Airport Sustainability Practices

DETAILS

112 pages | | PAPERBACK
ISBN 978-0-309-09809-0 | DOI 10.17226/13674

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ACRP
SYNTHESIS 10

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Airport Sustainability Practices

A Synthesis of Airport Practice

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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP **SYNTHESIS 10**

Airport Sustainability Practices

A Synthesis of Airport Practice

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SUBJECT AREA
Aviation

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TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2008
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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 principle means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

The need for ACRP was identified in TRB Special Report 272: Airport Research Needs: Cooperative Solutions in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

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.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

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.

Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

ACRP SYNTHESIS 10

Project 11-03, Topic S02-02
ISSN 1935-9187
ISBN 978-0-309-09809-0
Library of Congress Control Number 2008906006

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Business Office
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FOREWORD

Airport operators, service providers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to the airport industry. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire airport community, the Airport Cooperative Research Program authorized the Transportation Research Board to undertake a continuing project. This project, ACRP Project 11-03, "Synthesis of Information Related to Airport Practices," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an ACRP report series, *Synthesis of Airport Practice*.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

By Gail Staba,
Senior Program Officer
Transportation
Research Board

This synthesis study is intended to inform airport operators, stakeholders, and policy makers about a range of airport sustainability practices gathered from a literature review and web-based survey. It specifically targets airport operators and provides a snapshot of airport sustainability practices across the triple bottom line of environmental, economic, and social issues.

Information used in this study was acquired through a review of the literature and interviews with airport operators and industry experts.

Fiona Berry, Sarah Gillhespy, and Jean Rogers, of Arup North America, Ltd, San Francisco, California, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

AIRPORT SUSTAINABILITY PRACTICES

SUMMARY

This project was undertaken on behalf of TRB. The report documents a range of airport sustainability practices gathered from a literature review and web-based survey. It specifically targets airport operators and provides a snapshot of airport sustainability practices across the triple bottom line of environmental, economic, and social issues.

A literature review was undertaken to inform the development of a survey for airport operators to identify current sustainability practices. After the survey, another literature review was undertaken to supplement the survey findings. The web-based survey included questions related to the management of environmental, economic, and social practices at airports; current and future drivers and priorities; and barriers to implementing sustainability. The survey was issued to 52 persons at U.S. and non-U.S. airports. Twenty-five survey responses were received from a range of large, medium, small, and non-hub U.S. airports, and from airports in the United Kingdom, Europe, Asia, and Canada.

The survey asked respondents to assess their airport in relation to environmental, economic, and social sustainability performance using an ordinal management performance scale. Respondents were encouraged to identify practices that were planned or in place at their airport.

On overall sustainability performance, respondents from non-U.S. airports and large U.S. airports rated their airports' performance higher than those from small and medium U.S. airports.

Respondents identified regulation and airport policy as key drivers for the implementation of sustainability practices. For the future, they cited stakeholder concerns and global concerns such as climate change. For the next five years, large U.S. and non-U.S. airports consistently identified environmental sustainability practices as a priority. Smaller U.S. airports were more focused on economic prosperity. Corporate social responsibility and strategic environmental management at the governance level were key future priorities for some non-U.S. airports.

For all the airport respondents, funding was the predominant barrier to implementation of sustainability practices. Responsibility for these practices at airports was not restricted to an environmental manager but varied across a range of disciplines and management levels. Respondents from both U.S. and non-U.S. airports said that environmental training is offered at their airport; economic and social sustainability training were not mentioned as often.

Environmental reporting, whether as part of an annual report or separately, was common among the survey respondents. However, of the 25 respondents, only 4 non-U.S. respondents said that their airport uses the Global Reporting Initiative sustainability reporting guidelines for environmental, economic, and sustainability performance.

Environmental practices commonly in place at airports include measuring and monitoring water conservation, water quality, climate change, air quality, land use, biodiversity, environmentally sustainable materials, waste, noise and aesthetics, energy, and green buildings.

Economic sustainability practices commonly in place at airports include local hiring and purchasing, contributing to the community, quantifying the value of sustainability practices, contributing to research and development, and incentivizing sustainable behavior.

Social concerns at airports include public awareness and education, stakeholder relationships, employee practices and procedures, sustainable transportation, alleviating road congestion, accessibility, local culture and heritage, indoor environmental quality, employee well-being, and passenger well-being.

CHAPTER ONE

INTRODUCTION

This report presents the findings of the ACRP Synthesis S02-02: Airport Sustainability Practices project undertaken on behalf of TRB. The research synthesis included a literature review and a web-based survey of U.S. and non-U.S. airports.

The report presents analysis and detailed findings from the survey data collected on governance and on environmental, social, and economic practices currently being implemented in U.S. and non-U.S. airports. It includes details of the literature review, a discussion of findings in each topic area, and conclusions drawn from the survey data, as well as a section on topics for additional research.

AUDIENCE AND DISSEMINATION

This synthesis is specifically targeted to airport operators. Airlines, airport tenants, and other stakeholders associated with the aviation industry also may find the report useful. The synthesis focuses specifically on capturing and documenting airport sustainability practices. Although the survey asked respondents to assess the performance of their airports, the synthesis does not provide statistics on trends or performance in airport sustainability practices. Rather, it provides a snapshot of what U.S. and non-U.S. airports of varying sizes are currently doing with regard to triple-bottom-line sustainability issues.

The target audience is airport operators and members of the public who are interested in airport sustainability. The report offers suggestions for and examples of sustainability practices that can be adopted by airports. The survey could be repeated in the future for purposes of comparison.

BACKGROUND

TRB commissioned the synthesis in response to increasing interest in the aviation industry on the concept of sustainability and the need to establish management practices that address risks and opportunities associated with more than just environmental performance or economic success. In an effort to help the industry develop a management framework for sustainability, a number of information gaps were identified by TRB.

This synthesis aims to create a better understanding of current sustainability practices in airports in the United States and around the world, to understand the barriers to and drivers behind these practices, and to identify areas for improvement.

TRB PANEL

A panel of experts was formed to oversee this synthesis. The panel included academics, airport industry representatives, and airport environmental/sustainability managers.

The panel provided input at various stages of the project, including the following:

- Suggesting airports and contacts for the survey target list.
- Providing feedback on the proposed scope of work (work plan) submitted by the research team.
- Providing feedback on the survey content and format.
- Providing feedback on the draft versions of the report (by means of a workshop and teleconferences).
- Suggesting sources for the literature review.

The panel's contribution has been invaluable, and its feedback has ensured that this report will benefit various airport industry stakeholders, improve sustainability performance, and raise awareness about the importance of this issue.

DEFINITIONS

Airport sustainability practice is a broad term that encompasses a wide variety of practices applicable to the management of airports. For the purposes of this study, the term refers to practices that ensure:

- Protection of the environment, including conservation of natural resources.
- Social progress that recognizes the needs of all stakeholders.
- Maintenance of high and stable levels of economic growth and employment.

These three components of sustainable development are often referred to as the environmental, social, and economic triple bottom line.

In this report, organizational governance refers to the management, organization, and operation of sustainability issues at an airport.

ISSUES ADDRESSED

The focus of this synthesis is the triple bottom line as it applies to airports. Specifically, the survey and literature review focus on the following topics and subtopics developed by the research team (see Table 1):

- Organizational governance of airports with respect to implementation of sustainability practices.
- Existing and future barriers to implementing sustainability practices in airports.
- Existing and future drivers for implementing sustainability practices at airports.
- Environmental sustainability performance of airports, especially
  - water quality
  - climate change
  - air quality
  - land use
  - biodiversity
  - materials
  - waste
  - noise and aesthetics
  - energy
  - green buildings.
- Social sustainability performance of airports, especially
  - public awareness and education
  - stakeholder relationships
  - employee practices and procedures
  - sustainable transportation
  - alleviating road congestion
  - accessibility
  - local culture and heritage
  - indoor environmental quality
  - employee well-being
  - passenger well-being.

TABLE 1

LIST OF TOPICS ADDRESSED IN THE AIRPORT SUSTAINABILITY PRACTICES SURVEY

Introduction and Organizational Governance	Existing Sustainability Practices			Barriers and Future Priorities
	Environmental	Economic	Social	
Respondent Profile	Management of Environmental Practices	Management of Economic Practices	Management of Social Practices	Other Sustainability Practices
Expenditure and Employment	Measuring and Monitoring	Hiring and Purchasing	Public Awareness and Education	Barriers to Sustainability Practices
Responsibility for Sustainability Practices	Water Conservation	Community Contributions	Stakeholder Relationships	Future Priorities and Drivers for Sustainability
Reporting and Policies	Water Quality	Quantifying Sustainability	Employee Practices And Procedures	
Existing Drivers of Sustainability	Climate Change	Contribution to Research and Development	Sustainable Transportation	
	Air Quality	Incentivizing Sustainable Behavior	Alleviating Road Congestion	
	Land Use		Accessibility	
	Biodiversity		Local Identity Culture and Heritage	
	Materials		Indoor Environmental Quality	
	Waste		Employee Well-being	
	Noise and Aesthetics		Passenger Well-being	
	Energy			
	Green Buildings			

- Economic sustainability performance of airports, especially
  - local hiring
  - local purchasing
  - contribution to the community
  - quantifying sustainability
  - contribution to research and development
  - incentives for sustainable behavior.

REPORT CONTENT

The report is organized as follows:

- Method—outlines the process undertaken for the two tasks of the synthesis: the literature review and the online survey.
- Survey response—details the response rate and the airport sizes and geographic locations of respondents.
- Drivers, priorities, and barriers to sustainability practices—summarizes the feedback from respondents on drivers and barriers to sustainability practices and priorities for sustainability now and in the future.
- Organizational governance of sustainability—summarizes the information obtained from survey respondents on governance of sustainability practices at their airports.
- Environmental practices—summarizes the results of the management and implementation performance assessments for the environmental issues addressed.
- Economic practices—summarizes the results of the management and implementation performance assessments for the economic issues addressed.
- Social practices—summarizes the results of the management and implementation performance assessments for the social issues addressed.
- Conclusions—conclusions of the research.
- Opportunities for further research—discusses possible future research areas to explore these issues in greater detail.

Literature Review

The results of the literature review are referenced throughout this report, and the sources are listed in the References at the end of the document. Information from the literature review is differentiated from survey responses. Boxes identifying specific airport sustainability practices and related information are included throughout the report.

Survey

The results of the survey are included throughout the report in various formats:

- Statistical results such as numbers or percentages.
- Graphs and diagrams summarizing results.
- Boxes describing specific airport sustainability practices.
- A general discussion of survey results.

See Appendix A for a copy of the survey.

CHAPTER TWO

METHOD

LITERATURE REVIEW

A literature review was conducted to identify concepts of sustainability that could be specialized to an airport sustainability program. These concepts were translated into content and questions for the survey. The literature review also identified examples of airport sustainability practices to support the results of the survey.

A variety of sources are cited, including aviation industry reports, annual reports, transportation journal articles, and airport authority websites. The results of the literature review appear throughout the report as we highlight current airport practices for environmental, economic, and social performance. Information from the literature review is cited and sources are listed in the References.

SURVEY

A survey was developed to obtain information on the implementation of sustainability practices at airports. It was structured around a range of triple-bottom-line issues developed by the research team.

The survey consisted of multiple choice questions. To capture additional information on sustainability practices at their airports, survey participants were encouraged to write in blank text boxes. See Appendix A for a copy of the survey.

Self-Assessment Using Performance Scales

The survey was designed to allow users to undertake a self-assessment of their airport's performance across a range of issues. Under the triple-bottom-line framework, users were prompted to assess environmental, economic, and social sustainability performance using a management performance scale of 1 to 5 developed by the research team. For a copy of this scale, see Appendix B.

The scale was designed to measure the extent to which airport operators manage sustainability issues. Management is considered a proxy for performance. Financial analysts look at management practices to assess a company's exposure to financial risk, recognizing that quantitative indicators do not tell the whole story. Quantitative indicators tend to reflect past performance, whereas management practices can predict future performance. Robust, proactive, consistently well-funded management practices for sustainability issues reduce the risk of unexpected developments or undesirable effects associated with those issues.

The management performance scale was developed to assess the extent to which sustainability management practices are fully integrated into standard business processes at airports. The scale covers a wide range of classic management issues (such as staff awareness, formal policies, and accountability), with 1 representing little or no awareness of the issue and no policies or programs in place, and 5 representing high awareness, accountability and long-term planning, and incentives aligned with performance.

Following the management performance rating, the survey contains a series of multiple choice questions for each sustainability subtopic. The user was requested to rate the implementation performance for each subtopic by selecting one of the answers (see Figure 1). Examples are provided within the survey questions to help respondents choose an answer.

In Place	Planned	Not Applicable
There are initiatives being actively implemented and managed for the sub-topic.	No sustainability initiatives in place for the sub-topic at present; however, there are plans for initiatives to be implemented in the future.	The sub-topic does not apply to the respondents' particular airport.

FIGURE 1 Implementation performance scale.

Format

To ensure easy access to the survey within and outside the United States, it was translated into an online format. This program also allowed the survey to be password protected for each user and to be circulated to more than one person at each airport.

Target Audience

The survey was administered to 52 persons working in airports within and outside the United States. To obtain infor-

mation from a cross-section of airports, the researchers targeted airports of different sizes and geographic locations. The TRB Panel provided a list of airport names and key contacts. The research team added other airports to supplement the list.

The final target list is not an objective random sample of airports and may not present an unbiased representation of airport sustainability performance. For example, some of the survey respondents are also members of the TRB Panel.

Geographic Location

To capture a wide range of sustainability practices, 31 U.S. and 21 non-U.S. airports were targeted for participation in the survey.

The 31 U.S. airports were from the following states:

- California (5)
- Florida (2)
- Illinois (2)
- Pennsylvania (2)
- Texas (2)
- Arizona (1)
- Colorado (1)
- Georgia (1)
- Louisiana (1)
- Massachusetts (1)
- Michigan (1)
- Missouri (1)
- Mississippi (1)
- New Mexico (1)
- Nevada (1)
- New York (1)
- Ohio (1)
- Oregon (1)
- Tennessee (1)
- Utah (1)
- Virginia (1)
- Washington (1)
- Wisconsin (1).

The 21 non-U.S. airports were from the following regions:

- Continental Europe (7)
- United Kingdom (6)
- Asia (3)
- Canada (2)
- Middle East (2)
- Australia (1).

Airport Size

US Code Title 49 § 47102 categorizes airports into large hub, medium hub, small hub, and non-hub, according to passenger boardings. The categories are defined as follows:

- Large hub airport—a commercial service airport that has at least 1.0% of total U.S. passenger boardings (in 2005, this was more than 7.4 million passengers).
- Medium hub airport—a commercial service airport that has at least 0.25% but less than 1.0% of total U.S. passenger boardings (in 2005, this was more than 1.8 million and less than 7.4 million passengers).
- Small hub airport—a commercial service airport that has at least 0.05% but less than 0.25% of total U.S. passenger boardings (in 2005, this was more than 368,101 and less than 1.8 million passengers).
- Non-hub airport—a commercial service airport that has less than 0.05% of total U.S. passenger boardings (in 2005, this was less than 368,101 passengers) (US Code 2004).

The following sizes are represented by the 31 U.S. airports in our survey:

- 16 large hub
- 8 medium hub
- 4 small hub
- 3 non-hub.

In this report, we do not specify sizes for the 21 non-U.S. airports.

CHAPTER THREE

SURVEY RESPONSE

Of the 52 airports surveyed, 25 responses were received, representing a 48% response rate. (For a list of the 25 respondents, see Appendix C.)

SURVEY RESPONDENTS

The 25 persons who responded to the survey are referred to as *survey respondents* throughout this report. Any statistics derived from the responses relate to the survey respondent group only, not to the total target audience of 52.

AIRPORT AUTHORITIES

Two of the non-U.S. airport survey respondents represented large airport authorities that manage more than one airport. For the purposes of data analysis, we have counted the airport authorities as one airport, although their responses may represent sustainability practices at more than one airport.

GEOGRAPHIC LOCATION

The 25 survey responses were from 16 U.S. airports and 9 non-U.S. airports. The U.S. airports were located in various states and the non-U.S. airports in various regions (see Figure 2).

AIRPORT SIZE

As shown in Figure 3, the U.S. respondents represented the following kinds of airports:

- 9 large hub
- 4 medium hub
- 2 small hub
- 1 non-hub.

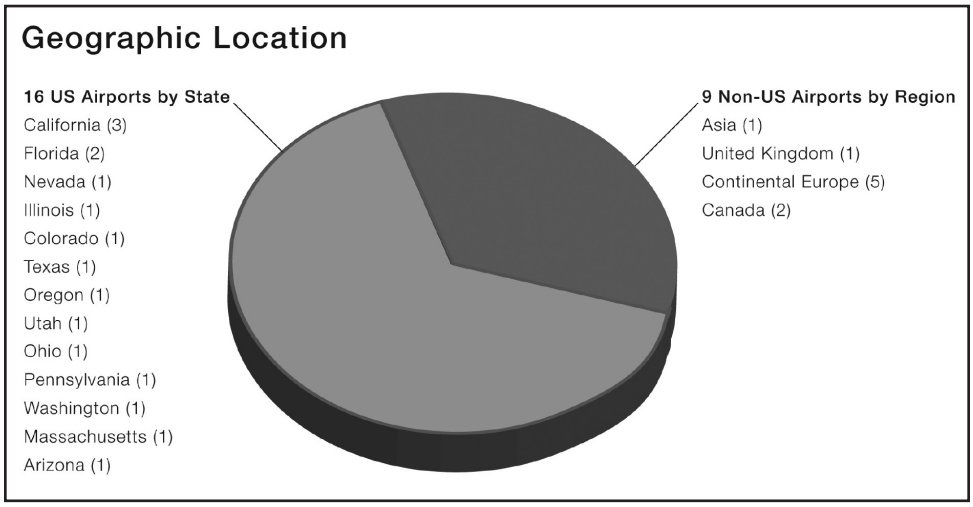

FIGURE 2 Geographic location of the 25 survey respondents.

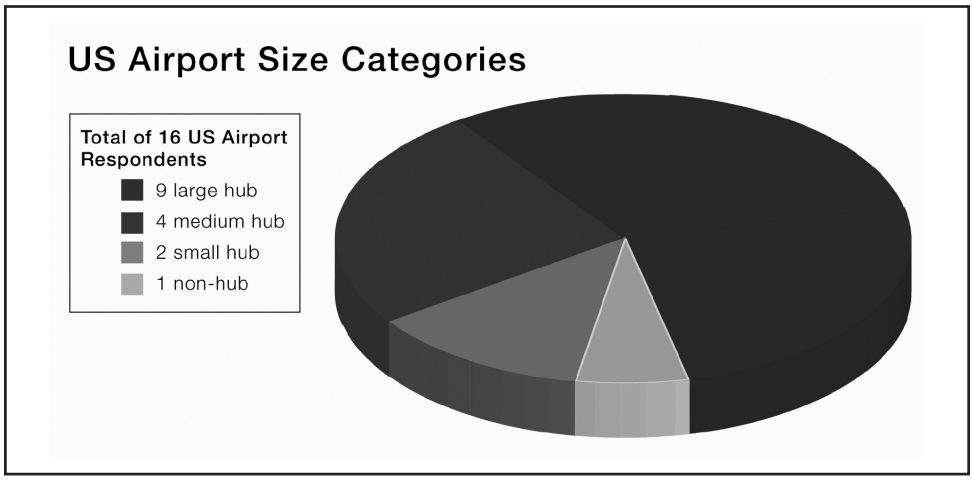

FIGURE 3 Varying airport sizes for 25 U.S. survey respondents.

CHAPTER FOUR

DRIVERS, PRIORITIES, AND BARRIERS TO SUSTAINABILITY PRACTICES

This synthesis sought to identify drivers, priorities, and barriers for implementing sustainability practices at airports and how these might change in the future. Specifically, the study sought to identify:

- The main driving forces (present and future) behind sustainability practices.
- Airports' top priorities for improving sustainability.
- The main barriers to implementation of sustainability practices.
- Future trends.

EXISTING AND FUTURE DRIVERS FOR SUSTAINABILITY

As sustainability becomes a bigger issue for the aviation industry, it is important to understand what motivates airport operators to improve their environmental, social, and economic performance. Changes in behavior can be attributed to external influences or internal changes in an organization.

The survey questions related to sustainability drivers focused on the motivations behind the sustainability practices already implemented in airports and the drivers for future practices. Survey respondents were asked to rank the top five drivers (with 1 being the highest) of their sustainability practices from the following list:

- State/regional regulations
- Airport policy
- Federal regulations
- Corporate responsibility
- Stakeholder concerns/relations
- City/local regulations
- Global trends (e.g., climate change)
- Economic incentives (e.g., rebates)
- International regulations (e.g., European Union directives, International Aviation Authority policies)
- Aviation Industry Association (e.g., position papers)
- Customers.

Survey respondents did not select economic incentives, international regulations, or customer satisfaction as key drivers for implementing sustainability practices. Figure 4 compares the top five current drivers for sustainability practices with the top five future drivers identified by the survey respondents.

Rank	Current	Future
1	State/Regional Regulations	Stakeholder Concerns/ Relations
2	Airport Policy	Global Trends
3	Federal Regulations	Airport Policy
4	Corporate Responsibility	Corporate Responsibility
5	Stakeholder Concerns/ Relations	Federal Regulations

FIGURE 4 Current and future drivers for sustainability.

Current Drivers for Sustainability

The survey respondents identified state/regional and federal regulations as key drivers for implementation of sustainability practices at airports, along with airport policies, corporate responsibility, and stakeholder concerns/relations. Table 2 shows the proportion of respondents from different-sized airports who selected these five drivers.

The following were not identified by any survey respondents as current drivers for airport sustainability practices:

- Global trends (e.g., climate change)
- City/local regulations
- Aviation Industry Association (e.g., position papers)
- Economic incentives (e.g., rebates)
- Customers
- International regulations (e.g., EU directives, International Aviation Authority policies).

Future Drivers for Sustainability

For the future, global issues such as climate change were identified as the most common drivers for implementation of airport sustainability practices and programs. This may be closely linked to another key future driver—stakeholder concerns/relations. Airport policies, corporate responsibility, and federal regulations were also among the top five future drivers. Table 3 shows the proportion of respon-

dents from different-sized airports who selected these five drivers.

The following were not identified by any survey respondents as future drivers for airport sustainability practices:

- State/regional regulations
- City/local regulations
- International regulations (e.g., EU directives, International Aviation Authority policies)
- Economic incentives (e.g., rebates)
- Customers
- Aviation Industry Association (e.g., position papers).

SUSTAINABILITY PRIORITIES

The survey asked respondents to list their priorities for implementation of sustainability practices in the next five years. Table 4 summarizes the sustainability priorities for the next five years, as identified by the survey respondents. The table is organized into the survey subtopic areas of environmental, economic, and social practices.

U.S. Airports

U.S. airports mainly identified environmental practices as key priorities for the future, followed by social and then economic practices. Under environmental practices, respondents from large and medium airports consistently mentioned energy, green buildings, and climate change. The sustainability practices included:

- Energy conservation, efficiency, demand management, and baseline audit.
- Emission (CO2) reductions.
- Clean energy production and clean fuel vehicles.
- Use of green building principles, sustainable design, and high-performance buildings.
- Green building certification using Leadership in Energy and Environmental Design (LEED), a green building rating system developed by the U.S. Green Building Council.

Other priorities for the future identified by respondents included social practices such as employee health and well-being, increased employee use of public transit, and maxi-

TABLE 2

PROPORTION OF RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS WHO SELECTED THE TOP FIVE CURRENT DRIVERS FOR SUSTAINABILITY PRACTICES

		Current Driver for Sustainability Practices				
	Airport Size	State/ Regional Regulation	Airport Policy	Federal Regulation	Corporate Resp.	Stakeholder Concerns/ Relations
% Respondents	U.S. Airports					
	Non-Hub (1)	100%	100%	100%	0%	0%
	Small Hub (2)	50%	0%	50%	0%	50%
	Medium Hub (4)	75%	50%	50%	100%	75%
	Large Hub (9)	89%	78%	33%	56%	56%
	Non-U.S. Airports					
	Continental Europe (5)	100%	80%	60%	40%	20%
	Asia (1)	0%	100%	0%	100%	100%
	United Kingdom (1)	100%	0%	0%	0%	100%
	Canada (2)	0%	0%	100%	100%	100%

TABLE 3

PROPORTION OF RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS WHO SELECTED THE TOP FIVE FUTURE DRIVERS FOR SUSTAINABILITY PRACTICES

		Future Driver for Sustainability Practices				
	Airport Size	Stakeholder Concerns/ Relations	Global Trends	Airport Policy	Corporate Resp.	Federal Regulation
% Respondents	U.S. Airports					
	Non-Hub (1)	100%	0%	0%	0%	100%
	Small Hub (2)	50%	0%	0%	0%	50%
	Medium Hub (4)	100%	75%	50%	75%	75%
	Large Hub (9)	56%	44%	56%	44%	33%
	Non-U.S. Airports					
	Continental Europe (5)	40%	60%	40%	60%	40%
	Asia (1)	100%	100%	100%	100%	0%
	United Kingdom (1)	100%	100%	100%	100%	0%
	Canada (2)	100%	50%	100%	100%	50%

TABLE 4

PRIORITIES SELECTED BY RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS FOR FUTURE IMPLEMENTATION OF SUSTAINABILITY PRACTICES

		Environmental Practices												Economic Practices						Social Practices									
	Airport Size	Measuring and Monitoring	Water Conservation	Water Quality	Climate Change	Air Quality	Land Use	Biodiversity	Materials	Waste	Noise and Aesthetics	Energy	Green Buildings	Hiring And Purchasing	Community Contributions	Quantifying Sustainability	Contribution to Research and Development	Incentivizing Sustainable Behavior	Public Awareness and Education	Stakeholder Relationships	Employee Practices & Procedures	Sustainable Transportation	Alleviating Road Congestion	Accessibility	Local Identity Culture and Heritage	Indoor Environmental Quality	Employee Well-being	Passenger Well-being	OTHER
Number of Respondents Priorities	U.S. Airports																												
	Non-Hub (1)																			1									2
	Small Hub (2)	1																											2
	Medium Hub (4)	1		1	1		1			1		1	4																2
	Large Hub (9)		1		4					1		7	4	1		1											1		1
	Non-U.S. Airports																												
	Continental Europe (5)	1			1						2	1	1							1		2							3
	Asia (1)																												3
	United Kingdom (1)			1							1	1																	
	Canada (2)				1					1		1			1														2

mizing mass transportation to and from the airport and onsite.

The three small and non-hub U.S. airport respondents identified other priorities for the future related to economic performance, such as:

- Economic self-sufficiency of the airport.
- Economic growth of the airport and the community.
- Capacity enhancement.
- Revenue growth.

Non-U.S. Airports

Respondents from non-U.S. airports also focused on environmental practices, followed by social and economic practices. Noise, aesthetics, and sustainable transportation issues were mentioned by respondents from continental Europe and the United Kingdom (UK):

- Noise insulation scheme.
- Minimizing operations noise.
- Improvement of railway infrastructure to the airport.

These respondents also mentioned energy, climate change, water, waste, and stakeholder relationships.

Respondents from airports in continental Europe, Asia, and Canada listed a variety of future priorities related to improving governance of sustainability at their airport, such as:

- Corporate social responsibility.
- Implementing the UN Global Compact (see box).
- Ensuring stable financial performance.
- Improving strategic environmental management.

The United Nations Global Compact is a framework for businesses that are committed to aligning their operations and strategies with 10 universally accepted principles in the areas of human rights, labor, the environment, and anticorruption. As the world's largest corporate citizenship initiative, the Global Compact is first and foremost concerned with exhibiting and building the social legitimacy of businesses and markets ("Global Compact…" 2007).

BARRIERS TO IMPLEMENTATION

The survey also sought to identify the reasons behind failed or slow implementation of sustainability practices at U.S. and non-U.S. airports. Respondents were asked to list three barriers to implementation of sustainability practices at their airports.

Table 5 shows the five key barriers identified by respondents and gives the proportion of U.S. and non-U.S. airport respondents who identified these topics as impediments to sustainability practices at their airports.

U.S. Airports

A lack of funding was identified as the key barrier to implementation of sustainability by 10 of the 16 U.S. respondents. A variety of other impediments received roughly equal mention: lack of staffing, lack of management support, lack of an environmental culture, and limited staff understanding of sustainability.

Respondents from small and medium U.S. airports especially cited lack of management support or an environmental culture in their organization, whereas respondents from large airports were more likely to mention lack of funding, lack of staffing, and lack of understanding/knowledge as barriers.

Non-U.S. Airports

As with their U.S. peers, respondents from non-U.S. airports—especially those in Asia and the UK—identified lack of funding as the most common barrier. Unlike any other non-U.S. respondents, one of the continental Europe respondents identified that the absence of a culture and behavior that supports sustainability practices makes the success of implementation difficult. Less common responses included:

- Strong political variability (continental Europe).
- Limited time to devote or dedicate to sustainability (Asia).
- Lack of experienced professionals (Canada).
- Lack of understanding of social sustainability (Canada).

TABLE 5

PROPORTION OF RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS IDENTIFYING KEY BARRIERS TO IMPLEMENTATION OF SUSTAINABILITY PRACTICES

		Barrier To Sustainability Practices				
	Airport Size	Funding	Staffing	Management	Culture/ Behavior	Training/ Understanding/ Knowledge
% Respondents	U.S. Airports					
	Non-Hub (1)	100%	0%	0%	0%	0%
	Small Hub (2)	50%	0%	50%	0%	0%
	Medium Hub (4)	75%	0%	0%	25%	0%
	Large Hub (9)	56%	33%	11%	22%	33%
	Non-U.S. Airports					
	Continental Europe (5)	60%	0%	20%	20%	0%
	Asia (1)	100%	0%	0%	0%	0%
	United Kingdom (1)	100%	0%	0%	0%	0%
	Canada (2)	50%	50%	50%	0%	50%

CHAPTER FIVE

ORGANIZATIONAL GOVERNANCE OF SUSTAINABILITY

Organizational governance of sustainability refers to the management, organization, and operation of sustainability issues at an airport. It is important to understand how an airport functions with regard to sustainability practices. To gather information on the characteristics of the organizations that own or manage airports, the survey queried respondents on organizational governance from a sustainability perspective.

ROLES AND RESPONSIBILITIES

Management of sustainability practices can be the responsibility of one person or can be spread over a number of roles in an organization. The survey sought to obtain information on the role of the respondent, whether the responsibility for implementation of sustainability practices was shared or not, and how closely the responsible person(s) worked with management on sustainability issues (see Table 6).

U.S. Airports

Respondents from U.S. airports generally said that more than one person at their airport is responsible for sustainability practices. Four of the nine respondents (44%) from large hub airports said that one person is a dedicated manager of sustainability matters at their airport. Sustainability practices at small and non-hub airports were the responsibility of the airport manager or finance director. Medium and large airport respondents identified more specific roles, such as managers of environment, engineering, facilities, or safety. One respondent from a medium airport said that no one had overall responsibility for sustainability practices.

Implementing sustainability practices in an airport organization usually involves the introduction of new ideas, concepts, and approaches. As stated in the proceedings of a TRB conference on sustainability, "[T]ransportation planning agencies face cultural challenges that must be overcome to address unsustainable transportation impacts. Cultural issues must be accommodated to enable the incorporation of sustainability-friendly solutions" (*Integrating Sustainability…* 2004).

A primary challenge is achieving management commitment to implementing sustainability practices at an airport, and a key indicator of the potential for successful implementation is the relationship between the person(s) responsible for sustainability and key leaders in the organization. The following proportions of respondents from U.S. airports said that those with responsibility for sustainability practices at their airport reported to the CEO:

- Large: 56% (5 of 9 airports)
- Medium: 25% (1 of 4 airports)
- Small: 50% (1 of 2 airports)
- Non-hub: 0% (0 of 1 airport).

Non-U.S. Airports

Most respondents from airports in continental Europe and Canada said that one person was responsible for managing sustainability practices at their airport. For example, Aéroports de Paris has a sustainable responsibility director who is specifically assigned to manage such initiatives. In Asia, the responsibility was more likely to be allocated to more than one person. Non-U.S. airport respondents identified roles—such as safety manager or community affairs manager—that also carried responsibility for environmental issues.

The following proportions of respondents from non-U.S. airports said that those with responsibility for sustainability practices at their airport reported to the CEO:

- Continental Europe: 60% (3 of 5 airports)
- Asia: 0% (0 of 1 airport)
- United Kingdom: no response (0 of 1 airport)
- Canada: 100% (2 of 2 airports).

TRAINING

Business and industry are ideal sites for ongoing sustainability training, so that all sectors of the workforce have the knowledge and skills necessary to make decisions and perform their work in a sustainable manner ("Decade of Education…" 2007). Airport operators oversee crucial components of the air transportation infrastructure and are key stakeholders in the transportation industry. A number of the respondents identified lack of understanding as a key barrier to implementation of sustainability practices.

TABLE 6

RESPONSIBILITY FOR SUSTAINABILITY PRACTICES IDENTIFIED BY U.S. AND NON-U.S. AIRPORT RESPONDENTS

		Responsibility For Sustainability Practices			
	Airport Size	1 Person	Description	>1 Person	Description
% Respondents	U.S. Airports				
	Non-Hub (1)	0%		100%	• Airports Manager + Assistant Airports Manager
	Small Hub (2)	0%		50%	• Finance Manager + Capital Program Administrator + Business Services Manager
	Medium Hub (4)	0%		75%	• Manager Engineering & Construction + Senior Director Planning/ Engineering + Director Facilities & Maintenance • Director Aviation + GM Aviation Environment & Safety + Chief Environmental Officer • ESH Supervisor + Environmental Coordinator + Associate General Counsel
	Large Hub (9)	44%	• Environmental Services Manager • Deputy Executive Director • Environmental Coordinator	56%	• Director Environmental Programs + Director Engineering + Director Planning • Senior Director Maintenance + Senior Architect • Executive VP Operations + VP Environmental Affairs + VP Energy Transport Management • Director Environmental Planning/Permits + Chief Environmental Management + Director Planning/Urban Design • Deputy MD Aviation Facilities & Environment + Manager Aviation Environmental Programs
	Non-U.S. Airports				
	Continental Europe (5)	60%	• Manager Safety & Environment • Sustainable Responsibility Director	40%	• Head of Environmental Protection + Others • Head of Environment + Head of Airport Business Development
	Asia (1)	0%		100%	• Corporate Environmental Manager • Assistant Environmental Manager
	United Kingdom (1)	100%	No response provided	0%	
	Canada (2)	100%	• VP Operations • VP Community & Environmental Affairs	0%	

The survey asked respondents to provide information on the provision of training on environmental, social, and economic sustainability topics. Table 7 shows the proportion of survey respondents who identified environmental, economic, and social sustainability training at their airports.

U.S. Airports

With the exception of the non-hub respondent, all U.S. respondents said that their airports provide training for staff on environmental sustainability topics. To a greater extent than large airports, medium airports also provide training on social (75%) and economic (50%) sustainability topics. Specific training topics include:

- Environmental management system training.
- Diversity training.
- Disadvantaged business enterprises training.

Non-U.S. Airports

Respondents from non-U.S. airports also consistently said that environmental training is offered at their airport. Training on social sustainability topics was cited by respondents

from three of the five continental European airports and the one UK airports. Economic sustainability training was cited by only three continental European airport respondents.

SUSTAINABILITY ORGANIZATIONS

Survey respondents were asked to list sustainability organizations to which their airport belongs.

U.S. Airports

The following organizations were listed by respondents from U.S. airports:

- California Climate Action Registry
- Sustainable Silicon Valley
- Sierra Business Council
- Green Print Denver
- ACI–NA Sustainability Subcommittee
- International Facility Management Association
- The Natural Step
- Oregon Environmental Council
- Columbia Slough Watershed Council
- ACI Task Force on Sustainability
- ACI–NA Technical Committee, Environmental Committee, and Sustainability Working Group
- U.S. Green Building Council
- TRB Aviation Group

TABLE 7

PROPORTION OF U.S. AND NON-U.S. AIRPORT RESPONDENTS IDENTIFYING SUSTAINABILITY TRAINING AT THEIR AIRPORTS

	Airport Size/ Region	Sustainability Training		
		Environmental	Economic	Social
% Respondents	U.S. Airports			
	Non-Hub (1)	0%	0%	0%
	Small Hub (2)	50%	50%	0%
	Medium Hub (4)	75%	75%	50%
	Large Hub (9)	100%	56%	33%
	Non-U.S. Airports			
	Continental Europe (5)	80%	60%	60%
	Asia (1)	100%	0%	0%
	United Kingdom (1)	100%	100%	0%
	Canada (2)	100%	0%	0%

- Alliance to Save Energy
- Department of Energy Clean Cities.

Non-U.S. Airports

Respondents from non-U.S. airports listed the following sustainability organizations:

- UK Sustainable Aviation Initiative
- Scotland's Climate Change Forum.

PUBLIC REPORTING

Reporting on sustainability performance allows airport organizations to measure and therefore manage their performance. The benefits of public reporting include increased transparency and accountability, improved stakeholder relationships, and the ability to benchmark performance against peers. Annual reporting of financial performance is common for organizations, but public reporting on environmental, economic, and social sustainability performance demonstrates a commitment to accountability, transparency, and ongoing improvement.

TABLE 8

PROPORTION OF U.S. AND NON-U.S. AIRPORT RESPONDENTS IDENTIFYING STAND ALONE SUSTAINABILITY REPORTING

	Airport Size/ Region	As Part of Annual Report			As Separate Report		
		Environmental	Economic	Social	Environmental	Economic	Social
% Respondents	U.S. Airports						
	Non-Hub (1)	100%	100%	100%	0%	0%	0%
	Small Hub (2)	0%	0%	0%	50%	50%	50%
	Medium Hub (4)	25%	0%	75%	25%	0%	25%
	Large Hub (9)	56%	44%	56%	67%	44%	22%
	Non-U.S. Airports						
	Continental Europe (5)	40%	40%	60%	60%	20%	40%
	Asia (1)	100%	100%	100%	0%	0%	0%
	United Kingdom (1)	0%	0%	0%	100%	100%	100%
	Canada (2)	100%	100%	100%	100%	100%	100%

The survey asked respondents whether their airports report on environmental, social, and economic performance as part of an annual report or in a separate report for each triple-bottom-line issue, and whether they used a standard reporting framework and indicators.

U.S. Airports

Respondents from large, medium, and non-hub U.S. airports said that their airports publicly report on environmental and social performance in the annual report (see Table 8). None of the respondents from medium airports said that economic sustainability performance is reported in their annual report. In addition, neither of the respondents from the two small airports said that environmental, economic, or social performance was included in the annual report. The respondent from one small hub airport said that the airport does not report sustainability performance publicly at all.

Some respondents from large, medium, and small airports said that their airports produce separate reports across the triple bottom line. Respondents from six of the nine large airports cited a separate environmental report, and three also produce separate social and economic reports. One small hub airport reports on environmental, economic, and social performance in three separate reports.

Non-U.S. Airports

Respondents from non-U.S. airports in continental Europe, Asia, and Canada said that their airports report on environmental, economic, and social sustainability practices in the annual report. All the respondents from the UK and Canada said that their airports publish dedicated public reports on environmental, economic, and social performance. Most respondents from continental Europe said that separate environmental reporting is common.

The Greater Toronto Airports Authority (GTAA) publishes data from the triple-bottom-line areas in its annual report and provides more detailed information in a separate sustainability report, which uses the Global Reporting Initiative Sustainability Reporting Guidelines (*2005 Sustainability Report* 2005). Table 9 outlines the issues addressed in this report.

Global Reporting Initiative

Comparison of airport sustainability performance using standardized benchmarking and reporting indicators would help both airport managers and stakeholders to make judgments about airport performance, both per airport and overall. Areas of differential impact are made more obvious through comparison, and the reasons for these differences can be investigated. Such differences can also be used as leverage points for regulators and other stakeholders who believe an airport should improve its environmental performance in terms of reducing absolute impact or in terms of environmental efficiency (Upham and Mills 2005).

> The vision of the Global Reporting Initiative is that comparable reporting on economic, environmental, and social performance by all organizations will become as routine as financial reporting.
>
> Organizations can use the Sustainability Reporting Framework—of which the Global Reporting Initiative Sustainability Reporting Guidelines are the cornerstone—as the basis for disclosure about their sustainability performance. This gives stakeholders a universally applicable, comparable framework in which to understand disclosed information (*Sustainability Reporting Guidelines* 2007).

The survey sought to identify airports that are using the Sustainability Reporting Framework, a standardized framework and set of indicators. Only four respondents said that their airport uses the framework to report sustainability performance, and all of them are outside the United States (three continental European and one Canadian).

TABLE 9

SUSTAINABILITY TOPICS ADDRESSED IN GREATER TORONTO AIRPORTS AUTHORITY 2005 SUSTAINABILITY REPORT

Environmental	Economic	Social
• ISO14001 Environmental Management System • Compliance • Energy Use • Water Use • Biodiversity • Emissions, Effluents and Waste	• 2005 Operating Activity • Operating Results • Risks and Uncertainties • Airport Development Program and Capital Projects • Pickering Airport Plan	• Employees • Material Use • Ethics • Public Donations Guidelines • Political Contributions • Privacy • Diversity • Training and Development • Health and Safety • Community

CHAPTER SIX

ENVIRONMENTAL PRACTICES

There is a compelling and urgent need to address the environmental effects of air transportation, especially as these effects will grow as the economy and the demand for air transportation grow. If these effects are not addressed, they could constrain air transportation growth in the 21st century (Waitz et al. 2004). Airports of the future will have to deal with the environmental concerns of the communities that surround them (Committee on Aviation and Environmental Protection 2007).

This section of the report presents the survey findings on environmental sustainability practices in the areas of measurement and monitoring, water, energy, climate change, land use, materials, waste, noise, energy, and green building. Table 10 shows which U.S. and non-U.S. airport respondents identified current or planned environmental practices at their airports. For a detailed list of environmental sustainability practices reported by survey respondents, see Appendix D.

ENVIRONMENTAL SUSTAINABILITY SELF-ASSESSMENT

Survey respondents were asked to rate performance at their airports with respect to the triple-bottom-line issues of environmental, economic, and social sustainability. Using the management performance scale (see Appendix B), respondents completed a self-assessment on how well their airport was managing environmental, social, and economic sustainability with regard to policies and programs, performance monitoring and reporting, and incentives and awareness.

On the management performance scale, 1 represents little or no awareness of the issue and no policies or programs in place, and 5 represents high awareness, accountability and long-term planning, and incentives aligned with performance. Figure 5 shows the results of the self-assessments.

U.S. Airports

Among respondents from U.S. airports, most of those from large airports rated their airport's environmental performance as 4 or 5. The two small hub airports rated their performance as 1 or 3, whereas the four medium airports rated their performance as 2 or 5. The non-hub airport respondent rated its airport's environmental performance as 3. Several of the large hub airports justified their high ratings by

TABLE 10

SURVEY RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS WHO PROVIDED INFORMATION ON ENVIRONMENTAL PRACTICES AT THEIR AIRPORT

Environmental Practice	Non-U.S. Airport Respondents	U.S. Airport Respondents			
		Large Hub	Medium Hub	Small Hub	Non-Hub
En1. Measuring and Monitoring	☒	☒	☒	☒	
En2. Water Conservation	☒	☒	☒	☒	
En3. Water Quality	☒	☒	☒		☒
En4. Climate Change	☒	☒	☒	☒	☒
En5. Air Quality	☒	☒	☒		
En6. Land Use	☒	☒	☒		☒
En7. Biodiversity	☒	☒		☒	
En8. Materials	☒	☒	☒		
En9. Waste	☒	☒	☒		☒
En10. Noise and Aesthetics	☒	☒	☒		
En11. Energy	☒	☒	☒	☒	
En12. Green Buildings	☒	☒	☒		

describing specific policies, performance monitoring, and reporting practices:

- "First comprehensive environmental sustainability report will be published in June 2007" (self-assessment = 5).
- "The airport has implemented a formal sustainability performance improvement management system. This management system incorporates sustainable practices, and monitoring, reporting and improvement into operations" (self-assessment = 4).
- "Compliance practices are very well developed; no sustainability program policy, funding, or baseline developed yet" (self-assessment = 3).
- "Performance driven by EMS [environmental management system]" (self-assessment = 4).

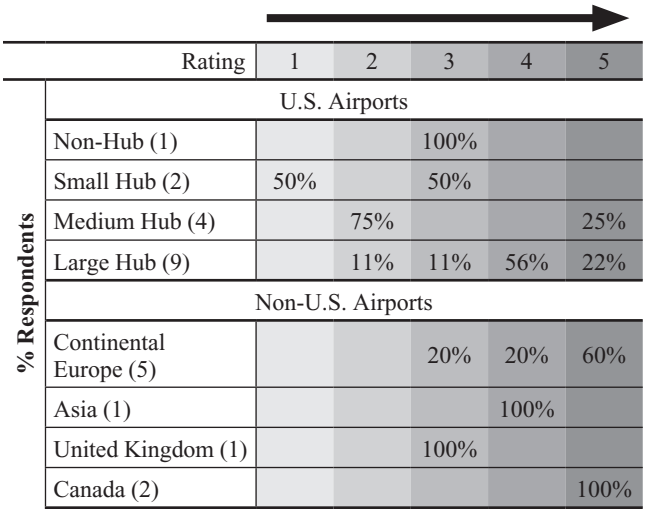

FIGURE 5 Environmental sustainability self-assessment by respondents representing U.S. and non-U.S. airports.

Non-U.S. Airports

The respondents from non-U.S. airports generally ranked their airport's environmental performance at high levels: 3 for the UK; 3, 4, and 5 for continental Europe; 5 for Canada; and 4 for Asia. The respondent from Toronto International Airport commented, "We are the first airport registered to ISO 14001 in North America." (ISO 14001 is the international standard for environmental management systems.)

MEASUREMENT AND MONITORING

A systematic approach makes managing a business both easier and more effective. Management systems allow businesses to define the best way to handle each key activity and create a common approach that all employees can use. A consistent approach reduces the number of mistakes and the cost of correcting problems. It also reduces the level of risk and ensures compliance with legislation ("Set Up a Health…" 2007).

An environmental management system (EMS) is a business management practice that allows an organization to strategically address environmental matters. Several EMS frameworks exist; most are based on the International Organization for Standardization (ISO) 14001 EMS standard. Globally, more than 130,000 organizations have certified their EMSs to the standard. Although an EMS does not relieve an airport operator of its environmental responsibilities under federal, state, and local law, it can reduce the costs and time for processing environmental analyses by providing baseline data and a framework for checking and reporting compliance with mitigation commitments ("Program Guidance Letter 06-07…" 2007).

The synthesis survey sought to identify airports that have implemented a system to measure and monitor environmental performance. Respondents were asked if their airport has implemented any of the following:

- EMS certified to ISO 14001.
- EMS uncertified.
- Registration with the EU eco-management and audit scheme (EMAS).
- Other measurement or monitoring systems.

An environmental management system (EMS) outlines specific activities for the implementation of an organization's environmental policy. The International Organization for Standardization (ISO) produced the ISO 14001 standard against which an organization's EMS is assessed and certified internationally (ISO 14001:2004 2007). The EPA supports and promotes the development and use of EMSs to help organizations achieve their environmental obligations and broaden environmental performance goals. EPA does not specifically favor ISO 14001 over other EMS models or approaches. The plan–do–check–act/continual improvement approach used by ISO 14001 and similar models has proven to be effective as applied to environmental management, but not all facilities have modeled their EMSs on ISO 14001 ("EPA's Position on EMS" 2007).

The European Union's eco-management and audit scheme (EMAS) acknowledges organizations that improve their environmental performance on an ongoing basis. EMAS registered organizations are legally compliant, run an environmental management system, and report on their environmental performance in an independently verified environmental statement ("EMAS: The Eco Management and Audit Scheme" 2007).

Table 11 shows the feedback from survey respondents on measuring and monitoring systems at their airports. Respondents from 16 U.S. airports and 9 non-U.S. airports identified some kind of EMS in place at their airport; however, only 2 respondents from large U.S. airports in the study have an EMS that is certified to ISO 14001. Alternatively, all five respondents from continental European airports and one from Canadian airports have an EMS that is certified to the standard. Only one of the continental European airports reported using the EMAS.

Respondents from a large U.S. airport and an airport in continental Europe described best practice management plans or comprehensive sustainability management systems that move beyond environmental performance and also address social and economic performance.

The respondents from one large U.S. airport said that its EMS is compliant with and audited by the EPA. A Canadian airport respondent said that its EMS is integrated with its health and safety management system.

Interestingly, all airports that have an ISO 14001 certified EMS also publicly report sustainability performance against the Global Reporting Initiative (GRI) guidelines.

TABLE 11

PROPORTION OF RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS IDENTIFYING ENVIRONMENTAL MONITORING OR MEASURING SYSTEMS AT THEIR AIRPORT

		Systems in Place to Measure and Monitor Environmental Performance				
	Airport Size/ Region	EMS (ISO14001)	EMS (uncertified)	EMAS Registration	Other	Description
% Respondents	U.S. Airports					
	Non-Hub (1)	0%	100%	0%	0%	
	Small Hub (2)	0%	50%	0%	50%	• Storm water Pollution Prevention Plan
	Medium Hub (4)	0%	100%	0%	0%	
	Large Hub (9)	22%	44%	0%	22%	• Best Practice Management Plans • Permit Tracking System
	Non-U.S. Airports					
	Continental Europe (5)	100%	0%	20%	20%	• Sustainability Management System
	Asia (1)	0%	100%	0%	0%	
	United Kingdom (1)	0%	100%	0%	0%	
	Canada (2)	50%	100%	0%	0%	

WATER

Water Conservation

Only 1% of the earth's water is available for human use, and even though both the population and the demand on freshwater resources are increasing, supply remains constant. Managing water is a growing concern in the United States as communities across the country face water supply and water infrastructure challenges ("Why We Need Watersense" 2007).

A new facility reprocesses highly concentrated wastewater from de-icing operations by means of distillation. The resulting solution (approximately 65% propylene glycol) is reprocessed at a recycling facility operated by Clariant at Munich Airport and turned into a de-icing agent. The distillate is disposed of through the spray irrigation system (see Figure 6).

FIGURE 6 Treatment of wastewater from de-icing operations at Zurich Airport.

Operation of airports—from cargo to passenger terminals to airline movements—requires the use of water. Ensuring efficient use can minimize waste and conserve this precious resource. Even seemingly small efforts help—at Los Angeles International Airport, maintenance staff phone numbers are

prominently posted in restrooms, so people can report leaky faucets or other water problems.

The survey respondents said that the following practices to enhance water conservation and efficient use of water are in place at their airports:

- Low flow/automatic fixtures and toilets, and waterless urinals.
- Monitoring to track water consumption and water conservation audits.
- Capturing and partially infiltrating rainwater.
- Use of gray/storm/recycled water for irrigation and recycled water for car washes.
- Computer-controlled, "smart" irrigation systems.
- Green roofs and limited landscaping that features xeriscape and drought-tolerant species.
- Water-efficient central heating and cooling systems.

Water Quality

The 21st century water environment holds many complex and challenging problems, such as polluted runoff, suburban growth, drinking water security, groundwater/surface water interactions, invasive species, microbes in drinking water, and atmospheric deposition. These problems require a modern approach to environmental protection—an approach grounded in sound science, innovative solutions, and broad public involvement (Mehan 2007).

> De-icing involves the removal of frost, snow, or ice from aircraft surfaces or from paved areas, including runways, taxiways, and gate areas.
>
> De-icing can be performed mechanically or by applying chemical agents (*Aviation and Environment…* 2000, p. 18).

Activities of airport operators have the potential to influence local water quality. Transportation and storage of fuels, de-icing of aircraft and surfaces, and indirect pollution can lower the quality of watersheds and water bodies near an airport.

Survey respondents listed the following practices to enhance water conservation and the efficient use of water at their airports:

- Onsite stormwater collection, treatment, and management (swales, bioretention, vaults, wetlands), and requiring a stormwater pollution prevention plan for all new construction.
- Onsite wastewater treatment plants.
- De-icing spots/pads, collection and treatment of de-icing fluids.
- Reducing impermeable surfaces (runways, taxiing lanes, buildings, etc.).
- Spill traps/management, oil separator pumping stations, fuel delivery systems.
- Dyke system and flood storage capacity.

(TRB ACRP is also publishing Project 02-02, "Planning Guidelines and Best Management Practices for Aircraft and Airfield De-icing Stormwater Management Systems." For more information, go to www.trb.org.)

The principal law governing pollution of U.S. surface waters is the Federal Water Pollution Control Act (Clean Water Act). Originally enacted in 1948, it was totally revised in 1972 by amendments that spelled out ambitious programs for water quality improvement. These programs have been expanded and are still being implemented by industries and municipalities. The Clean Water Act has two major parts: (1) provisions that authorize federal financial assistance for municipal sewage treatment plant construction, and (2) regulatory requirements that apply to industrial and municipal dischargers (Copeland 2002).

Several airport respondents identified water quality practices at their airports that are direct responses to the Clean Water Act, such as water-efficient equipment and facilities, and enhancing the management of stormwater runoff in response to National Pollutant Discharge Elimination System permitting requirements.

AIR QUALITY

More than a quarter of all commercial airports operating in the United States are located in air quality nonattainment areas. As federal controls become increasingly stringent for industrial sources, airports are emerging as a major source of pollution—they are responsible for up to 10% of total emissions in some urban areas. To receive regulatory approval, an airport located in a nonattainment area must show that its growth will conform with air quality plans for the region and that, at a minimum, enforceable programs will be established to offset increases in pollution (*Alternative Fuel…* 2001).

> The Clean Air Act was passed in 1970. Under the Act, EPA sets limits on certain air pollutants and on pollutants from certain sources, as well as limits on pollution levels anywhere in the United States. States must develop State Implementation Plans (SIPs) that outline how they will control air pollution under the Clean Air Act. A SIP is a collection of regulations, programs, and policies a state will use to clean up polluted areas. The states must involve the public and industries through hearings and opportunities to comment on the development of the state plan ("Plain English Guide to the Clean Air Act" 2007).

Survey respondents listed the following practices to address air quality issues at their airports:

- Air quality monitoring and metering.
- Particle filters on airport vehicles.
- Air quality management plan (tied to 20-year master plan) and air quality enhancement program.
- Partnering with research institutions and resource agencies to address air quality issues.
- Planning for development that complies with the SIP and the Clean Air Act.
- Active dust control, permitting, and conformity analysis programs.
- Stationary source reductions.
- Transport Demand Management (strategies or policies to reduce or redistribute automobile travel demand).

Several survey respondents from both U.S. and non-U.S. airports identified research efforts and partnerships with universities or aviation research bodies on air quality issues:

- Participation in ACRP's Hazardous Air Pollutants study and sustainability survey.
- Support for the International Civil Aviation Organization's development of new guidance governing the calculation of emission sources at airports.

CLIMATE CHANGE

At the global level, climate change is likely to drive important changes in the aviation industry over the next 10 to 20 years (Upham et al. 2003). Growth in global air transport is forecast to triple aviation carbon dioxide emissions between 1990 and 2050, and total radiative forcing (global warming) effects are forecast to increase fourfold over the same period ("Aviation and the Global Atmosphere" 1999).

Airport operators are realizing how construction, operation, maintenance, and other activities at airport facilities can contribute to the industry's overall climate change impacts. Airports can play a role in reducing their impact on climate change by addressing emissions in ground transportation, energy use in buildings, and associated indirect emissions.

Survey respondents listed the following practices to reduce greenhouse gas emissions and minimize their airport's contribution to climate change:

Ground Vehicles

- Clean/alternative fuel vehicle program using liquefied natural gas (LNG).

Boston–Logon International Airport's voluntary 15-year Air Quality Initiative (AQI) strives to maintain NOx emissions at or below 1999 levels (see Figure 7).

FIGURE 7 Air quality practices at Logan International Airport (Massachusetts).

- Use of compressed natural gas (CNG), electricity, propane, solar power, hydrogen, ethanol, and biodiesel fuels.
- Provision of a public CNG fueling station and electric vehicle charging stations.

Aéroports de Paris uses energy management as a key indicator in strategic decision making. All revenue generated by savings in CO2 emissions are used for energy management. For accounting year 2005, 10,000 tonnes of CO2 were sold under prior virtuous practices.

Passenger Access

- Intraterminal train, automated people movers.
- Comprehensive public transportation network, investment in light rapid transit to airport, subsidized public transport.
- Flyaway program providing parking and reduced rate bus service from remote locations to the airport (reduced emissions by more than 1,000 tonnes last year).

Aircraft on the Ground

- Installation of stationary aircraft energy supply systems; ground power units at all gates.
- Airport constructed a taxiway to reduce taxi distances from terminal to runway.
- Airport conducted the first aircraft towing trial in North America with Virgin Atlantic, Boeing, and FAA—an aircraft was towed from the gate closer to the runway, reducing engine running time on the taxiway.

Aircraft must have a power source at the gate to maintain electronic systems and pneumatic pressure for air conditioning. Aircraft formerly met this need with portable ground power units, or by running an onboard auxiliary power unit (APU)—a small turbine engine inside the fuselage. A B-737 APU burns 34 gallons of jet fuel/hour, emits exhaust on the airport ramp, and is noisy. A typical land-takeoff cycle of 15–26 min burns 12–17 gallons of jet fuel if the APU is used the entire time. If 100 aircraft/day eliminated use of the APU, there would be an NOx reduction of 10 tonnes/year (Rowe 2005).

Aircraft in the Air

- Use of continuous descent approach program.
- Air emissions charge—the most highly polluting aircraft incur the highest charge.

Buildings

- Conversion of heating systems from oil to gas.
- Tracking and reduction of airport energy consumption.

Monitor and Manage Emissions

- Company-wide quota unit set up to control and manage CO2 emissions.
- Greenhouse gas inventory reported online through California Climate Action Registry.

Research and Partnerships

- Support International Civil Aviation Organization and Eurocontrol (European Organization for the Safety of Air Navigation) method of monitoring global emissions.
- Participate in the city's Zero Emissions 2020 Plan, which commits the city to developing a clean air plan for public transit.
- Active participation of airport staff in local, regional, state, and national climate change research and programs.

The Green Apron Policy at Hong Kong Airport involves replacing the existing 43-vehicle fleet with alternative-fuel or low-emission vehicles over the next five years, and providing fixed ground power and preconditioned air supply at each frontal gate so aircraft can shut down their APUs while they are parked at the gate (see Figure 8).

FIGURE 8 Airport practice in relation to reducing emissions.

LAND USE

One of the greatest concerns facing airports today is incompatible land use. With the pressure to convert open space for development and the proliferation of telecommunication structures, the demand on the national airspace and the ground area around airports continues to increase. The list of incompatible land uses that encroach on airspace and approach areas is long; it includes noise-sensitive and high-density land uses such as residential areas and parks/open spaces. Conflicts between airports and their urban environments escalate as the demand for developable land increases (Oregon Department of Aviation 2003).

A significant problem facing airports is incompatible land uses. Noise-sensitive land uses such as parks and open space and residential areas near airports are considered incompatible. Managing and treating contaminated land is also a prevalent issue for many airport operators. Placing land uses that attract wildlife hazardous to aviation (e.g., deer, large waterfowl, and flocking bird species) are other major concerns.

Survey respondents listed the following practices related to land use at their airports.

Contaminated Land

- Hazardous materials management plan and team.
- Measurement campaign to evaluate soil pollution, survey of contaminated sites, groundwater monitoring program.
- Decontamination of polluted zones, soil and groundwater cleanup.

Some respondents cited regulations and relationships with government to manage this issue:

- Clean Land Act controlled by the Netherlands Environment Department.
- Development of a Prospective Purchaser Agreement with the EPA for certain contaminated land acquisitions.
- Polluted airport sites illustrated in a "cadastre of polluted sites at aerodromes," published by the Swiss Federal Office of Civil Aviation and available to the general public.

The U.S. Army Corps of Engineers worked with Redding (California) Municipal Airport staff to remove World War II–era underground storage tanks. An aggressive land acquisition program seeks to prevent residential encroachment and preserve wetlands and green space (see Figure 9).

FIGURE 9 Redding Municipal Airport land use practices.

Land Use Planning

Survey responses related to land use planning were limited to the following:

- Plans to partner with the community on an airport-centered eco-industrial zone.
- Incorporating green space as much as possible in future developments.

(Noise-compatible land uses are discussed in the "Noise Pollution and Aesthetics" section of this chapter.)

BIODIVERSITY

Two key issues related to wildlife have an impact on airports: the conflict between wildlife preservation and aircraft safety, and the effects of noise on migration and nesting patterns.

Aircraft collisions with wildlife (commonly referred to as "wildlife strikes") cost the civil aviation industry in the United States at least $500 million a year in direct damages and associated costs, and more than half a million hours of aircraft down time. However, it is not the economic cost of wildlife strikes but the cost in human lives that requires the industry to manage this problem (Cleary and Dolbeer 2005).

The effect of noise on wildlife is poorly understood for a number of reasons including the difficulty of separating visual and aural components of an event, and the applicability of experimental results to a natural setting. It is also very difficult to generalize behavioral responses across species because of the multiple variables of each noise event: volume, frequency, rate of onset, season, time of day, year, and so on (AMEC 2005).

Survey respondents listed the following practices relating to biodiversity at their airports:

Nonlethal Bird Techniques

- Noise systems to scare birds (fixed on cars or on the ground).
- Crackers to scare birds.
- Habitat management and landscaping that is not attractive to birds.
- Monitoring and movement of birds away from aircraft.
- Managing unsealed areas of the airport as extensive grassy meadows to prevent collisions between aircraft and birds.

Tallahassee Airport in Florida has implemented a number of biodiversity practices including onsite conservation area for gopher tortoise (species of concern); remediation of area of bent golden aster (endangered) during construction; establishment of tree bank, and use of native species in area where residences were demolished for noise mitigation; bird control plan uses habitat modification and harassment as primary means of reducing threat to aircraft.

Habitat Protection or Enhancement

- Eighty percent of airport area is for operations and 20% for nature conservation zones, woodlands, and bodies of water; annual plan implemented by airport's greenery maintenance service.
- Dolphin sanctuary/marine park to protect endangered dolphin species; membership to Marine Mammals Conservation Committee.
- Protected and enhanced foreshore habitat during dike repairs.
- Wildlife hazard management plan.
- Wetland mitigation program.
- Vegetation management/habitat protection.
- 300-acre dunes preservation area—largest remaining coastal dunes fragment in Southern California, home of endangered El Segundo blue butterfly; two landscape technicians remove noxious/invasive species and reestablish native species; biologist annually monitors endangered species.
- Contract with U.S. Department of Agriculture.
- Partnership with the local conservation group to fund the restoration of 21 acres of grassland habitat.
- Financial support to Nature Conservancy to manage local nature reserve.

- Support local greenbelt trust and outreach program—staff involved in habitat improvement.
- Nature conservation areas created and financially supported as ecological compensation measures.

MATERIALS

Construction and demolition waste constitutes about 40% of the total solid waste stream in the United States. Extraction, processing, and transportation, as well as the air and water pollutants created during production, can destroy natural habitats and deplete natural resources (*Green Building…* 2005). Reuse and recycling of materials can significantly reduce consumption of virgin materials, as well as the amount of waste sent to landfill. Ensuring that materials have little or no environmental impact and do not harm human health is paramount for achieving sustainable outcomes at an airport.

> Vancouver International Airport's building and construction processes use materials such as strawboard and paints that are low in volatile organic compounds, reuse building materials onsite, and have a high reuse rate of concrete and asphalt (see Figure 10).

FIGURE 10 Vancouver Airport sustainable materials use.

Survey respondents listed the following practices related to materials use at their airports:

- Free-trade coffee purchased for offices.
- Compostable food serviceware.
- Soy-based ink.
- Carpeting with high recycled content.
- Restroom paper products with high recycled content.

Construction Materials

- Use of strawboard instead of gyprock.
- Reuse of building materials onsite; very high reuse of concrete and asphalt during construction projects.
- Forest Stewardship Council certified cherrywood paneling.

Hazardous or Toxic Products

- Use of lower biochemical oxygen demand (BOD) deicing materials. (TRB ACRP has also published Project 02-01 "Alternative Aircraft and Airfield De-icing and Anti-Icing Formulations with Reduced Aquatic Toxicity and Biological Oxygen Demand." For more information, go to www.trb.org.)
- Work safety service tracks harmful chemicals and enters records into a database when the chemical products work group encounters a new product.
- Use of nontoxic pest-control products.
- Use of antifreeze with high recycled content (glycol).

WASTE MANAGEMENT

Waste management at airports is becoming increasingly important with the enormous increases in passenger numbers; it is a key responsibility of the facilities manager (Pitt and Smith 2003). Airports are notoriously poor environmental performers, and the growth in the industry is leading to increasing levels of waste production. Environmentally sound waste management must go beyond the mere safe disposal or recovery of wastes and address the root cause of the problem by attempting to change unsustainable patterns of production and consumption (United Nations Conference on the Environment and Development 2001).

> Portland Airport recycles foreign periodicals from international flights to educational institutions that teach foreign languages (see Figure 11).

FIGURE 11 Waste management at Portland Airport.

Managing the waste streams from airport operations provides a variety of challenges, including separating and recy-

cling waste at terminals, tenant requirements, and meeting/adhering to city or county ordinances. In addition, international airports are required to meet government disease control regulations for recycling and disposing of international waste. Survey respondents listed the following practices related to waste management at their airports.

Tenant/Airline Waste Management

- Implementing pilot programs for food/trash waste separation at concessionaires.
- Separating solid waste types at the point of generation.
- Recycling waste and scrap materials from airport, airline, cargo, and construction activities.
- Planning to participate in a pilot program with other airports to target in-flight operation paper waste.
- Airport-wide recycling of cardboard, wood pallets, scrap metal, batteries, and used oil.

Besides the waste taken off airplanes, airport waste is generated in offices, shops, restaurants, restrooms, and flight kitchens; from cargo operations, maintenance areas, and hangars; and from landscaping, construction, and demolition. Each of these areas creates distinct waste streams, making it complicated to establish an airport-wide recycling program (Atkin et al. 2006).

Waste Disposal Logistics and Management

- Waste disposal contractor chosen to encourage the recovery of separated waste materials as much as possible. Each tenant chooses the number of waste types to separate at the source—cost reflects the degree of separation, which provides a financial incentive for good practices.
- Waste disposal logistics (landside and airside) revised in 2007 to meet EU regulations modified in response to the Schengen Agreement (which seeks to abolish physical borders among European countries).
- Waste disposal services optimized through the use of new providers (shorter journeys to and from the airport) and more efficient means of transport (vehicles with trailers to reduce the number of trips required).
- Feasibility study concerning separate disposal of onboard waste (e.g., newspapers/paper from aircraft cabins and onboard catering recyclables).

Waste Minimization

- Implementing waste minimization program for paper, cardboard, aluminum cans, plastic bottles, plastic sheets, fluorescent tubes, lube oil, food waste for composting, and CDs.
- Reducing number of copier machines by 12% airport-wide.
- Reproducing engineering/architectural contracts and bid documents on CDs and submitting work orders electronically.
- Reducing paper towel use in restrooms.

Recycling and Waste Management

- Adequate space provided for the collection, storage, and disposal of recyclable materials.
- Waste containers around the airport for passengers and tenants—transferred to onsite dumpsters and compactors, then transported to an offsite processing facility.
- Thirty different waste types recycled at the airport.
- Airport offices recycle paper.

Composting

Respondents from both U.S. and non-U.S. airports identified a number of composting initiatives at their airports:

- Food waste composting to organic soil conditioner for airport landscaping.
- Compost coffee grounds from an airline for use in airport landscaping.
- Food service operations participate in the food scraps composting program.

Respondents did not supply details of the composting operations. The U.S.DOT recommends the following:

Composting operations that accept only yard waste (e.g., leaves, lawn clippings, and branches) generally do not attract hazardous wildlife. Sewage sludge, woodchips, and similar materials are not municipal solid wastes and may be used as compost bulking agents. The compost must never include food or other municipal solid waste. Composting operations should not be located on airport property ("Advisory Circular…" 2004).

NOISE POLLUTION AND AESTHETICS

Today's aircraft are typically 75% quieter than jets in the 1960s; however, action is needed to prevent deterioration in the noise climate as air traffic growth overtakes the rate of technological advance (UK Department for Transport 2003).

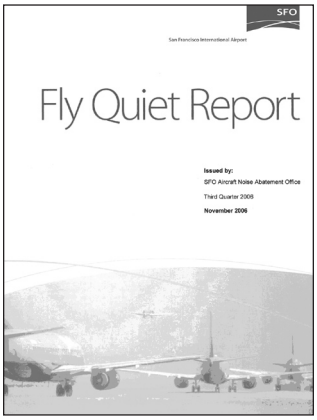

FIGURE 12 San Francisco International Airport noise management activities.

The Fly Quiet Program at San Francisco International Airport takes a participatory approach to complying with noise abatement procedures by grading airline performance, making scores available to the public, and presenting awards to high achievers (see Figure 12).

Code of Federal Regulations Title 14 Part 150 prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs, including the process for evaluating and approving or disapproving those programs. It also identifies land uses that are normally compatible with various levels of exposure to noise by individuals ("Electonic Code…" 2007). Survey respondents listed the following practices related to noise pollution or aesthetics at their airports:

Aircraft in the Air

- Separate pricing for low-sound-classified planes.
- Chapter 2 aircraft that produce more noise were phased out.
- Only the quietest aircraft are authorized to fly at night.
- Arrivals and departures occur over the ocean and not over residential areas.
- VHF omni range radio beacon guides aircraft on a noise abatement route.

The FAA has developed a toolkit for land use planning around airports. "Airport Noise Compatibility Planning Toolkit" is available on the FAA website (www.faa.gov). The toolkit helps local governments and planners develop noise-compatible land use plans for airports and their environs.

Aircraft on the Ground

- Limitations on taxiing and engine testing; engine run-up pad to attenuate noise from engine testing.
- Preferential runway use policy—limits departures to runways in the interior of the airport.
- Ground run-up enclosure contains noise from maintenance testing.

Surrounding Neighborhoods

- Housing scheme for noise insulation; airport soundproofing program; residential noise mitigation program.
- Noise walls constructed.
- Enhancement program—parkways and greenbelts along the airport perimeter as an attractive buffer between the airport and the community.
- Noise mitigation program for residential areas, schools, and other sensitive public buildings.

Monitoring

- Permanent noise monitoring system to monitor noise levels in communities around the airport (29 stations).
- Airport Noise Abatement Office maintains a database of all complaints from nearby communities about airport noise nuisance.
- Noise mitigation program with full-time staff and extensive noise monitoring system.

Land use decisions that conflict with aviation activity and airport facilities can result in undue constraints on an airport. To enable this sector of the economy to expand, to provide a wide variety of job opportunities for local citizens, and to meet the needs of the traveling public, it is vitally important that airports operate in an environment that maximizes the compatibility of the airport with off-airport development (*Program Guidance Letter 06-07* 2007, pp. 1-3–1-4).

The FAA has prepared a guide to help all involved to work together to protect this valuable resource and to promote land use compatibility around airports. "Land Use Compatibility and Airports: A Guide for Effective Land Use Planning" is available on the FAA website (www.faa.gov).

Research and Partnerships

- Working with FAA Air Traffic Control to suggest changes to approach and departure procedures to reduce noise impact on neighboring residents.
- Working with Boeing, FAA, and United Airlines on Oceanic Tailored Arrivals to reduce noise from flights arriving from the Pacific Rim.
- Working with community group, FAA, and airlines to address noise issues.
- Study to implement continuous decent approach procedure.

Several respondents identified practices required by regulations:

- Local regulations limit neighborhood construction and air traffic.
- Altered takeoff patterns imposed by authorities.

ENERGY

Energy efficiency is not a new concept among airport operators and designers. Kaszewski and Sheate (2004) cite several airports that have adopted green construction; for example, Stansted (UK), Barajas-Madrid (Spain), and Chep Lap Kok (Hong Kong) airports have all maximized the use of natural lighting in their terminal buildings. These buildings also incorporate very high standards of insulation and high heat-recovery air-conditioning systems.

The activities and facilities operating at airports are very energy-intensive environments. The use of electricity, requirements for heating and cooling, and specific energy requirements for aircraft operations and maintenance keep energy demand at high levels. The synthesis survey sought to identify airport practices that reduce energy through efficiency of design and operation and use of low- or zero-carbon energy sources. Survey respondents listed the following practices related to energy use or efficiency at their airports.

Motivated by the West Coast energy crisis of 2000–2001, the Seattle–Tacoma International Airport invested $7 million over five years to reduce electricity consumption by $1.7 million/year. Initiatives included light retrofitting, improving HVAC efficiency and escalator efficiency, and using improved architectural standards for new buildings ("Improving Building Efficiency…" 2004, p. 3) (see Figure 13).

FIGURE 13 Port of Seattle energy practices.

Interiors

- Automatic lights/system based on ambient lighting and occupancy; use of a light intensity meter; changing incandescent bulbs to fluorescent; uncoupling strip lights, using efficient ballasts; computer-operated lighting systems.
- Automatic engine and heating, ventilation, and air conditioning (HVAC) control, hot air curtains, airflow return, carbon monoxide monitors to reduce unnecessary HVAC, upgraded air-handling units with variable speed drives and soft-start controls; changing the heating source from fuel oil to natural gas and using excess heat for cooling.
- Energy Star energy-efficient equipment.
- Grouping flights in a certain part of the concourse during nonpeak hours allows the airport to shut off air conditioning and lighting in unused areas.
- Escalator sleep mode.
- Solar hot water panels reduce natural gas consumption, as boilers are not required in the summer.
- 20kW capacity solar photovoltaic panel array on roof of airport building.

As a result of the modification of the VLAREM II regulation (Flemish regulation on environmental permits), the Brussels Airport Company is obliged to develop periodic energy plans. An exhaustive energy audit carried out in 2005–2006 has resulted in three energy plans. The energy-saving measures laid out in these plans will be carried out in 2007–2008 ("Energy Planning" 2007).

Management

- Preliminary energy audit.
- Regulations related to insulation, energy efficiency, and CO2 emissions are becoming stronger—working group formed to examine possibilities.
- Energy reduction team identifies opportunities to improve energy efficiency.
- Agreement with Department of Water and Power for 15% green power in all facilities.

(TRB ACRP is in the process of publishing Project 11-02/ Task 1, "Model for Improving Energy Use in U.S. Airport Facilities." This model will provide guidance for facility managers on improving energy use through improved energy-related operations and maintenance procedures; commissioning/optimizing major energy-consuming systems; and installation of the latest cost-effective energy conservation measures. For more information, go to www.trb.org.)

GREEN BUILDING

Green buildings are designed, constructed, and operated to boost environmental, economic, health, and productivity performance. Many of the benefits of green building technologies and practices for occupants, owners, the environment, and society at large are quantifiable and well documented. These benefits include measurable reduction of waste, decreased water use, energy savings, reduced operating and maintenance costs, and improved indoor air quality. Less tangible benefits are improvements in occupant health, employee morale, productivity, recruitment, and retention, and an improved public image for the organization that builds green (U.S. Green Building Council 2003).

When queried on priorities for sustainability in the next five years, survey respondents selected energy efficiency and green building as the top two priorities for their airports. They cited the following practices related to green building:

Established in 1996 in France, the High Quality Environmental (HQE) Association involves French businesses, industries, experts, and project managers in developingg the environmental quality of buildings in the residential and tertiary sectors. The HQE approach requires the environment to be taken into consideration at every stage of the development and life of a building (planning, design, construction, demolition, etc.). Many parameters are integrated, including the management of energy, water, and waste; air quality and the quality of the spaces; and reducing the noise and visual pollution typical of building sites. The HQE approach is a wide-ranging cross-disciplinary approach to the living environment ("High Environmental Quality…" 2007).

Certification and Policies

- Airport joined the HQE (High Quality Environmental) Association in 2005; 14 target areas earmarked for action, broken down into eco-building, eco-management, comfort, and health.
- Building certified to Silver level of LEED (Leadership in Energy and Environmental Design)—the U.S. green building rating system.
- Policy to assess feasibility of LEED for all new buildings and major renovations.
- Developing green building policy to guide future renovations and development.
- City's green building ordinance specifies that construction projects larger than 15,000 square feet should achieve a minimum LEED rating of Silver.
- Terminal building design is 30% more efficient than required under federal law—high-performance glazing, enhanced daylight, energy-efficient fixtures, efficient entryways, efficient ventilation, outside air economizer, energy management and control system, variable-flow chilled and hot water systems.
- Sustainable building policy requires all construction to achieve the highest practical LEED certification.
- Sustainable design guidelines used for all design and construction projects.
- Use of natural light.
- LEED for all new buildings.

Green Building Practices

- Grid-connected solar photovoltaic panels.
- Forest Stewardship Council certified wood.
- Ground landscaping composed of native plants and trees grown in local nurseries specifically for the airport.
- Green building concepts incorporated into designs and remodels, although the airport does not necessarily seek certification.

At Toronto Pearson International Airport, the New Fire and Emergency Services Training Institute (FESTI) at the airport is certified to a LEED Silver level.

CHAPTER SEVEN

ECONOMIC PRACTICES

The air transportation system provides for the cost-effective transportation of goods and services and is a significant engine of the U.S. economy. About 75% of long-distance travelers and 42% of medium-distance travelers prefer air travel. The air transportation industry requires large capital investments to provide services—airport capacity is one of the most significant issues facing civil aviation, as building new airports can be more expensive than expanding available facilities. Policymakers must project the impact of their policies in the presence of long lead times (Mezhepoglu and Sherry 2006).

Examples of economic sustainability includes local hiring and purchasing policies, charitable donations, long-term and life-cycle financial considerations, research to develop sustainable technologies, and incentives to encourage sustainable behavior. Responsible and successful economic performance is not just a key indicator of business practice but of the long-term sustainability of an organization.

Table 12 provides a summary of the economic practices most frequently cited by survey respondents from U.S. and non-U.S. airports. For a detailed list of economic sustainability practices reported by survey respondents, see Appendix D.

ECONOMIC SUSTAINABILITY SELF-ASSESSMENT

Participants in the survey were asked to provide an overall rating of the performance of sustainability at their airports with respect to the triple-bottom-line issues of environmental, economic, and social sustainability. Using the management performance scale (see Appendix B), respondents completed a self-assessment on how well they believed their airport was managing environmental, social, and economic sustainability with regard to policies and programs, performance monitoring and reporting, and incentives and awareness. On the management performance scale, 1 represents little or no awareness of the issue and no policies or programs in place; and 5 represents high awareness, accountability and long-term planning, and incentives aligned with performance. Figure 14 shows the results of the survey respondents' self-assessment.

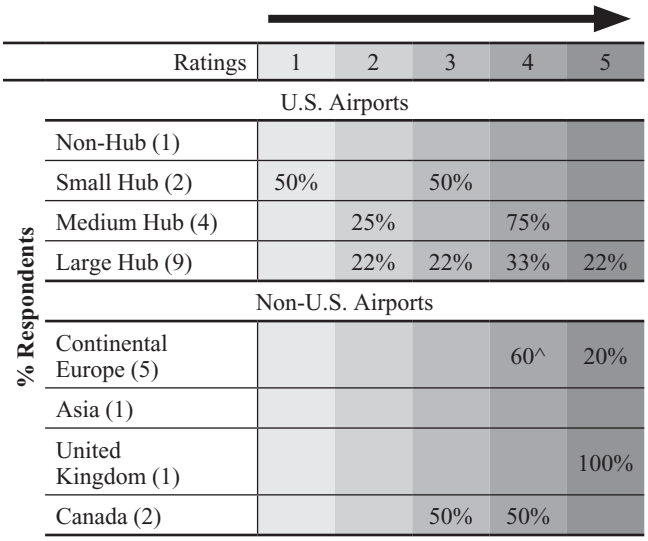

FIGURE 14 Economic sustainability self-assessment of respondents.

TABLE 12

SURVEY RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS WHO PROVIDED INFORMATION ON ECONOMIC PRACTICES AT THEIR AIRPORT

Economic Practice	Non-U.S. Airport Respondents	U.S. Airport Respondents			
		Large Hub	Medium Hub	Small Hub	Non-Hub
Ec1. Hiring and Purchasing	☒	☒			
Ec2. Community Contributions	☒	☒	☒		☒
Ec3. Quantifying Sustainability	☒	☒	☒		
Ec4. Contribution to Research and Development	☒	☒			
Ec5. Incentivizing Sustainable Behavior	☒	☒	☒		

U.S. Airports

Respondents from large hub U.S. airports assessed their economic management performance between 2 and 5, with a preference for 4. This rating is similar to their self-assessment for environmental performance. Respondents from medium airports mostly ranked their airports at 4, compared with the highest ranking for environmental performance at 5. Respondents from the two small hub airports assessed the management of their economic sustainability practices at 1 and 3, the same rating they gave their environmental performance. The non-hub respondent rated their airport as having better economic sustainability practices than their environmental practices (4 rather than 3).

Non-U.S. Airports

The survey respondents from continental European and UK airports assessed the management of their economic sustainability practices as stronger than the management of their environmental practices. The respondent from Asia rated economic sustainability performance at 2, compared with a rating of 4 for environmental performance. The respondents from Canadian airports rated management of environmental practices higher 5 than management of economic sustainability (3 and 4). A Canadian respondent noted that their airport is a not-for-profit organization. (See box for explanation of Canada's National Airports System.)

> The 26 airports that currently handle 94% of air travelers in Canada comprise a network known as the National Airports System (NAS). The system includes airports in the national, provincial, and territorial capitals, as well as those that handle at least 200,000 passengers a year. In 1994, the Canadian government introduced the National Airports Policy, in which it retained ownership of the 26 NAS airports but leased them to local airport authorities who are responsible for financial and operational management. The objective of this policy was to allow locally owned and operated airports to function in a more commercial and cost-efficient manner, be more responsive to local needs, and be better able to match levels of service to local demands ("National Airports Policy" 2007).

LOCAL AND RESPONSIBLE ECONOMIC PRACTICES

"Sustainable procurement is a process whereby organizations meet their needs for goods, services, works, and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst minimizing damage to the environment ("Procuring the Future…" 2006). Local and environmentally responsible procurement can have a wider range of benefits than immediately apparent; for example, the environmental benefits of using recycled materials and the social benefits of reducing unemployment.

The survey sought to identify specific practices in the following focus areas of economic sustainability:

- Local hiring by airports and tenants.
- Local purchasing by airports and tenants.
- Purchase of goods and services from local and environmentally friendly businesses.

Survey respondents listed the following practices related to local hiring or purchasing at their airports.

Local Hiring

- Attract business by promoting regional assets.
- Contracts have Medium/Women/Disadvantaged Business Enterprise requirements.
- First Source Hiring Program requires tenants and contractors to give the airport impact area (local communities) the first opportunity to fill airport jobs.
- Local job fairs.
- "Means Business Program" helps local small business owners get better access to airport purchasing dollars and share in the revenue the airport generates for the regional economy.
- Preference for local businesses and contractors in public solicitations.
- Airport jobs represent 11% of jobs for the county.

Local and Responsible Purchasing

- Green procurement in place whenever possible and reasonable.
- ISO 14001 EMS gives preference for other ISO businesses.
- Social and environmental sustainability criteria are incorporated in requests for proposals.
- "Business Development Opportunities in Economic Communities" project aims to analyze the territorial impact of purchases made by the major airport principals and make airport-specific purchases more visible.
- Airport purchases services from contractors who use environmentally friendly practices; for example, waste hauling contractors who use alternative fuel vehicles.
- Diversity study identified areas to improve contract opportunities for Medium and Women Business Enterprises.
- City regulations on small business enterprises.

COMMUNITY CONTRIBUTIONS

There is a clear connection between a healthy business and the well-being of the community in which it operates. By contributing to the surrounding community, an organization can:

- Recruit, motivate, and retain employees.
- Use community programs as part of staff training and development.
- Improve its reputation and profile.
- Realize new opportunities by being in touch with the local community.
- Boost networking opportunities with suppliers and customers.
- Improve the bottom line by tackling social issues in the local area (Small Business Journey 2007).

At San Francisco International Airport, an extensive employee donation program raised more than $120,000 in employee contributions in 2004 and 2005 (see Figure 15).

FIGURE 15 San Francisco International Airport employee contribution initiative.

The survey queried respondents about practices at their airport regarding monetary or in-kind contributions to industry, charity, or the community. Respondents listed the following practices related to community contribution:

- Sponsors community projects such as organic farming.
- Provides outreach to affected communities.
- Provides airport job center to help tenants recruit employees and help employees fill out job applications.
- Established a foundation in 2003 to coordinate social sponsorship schemes and pursue structured long-term subsidizing policy—backs projects directly rather than subsidizing the associations behind them.
- Provides job opportunities for summer or short-term employment in neighboring communities.
- Comprehensive corporate support program provides funding to local charities and organizations.
- Office of Employment and Community Partnerships coordinates programs linking welfare-to-work recipients and unemployed and underemployed city residents to airport jobs.
- Student Employment Program offers intern programs to high school and college students and recent master's graduates.
- Supports ACI–NA and participates on all committees.
- Partnered with local universities to establish aviation academies.
- Provides substantial support on an annual basis to charitable and community organizations.
- Participates in ACI–NA and AAAE.
- Makes in-kind contributions to airport community groups.
- Supports local K–12 educational institutions.
- Makes payments in lieu of taxes to local municipalities.
- Speakers bureau presents regularly to community groups and academic institutions.
- Employees participate in giving campaigns.
- Sponsors a cleanup day and contributes substantially to charity.
- Recycles foreign periodicals from international flights to educational institutions teaching foreign languages.
- Participates in community involvement consultations and "one company one job" employment programs.

VALUING SUSTAINABILITY

Economic considerations are fundamental to environmental decision making, because these decisions involve trade-offs between the costs and benefits of protecting or improving environmental quality. Those who have the responsibility for making environmental management decisions must reconcile conflicts among environmental, economic, and social considerations. Economic appraisal ensures that the best option to meet an objective is selected, taking into account costs and benefits, risk and uncertainty, and other policy objectives and constraints (Fisher and McMahon 2003).

Examples of how sustainability practices are quantified at Portland Airport include capital projects required to predict operating and maintenance costs:

Asset management program considers energy costs.

Annual objectives and targets include quantification of nonmonetary benefits.

To understand how airports value sustainability practices, the survey included questions on life-cycle costing, quantifying financial and nonfinancial savings, and forecasting potential future costs. Survey respondents listed the following practices related to quantifying sustainability at their airports:

- All new projects require life-cycle costing before implementation.
- Reductions in CO2 from onsite transportation and carsharing initiatives are quantified.
- Quantifying monetary and nonmonetary benefits is part of every business case and net present value evaluation.
- Every project is reviewed with prudent commercial and life-cycle analyses before approval.
- The 20-year master plan uses a sustainability matrix to assess possible projects.
- Life-cycle cost analysis is performed for all new construction projects.
- Emissions reductions from energy savings are quantified.
- Diverted waste from landfill through waste management initiatives is quantified.
- Water efficiency is quantified as water reductions per passenger.
- The success of wastewater treatment is measured as the percentage improvement above regulated levels.
- Capital projects are required to predict operating and maintenance costs.
- The asset management program considers energy costs.
- Annual objectives and targets include quantification of nonmonetary benefits.

SUSTAINABILITY RESEARCH AND DEVELOPMENT

Sustainability research and development is a way for airports to improve existing, environmental, social, and economic practices, and discover new ones. Research and development can also benefit airports through the implementation of new technologies, processes, and ideas.

> Los Angeles International Airport funds research projects on air quality impacts through the University of Southern California and UCLA. A full-time community benefits coordinator/liaison works with local stakeholders on this project.

The survey queried respondents on the extent to which their airports invest in research and development into environmental, social, and economic sustainability topics. Survey respondents cited the following examples:

- Aircraft emissions measurement, monitoring, and modeling—the airport has its own lab that contributes to research programs such as AIRPUR (an airport emissions measurement project run by the French Aerosace Lab ONERA).
- AERONET—European Commission network on aircraft emission reduction technologies.
- Fund monitoring and conservation programs for endangered species.
- Airport plans to collaborate with state energy and environmental agencies.
- Airport is forming a regional coalition of similar-sized organizations to benchmark each other's sustainability initiatives.

Seventeen of the 25 survey respondents said that their airport does not currently invest in economic or social sustainability research.

INCENTIVES FOR SUSTAINABLE BEHAVIOR

An incentive is something that "incites or has a tendency to incite to determination or action" (Merriam-Webster 2007). By providing incentives, airports can motivate stakeholders to change their behavior and contribute toward successful implementation of sustainability practices. The survey sought to identify any incentives provided by airports to influence the behavior of tenants, employees, and passengers. Respondents listed the following incentives for sustainability practices at their airports.

Financial Incentives

- Emissions and noise charging, separate pricing for low-sound-classified planes.
- Choice of waste disposal contractor made with the aim of encouraging recovery of separated waste materials as much as possible—each tenant can choose number of waste types to separate at the source, and the cost reflects the degree of separation.
- Airport subsidizes public transport buses and bus rapid transit to all terminals.
- Commuter rebate program provides financial incentive to carpool/bus/bike to work.

> Hong Kong International Airport has an annual green office competition for airport staff, as well as an environmental best practice competition among airport business partners (see Figure 16).

FIGURE 16 Sustainability incentives at Hong Kong International Airport.

Non-Financial Incentives

- The Environmental Club aims to raise employee and tenant awareness. During National Week of Sustainable Development the airport developed leaflets to inform stakeholders about good environmental practices.
- Website (accessible by all tenants) created to raise employee and manager awareness.
- Airport has a strong collaboration with public transport companies (bus) to improve public transport network.
- Separate waste receptacles are available in the terminal building for recyclables.

CHAPTER EIGHT

SOCIAL PRACTICES

This section of the survey addressed sustainable practices designed to promote social progress and recognize the needs of all stakeholders. Social sustainability plays an important role in an airport's relationship with its community and region. It aims to improve interactions with all stakeholders, including passengers, employees, airlines, and residents of neighboring areas. The category includes stakeholder relationships, employee practices and procedures, transportation practices, indoor environmental quality, and the well-being of employees and passengers.

Table 13 shows which U.S. and non-U.S. airport respondents identified planned or existing social practices at their airports. (For a detailed list of social sustainability practices reported by survey respondents, see Appendix D.)

SOCIAL SUSTAINABILITY SELF-ASSESSMENT

Participants in the TRB survey were asked to provide an overall rating of the performance of sustainability at their airports with respect to the triple-bottom-line issues of environmental, economic, and social sustainability. Using the management performance scale (see Appendix B), respondents completed a self-assessment on how well they believed their airport was managing environmental, social, and economic sustainability with regard to policies and programs, performance monitoring and reporting, and incentives and awareness. On the management performance scale, 1 represents little or no awareness of the issue and no policies or programs in place; and 5 represents high awareness, accountability and long-term planning, and incentives aligned with performance. Figure 17 shows the results of the survey respondents' self-assessment.

% Respondents	Ratings	1	2	3	4	5
	U.S. Airports					
	Non-Hub (1)		100%			
	Small Hub (2)	50%		50%		
	Medium Hub (4)	50%			25%	
	Large Hub (9)		11%	22%	33%	33%
	Non-U.S. Airports					
	Continental Europe (5)		20%		40%	20%
	Asia (1)		100%			
	United Kingdom (1)			100%		
	Canada (2)		100%			

FIGURE 17 Social sustainability self-assessment of respondents representing U.S. and non-U.S. airports.

TABLE 13

SURVEY RESPONDENTS FROM U.S. AND NON-U.S. AIRPORTS WHO PROVIDED INFORMATION ON SOCIAL PRACTICES AT THEIR AIRPORT

Social Practices	Non-U.S. Airport Respondents	U.S. Airport Respondents			
		Large Hub	Medium Hub	Small Hub	Non-Hub
So1. Public Awareness and Education	☒	☒	☒		
So2. Stakeholder Relationships	☒	☒			
So3. Employee Practices and Procedures	☒	☒	☒		
So4. Sustainable Transportation	☒	☒	☒		
So5. Alleviating Road Congestion	☒	☒	☒		
So6. Accessibility	☒	☒			
So7. Local Identity Culture and Heritage		☒	☒		
So8. Indoor Environmental Quality	☒	☒			
So9. Employee Well-being	☒	☒			
S010. Passenger Well-being	☒	☒	☒		

U.S. Airports

Management of social sustainability practices at the two small hub airports was rated the same as environmental and economic practices (3 and 1). Fifty percent of medium airport respondents rated their airport's social sustainability management at 1, compared with higher assessments for economic and environmental sustainability management. One medium airport respondent did not provide a self-assessment of social sustainability performance. Respondents from large airports rated their airports between 2 and 5, in a similar pattern to their ratings for economic and environmental performance.

Non-U.S. Airports

Respondents from non-U.S. airports generally rated management of social sustainability practices at their airports lower than they rated environmental and economic practices. Only three of five respondents from continental Europe rated their airports at 4 or 5 in this area, compared with four of five for environmental and economic practices. Twenty percent of these respondents rated their airport's performance at 2, and one respondent did not provide any information.

A UK respondent rated social sustainability practices at the airport at 3, the same as environmental practices. The Canadian airports both rated their social sustainability performance at 2, compared with 5 for environmental sustainability and 3 or 4 for economic sustainability.

Respondents justified their ratings with comments such as the following:

- "Noise mitigation and residential purchase program is rated at a 5 level" (large U.S. airport, self-assessment = 5).
- "We do a lot, but program and policy not formalized" (non-U.S. airport, self-assessment = 2).

STAKEHOLDER RELATIONSHIPS

Maintaining good relationships with stakeholders can help airport operators better understand airport impacts, articulate values and strategies, facilitate regulatory approval processes, participate in measurement and reporting, avert or resolve a crisis, and contribute to the local community ("The Importance of Stakeholder Engagement" 2007).

Stakeholder engagement is not unidirectional and linear; rather, it is an interactive and iterative system that feeds into and enriches itself. It is an ongoing process, not an event (Amaeshi and Crane 2005). By considering the needs and interests of stakeholders, airport operators can manage, implement, and continually improve relationships; enhance reputation; and minimize conflict.

The synthesis survey sought to identify airport practices that maintain and enhance relationships with stakeholder groups. Twelve example groups internal and external to the airport were listed to prompt survey respondents. Respondents cited the following practices at their airports.

Community/Neighborhood Groups

- Community programs such as caring for the elderly and organic farming.
- Area advisory committee includes a number of community members and meets each month.
- Bimonthly Noise Roundtable with community members.

Airlines

- Strategic plan undertaken with main airline includes an important chapter on sustainable development.
- Airline operating committee meets monthly with airlines.

Transport Bodies

- Member of and active participant in ACI.

Federal, State/Regional, Local Government

- Regular communication with local government.

Tenants

- Launched Environmental Club to allow airport tenants to voice environmental concerns and make suggestions.

Airport Operator Employees

- Projects can be initiated by the staff or the local community.

Local Businesses

- Regular meetings with groups of business partners.
- Quarterly forums with local businesses.

Passengers

- Customer service office searches for ways to improve services and systems to meet customer needs and desires.
- Customer comment cards with prepaid postage available at convenient locations. Airport director reads all cards and responds weekly.

The Vancouver Airport Authority has demonstrated its commitment to ongoing stakeholder engagement through annual public meetings and reports, airport tours, media interviews, and presentations. Stakeholders are invited to participate in community forums to discuss issues that affect the region, especially noise pollution and environmental management. A comprehensive 20-year master plan is being developed with extensive input from community, industry, and government representatives (see Figure 18).

FIGURE 18 Example of enhancing stakeholder relationships by Vancouver International Airport Authority.

- E-mail system on the airport's website receives complaints; most are responded to the same day. Improvements implemented on the basis of customer comments include family/companion restrooms, wheelchair assistance, free assistance in parking garages for cars with flats/dead batteries/no fuel, designated meeting points to eliminate greeter/traveler confusion, additional seating, dog relief areas for service animals and family pets, foreign language line at information desk, e-mail contact to the lost and found for overseas travelers, and baby changers in all restrooms, including men's.

Other

- Annual corporate responsibility report based on stakeholders, their demands and how the airport has built relationships with stakeholders through its sustainable development strategy.
- The airport is in constant contact with all stakeholders.

EMPLOYEE PRACTICES AND PROCEDURES

A high turnover rate can indicate employee uncertainty and dissatisfaction, or it may signal a fundamental change in the structure of the organization's core operations. The quality of benefits is a key factor in retaining employees ("What Is the Global Reporting Initiative?" 2000–2006).

> The equality label (France) acknowledges equality and professional gender mix in a company and its management. Certification is handled by an internationally recognized organization—AFAQ AFNOR and is based on the company's implemented gender equality policy. A commission composed of management, labor, and government representatives advises AFAQ AFNOR. The label is granted for three years at a time, with an inspection at 18 months to ensure that the company continues to satisfy the labeling criteria ("Equality Label Brochure" 2007).

Airport respondents listed the following employee practices at their airports:

- Endorsed equal opportunity agreement and seeks to achieve the AFAQ AFNOR equality label (see box); introducing paternity leave and intercompany day nurseries; held a seminar on the theme of equal work opportunities as a factor in performance.
- Performance-related pay available only to nonunion employees.
- Airport's Equal Employment Opportunity, Diversity and Training Office promotes employee recognition and development, and sponsors employee appreciation day.
- Employee awards recognize merit, safety, security, length of service, valor, and undertaking exceptional tasks not included in the normal course of duty.
- First aid, cardiopulmonary resuscitation, and automatic external defibrillator training are offered free to all employees—classes are offered on all shifts to accommodate the 24-hour workforce.
- Health and wellness policy incorporates nutrition, exercise, and education to improve health and reduce sick time.
- Active safety committees have resulted in lower injury rates.
- Airport expanded the use of online computer-based training to provide flexibility and promote efficient use of employee time.
- All employees fall under the city's employment guidelines, including the equal opportunity and diversity and retirement programs.
- Airport has an onsite child care facility and subsidizes child care for employees.
- Airport offers performance-related pay and pay benchmarking.
- Airport has a public employee retirement program with fixed benefits.
- Airport has a telecommuting policy.

TRANSPORTATION

Sustainable transport includes all forms of transport that reduce congestion and minimize emissions of carbon dioxide and other pollutants. Kaszewski and Sheate (2004) found that stakeholders overwhelmingly supported a best practice scenario for sustainable airport development that included a "green transportation plan." The UK Department for Transport defines this as reducing traffic congestion and emissions pollution, and developing effective partnerships among businesses, local authorities, and transport operators.

Because this synthesis focuses on airports, the survey question for this topic refers to transportation that is under the influence of the airport operator (i.e., traveling to and

from and within an airport); it does not include sustainable transportation practices by individual airlines. Airports require extensive transportation services, not just for passengers but for employees, tenants, cargo, and associated services. Because of the high traffic, airports are multimodal and can play a major role in influencing regional transportation practices, as well as creating their own alternatives to car travel. Examples of sustainable transportation might include walking or cycling, public transport, car pooling, and alternative or cleaner fueled vehicles.

The survey asked respondents about the extent to which their airport was implementing public transportation and cleaner transportation practices. Respondents cited the following sustainable transportation practices:

Public Transit

- Bus, rail, and ferry transportation.
- New intra-airport passenger train.
- Significant investment ($300 million) into public light rapid transit line to airport.
- Built a train station and bus access.
- Employee rideshare program has received EPA's Gold Medal for the past two years—28% of employees participate.
- Airport provides subsidized van pools.
- Airport offers free public transit passes to employees.

Sky Harbor Airport in Phoenix offers free transportation between the terminals in shuttle buses fueled by CNG. The airport recently opened a Stage & Go cell phone lot where drivers can wait in their vehicles, free of charge, while passengers deplane, pick up their luggage, and walk out to the curb. This eliminates the need to circle the terminals (see Figure 19).

FIGURE 19 Sustainable transportation at Sky Harbor Airport (Phoenix).

Ground services provide an excellent opportunity for alternative fuel vehicles because of their limited range of use, high daily mileage, long idle times, and frequent stops ("Alternative Fuel…" 2001). Survey respondents cited the following practices in place at their airports related to alternative fuel vehicles.

Clean and Alternative Fuel Vehicles

- Clean vehicles—approximately 30% of the vehicles are liquefied petroleum gas or electric.
- Sports facilities with lockers for staff; biking opportunities.
- Airport participates actively in the public debate to implement a new rail link between the city and the airport.
- Parking lot bus fleet is 100% CNG.
- Thirty-three CNG buses with more than 10,000,000 miles traveled.
- CNG stations on airport property.
- Second largest airport-based alternative fuel vehicle (AFV) program in the world—more than 600 AFVs.
- All shuttles have been converted to CNG or biodiesel.

Alleviating Road Congestion

Survey respondents cited the following practices at their airports to reduce road congestion:

- Global Compact best practice car sharing being developed to reduce employees' use of cars; website allows communication about car sharing.
- Commuter rebate program provides financial incentive to carpool/bus/bike to work.
- High-occupancy vehicle (HOV) and airport priority lanes.
- Aggressive HOV goals being met through express bus services and transit to terminals.
- Airport subsidizes "flyaway project," in which passengers park in remote locations, check in (including luggage), and ride an HOV to the airport. Last year more than a million people used the two flyaway locations.
- Airport offers "cell phone lots" to reduce terminal circling.
- Active Transportation Management Association facilitates ride matching, van pooling incentives, and transit subsidies.
- Employees are charged for parking.
- Airport is active in transportation planning to minimize congestion.

Survey respondents cited the following practices related to pedestrian and cycling facilities at their airports.

Pedestrian/Cycling

- Pedestrian walkways and automated people movers.
- Running trail.
- Pedestrian/cycle trails being constructed through the airport land; however, foot and cycle access to terminals is discouraged.
- Zebra crossings and footpaths for access to taxis.
- Bike access to facilities.
- Cycle facilities started, but much more is required.

ACCESSIBILITY

A child, a person with a broken leg, a parent with a baby carriage, an elderly person—all are "disabled" in one way or another. As far as the built-up environment is concerned, it is important that it should be barrier-free and adapted to fill the needs of all people equally. The needs of disabled persons coincide with the needs of the majority, and all people are at ease with them. As such, planning for the majority implies planning for people with varying abilities and disabilities ("Accessibility for the Disabled" 2003–2004). The survey sought to identify airport practices that improve accessibility for disabled or disadvantaged stakeholders.

Disabled Persons

Survey respondents cited the following practices at their airports to improve accessibility:

- Service that lifts a physically impaired person up to the aircraft.
- Accessible toilets, extra-large toilet stalls; nursing rooms and changing tables.
- Handicap accessibility is the law.
- Barrier-free access for people with disabilities is a significant design aspect of airport terminals.

Other Accessibility Issues

Respondents also cited practices related to accessibility for disadvantaged/disabled employees and families:

- Employs 223 disabled persons (2.8% of workforce); committed to increase to 6% to meet statutory requirements.
- In 2005, the airport organized two sessions on the role of disabled people in the organization, highlighting that disability and efficiency are not mutually exclusive.
- Human Resources division has a Disability Mission to provide information and advice in connection with the professional integration of disabled workers.
- Airport offers vehicles at very low cost to employees based on the airport—providing transport to work for people who could not afford it otherwise.
- Airport provides family rooms where parents can care for infants.

> Zurich Airport was the first European airport to implement regulations related to physical and rehabilitation medicine (PRM), which is a recognized medical specialty in all European countries.

Americans with Disabilities Act

- A number of U.S. airport respondents cited practices to comply with the Americans
- with Disabilities Act (ADA):
- All facilities comply with the ADA Standards for Accessible Design and continue to improve access.
- Airport conducted an ADA survey of all facilities and is retrofitting locations where accessibility is limited.
- Airport developed an ADA program.

> The ADA Standards for Accessible Design provide guidelines for accessibility to places of public accommodation and commercial facilities by persons with disabilities. These guidelines are to be applied during the design, construction, and alteration of such buildings and facilities to the extent required by regulations issued by federal agencies, including the Department of Justice, under the Americans with Disabilities Act of 1990 ("Code of Federal Regulation…" 1994, p. 492).

LOCAL IDENTITY, CULTURE, AND HERITAGE

Social sustainability principles emphasize social equity, meeting basic needs, personal development, and responsible citizenship. One measure of social sustainability is the ability to express a sense of identity through heritage, art, and culture ("Guidelines for the Development…" 2001).

Survey respondents from U.S. airports cited the following practices at their airports intended to enhance local identity, culture, and heritage:

- Preserved archeological finds during airport construction.
- Maintain natural coastline of airport island.
- Native American art exhibited throughout the airport.
- Archaeological procedure for all construction ensures that existing sites are protected.
- Built museum of commercial aviation at new international terminal by replicating 1930s terminal—first airport to be accredited by the American Association of Museums.

- Planted native plants and trees throughout the facility.
- Art collection comprises more than 75 pieces by artists of local, national, and international acclaim—in line with the city's percent-for-art ordinance, which requires an art enrichment allocation equivalent to 2% of the construction cost of a new or renovated civic structure.
- Local art program requires that a percentage of all construction projects go to public art—rotating local art exhibit in terminal locations.
- Historical property display in airport.
- Public/local community art at various locations in terminals.
- Airport works with state historical preservation office when archeological sites are found.
- In-terminal museum/educational display about local river history.
- Art on one concourse celebrates the local region by incorporating a map of the river basin into the floor design.

None of the respondents from non-U.S. airports provided information on practices in their airports to enhance local identity, culture, and heritage.

The Phoenix Airport Museum has a collection of more than 500 works of art, as well as gallery spaces for exhibitions. Most art and museum displays are in terminals rather than concourses, so visitors can enjoy them without going through airport security. Some displays are outdoors; all are free and most are accessible 24 hours a day. In 1986, the city of Phoenix passed an ordinance to allocate funding of up to 1% of the city's capital improvement projects for public art. Today, the Phoenix Office of Arts and Culture administers aviation percent-for-art projects in collaboration with the Aviation Department's Phoenix Airport Museum. Historic preservation assessments are also being undertaken for residential purchases near the airport ("Phoenix Sky Harbor…" 2007) (see Figure 20).

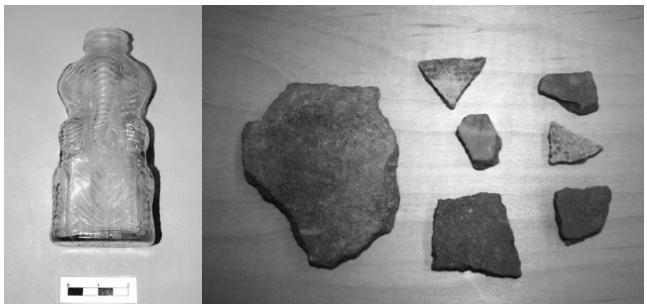

FIGURE 20 Practices for enhancing local culture, identity, and history at Sky Harbor Airport (Phoenix).

INDOOR ENVIRONMENTAL QUALITY

Indoor environmental quality includes air quality, thermal comfort, lighting, and acoustics, and is closