the construction process.	No applicable Research Team Consideration.	Helps sustain the comfort and well-being of construction workers and building occupants.	19, 64
Replace all air filter media used during construction at least two weeks prior to building occupancy, subsequent to building flush-out. After construction ends and prior to occupancy, conduct a two-week building flush out with 100% outside air.	LEED®	IEQ Credit 3.1	ORD	Additional time and labor may be required to protect and clean ventilation systems, but would extend the lifespan of the system, improving ventilation efficiency and reducing energy use. If contaminates remain they may lead to expensive and complicated clean up procedures.	Reduces IAQ problems resulting from the construction process.	May delay occupancy by two weeks if not accounted for at the beginning of the project.	May improve air quality within buildings. May minimize worker's exposure to potentially harmful chemicals.	19, 64
Filtration media installed at the end of construction shall have a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2-1999.	LEED®	IEQ Credit 5	ORD	Improves ventilation efficiency. May help contribute to lowering health insurance rates and healthcare costs.	Reduces IAQ problems resulting from the construction process.	Filtration should be applied to process both return and outside air that is to be delivered as supply air.	May improve air quality within buildings.	19
Prohibit "bake-out" or "superheating" of spaces to accelerate the release of gaseous emissions.				May damage building parts, requiring the purchase of new materials and additional labor costs.	Can reduce materials/components that are sent to the landfill and the environmental impacts of producing new construction products and materials. Moisture from the air, and some volatile gases, can condense on cooler surfaces.	May damage parts of the building (e.g., moving concrete floor slabs, causing carpet and vinyl flooring to buckle, cracking windows, warping wood doors warped, etc.) May reduce delays associated with the ordering/ transportation of new materials.	Keeping materials pristine may reduce the duration of construction projects, minimizing temporary noise and traffic impacts on the local community.	13

Sustainable Practice	LEED® LEED@	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Commissioning/Post-Construction								
Indoor Air Quality								
Only use non-toxic cleaning agents for cleaning activities.				Minimal costs; may help contribute to lowering health insurance rates and healthcare costs.	Non-toxic cleaning supplies are less harmful to the natural environment. Biodegradable and bio-based concrete cleaning agents are available.	Specifications may need to be established in project standards and procedures.	Protects worker and occupant health.	2
Community Outreach and Sustainability Accomplishments								
Document all sustainable construction activities to track progress at several stages throughout the construction process (e.g. checklists and progress reports). Prepare interim progress reports to track and document any gaps that may occur in construction or documentation. Provide continual feedback on sustainability performance.			LAX, ONT, VNY, PMD	Widely varies on detail and goals; less so as it becomes part of standard operating procedures.	Helps achieve environmental goals.	Helps ensure that the contractor is following sustainability requirements.	Helps track sustainability goals, accomplishments, and lessons learned. May help improve the community's view of the airport if part of an outreach program.	39
Establish an airport-specific rating/ranking system in conjunction with the airport sustainability guidance manual. Provide rewards (certificates of achievement, financial incentives, etc.) for contractors who meet and or exceed sustainability goals.			LAX, ONT, VNY, PMD	Could be tied to cost savings generated by practices employed.	Helps achieve environmental objectives. Encourages other contractors to improve their sustainability efforts to achieve recognition.	Determined by goals. May have operational and/or cost implications.	Markets the specific sustainable practices and related EONS benefits on a local, national, and international level.	55
Post signage (e.g., display/poster boards) of LEED®/sustainability goals for construction projects.	LEED®	*General*		Minimal cost.	Creates awareness of environmental focus and benefits.	No applicable Research Team Consideration.	Promotes worker, customer, and community awareness of the airport's sustainability objectives/goals.	3
Conduct an industry forum/conference to share and learn about sustainable construction practices (engage other contractors, the local community, and construction and aviation industries). Conduct tours of the construction site.			LAX, ONT, VNY, PMD	Raises awareness; potential cost savings from learning from others.	Creates awareness of environmental focus and benefits.	Use industry conferences, annual reports, websites, presentations, press releases, articles in trade journals, etc.	Markets the specific sustainable practices and related EONS benefits on a local, national, and international level.	3, 39
Engage the FAA to discuss the use of regional or local suppliers as part of projects that utilize FAA funding and adhere to FAA rules.			LAX, ONT, VNY, PMD	Regional building materials are more cost effective for projects due to reduced transportation costs. Consider early on in the design process, if possible, since research may be required to determine what products can be sourced locally and realistically be expected to be purchased for the project.	Reduces the environmental impacts resulting from transportation.	No applicable Research Team Consideration.	Supports the local economy and the use of indigenous resources. Retains capital for the community, contributing to a more stable tax base and a healthier local economy.	39

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Appendix B. (Continued).

Sustainable Practice	LEED® LEED®	LEED® Credit	Example(s)	Research Team Considerations: Economic	Environmental	Operational	Social	Source (see reference below)
Commissioning/Post-Construction								
Community Outreach and Sustainability Accomplishments								
Create an interactive multimedia display (i.e. video, website, kiosk, etc.) that would engage and educate visitors about the sustainable aspects of construction projects.			LAX, ONT, VNY, PMD	Creates awareness at a minimal initial cost.	Creates awareness; helps achieve environmental objectives.	No applicable Research Team Consideration.	Promotes awareness and internal and external communication. Facilitates information sharing with airport customers.	39
Establish sustainable airport construction internships, stewardships, and/or public education programs (focus on low-income and diverse populations).				Provides added staff assistance and creates research and educational opportunities.	No applicable Research Team Consideration.	No applicable Research Team Consideration.	Helps assure the community is involved in the project. Provides job opportunities and career training for the local community. Promotes awareness, communication, and educational opportunities.	3
Submit a final site waste recycling form prior to contract closeout that records the total amount of construction or demolition materials recycled during the duration of the project.	LEED®	MR Credit 2	PDX	Increased recycling efforts may reduce disposal costs; however, the cost of monitoring the recycling efforts may outweigh the benefits.	Ensure compliance with waste management and recycling goals. May enhance recycling activities and thus reduce the emissions from hauling, the traffic impacts, and the consumption of fossil fuels.	Partners contractor and construction management teams. May require additional staff training to explain procedures and requirements to contractors.	Educates construction workers and identifies that sustainability is a priority at the airport.	53
Review sustainable building requirements in specifications with each sub-contractor prior to commencement of work.				Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures project team members are incorporating sustainability requirements in their daily responsibilities and assignments.	Promotes awareness and internal communication.	55
Link achievement of the construction team's sustainability goals to performance reviews of key personnel.			LAX, ONT, VNY, PMD	Creates awareness; helps achieve cost objectives.	Creates awareness; helps achieve environmental objectives.	Ensures project team members are incorporating sustainability requirements in their daily responsibilities and assignments.	Promotes awareness and internal communication.	39
Provide financial incentives to contractors who substantially exceed requirements of the construction waste management plan.				May reduce hauling, disposal, and fuel costs.	Conserves natural resources.	Contractual requirements to be specified; perhaps difficult to monitor.	Stresses that construction waste management is a priority at the airport.	66

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Acronyms:

AC – Air Conditioning
ACQ – Ammoniacal Copper Quaternary
ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers
ASTM – American Society for Testing of Materials
BMP – Best Management Practices
BOS – Boston Logan International Airport
BWI – Baltimore-Washington International Airport
CARB – California Air Resources Board
CCA – Chromate Copper Arsenate
CFC – chlorofluorocarbon
CLF – Compact Fluorescent Lighting
CFR – Code of Federal Regulations
CRI – Carpet and Rug Institute
CRRC – Cool Roof Rating Council
DAL – Dallas Love Field Airport
dB – decibel
DBE – Disadvantaged Business Enterprise
DEN – Denver International Airport
DFW – Dallas/Fort Worth International Airport
DOC – Diesel Oxidation Catalysts
EA – Energy and Atmosphere
EGGD – Bristol International Airport
EGKK – London Gatwick Airport
EMAS – Engineered Materials Arresting System
EMS – Environmental Management System
EONS – Economics, Operational, Natural Resources, and Social
EPS – Expanded Polystyrene
ETS – Environmental Tobacco Smoke
F45 – North Palm Beach County General Aviation Airport (Florida)
FAA – Federal Aviation Administration
FSC – Forest Stewardship Council
GHG – Greenhouse Gas
GGBF – Ground Granulated Blast Furnace
GPS – Global Positioning System
HCFC – hydrochlorofluorocarbon
HDPE – High Density PolyEthylene
HECA – Cairo International Airport
HEPA – High Efficiency Particulate Air
HPS – High Pressure Sodium
HNL – Honolulu International Airport
HVAC – Heating, Ventilating, and Air Conditioning
IAQ – Indoor Air Quality
ICF – Insulating Concrete Form
ID – Innovation in Design
IEQ – Indoor Environmental Quality
LAX – Los Angeles International Airport
LCA – Life Cycle Assessment
LED – Light-Emitting Diode
LEED® – Leadership in Energy and Environmental Design
LEED® AP – LEED Accredited Professional
LGAV – Athens (Eleftherios Venizeolos) International Airport
LNA – Palm Beach County Park Airport (West Palm Beach, Florida)
MBE – Minority Business Enterprise
MERV – Minimum Efficiency Reporting Value
MH – Metal Halide
MKE – General Mitchell International Airport
MR – Materials and Resources
MSDS – Material Safety Data Sheets
MSP – Minneapolis-St. Paul International Airport
NESHAP – National Emissions Standards for Hazardous Air Pollutants
NiCad – Nickel-Cadmium
NOx – Nitrogen oxides
ONT – Ontario International Airport
ORD – O'Hare International Airport
OSB – Oriented-Strand Board
OSHA – Occupational, Health and Safety Administration
PBI – Palm Beach International Airport
PBT – Persistent, Bioaccumulative, and Toxic
PCB – Polychlorinated biphenyl
PCCP – Prestressed Concrete Cylinder Pipe
PDX – Portland International Airport
PMD – Los Angeles/Palmdale Regional Airport
PVC – Polyvinyl Chloride
RBD – Dallas Executive Airport
RFP – Request for Proposal
RFQ – Request for Qualifications
RMA – Rubber Modified Asphalt
RR – Rapidly Renewable
SCAQMD – South Coast Air Quality Management District
SCDA – Soundless Chemical Demolition Agents
SESC – Soil Erosion and Sediment Control
SFO – San Francisco International Airport
SIP – Structural Insulated Panels
SLC – Salt Lake City International Airport
SPCC – Spill Prevention Control and Countermeasure Plan
SRI – Solar Reflectance Index
SS – Sustainable Sites
STL – Lambert-St. Louis International Airport
SWPPP – Stormwater Pollution Prevention Plan
TDF – Tire-Derived Fuel
TMA – Transportation Management Association
TPO – Thermoplastic Olefins
TVY – Bolinder Field-Tooele Valley Airport (Utah)
U42 – South Valley Regional Airport (Utah)
ULSD – Ultra Low Sulfur Diesel
USDOE – U.S. Department of Energy
USEPA – U.S. Environmental Protection Agency
USGBC – U.S. Green Building Council
VCP – Vitrified Clay Pipes
VNY – Van Nuys Airport
VOC – Volatile Organic Compounds
WBDG – Whole Building Design Guide
WE – Water Efficiency
WRAP – Waste Resource Action Programme
XPS – Extruded Polystyrene
YYZ – Toronto Pearson International Airport

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation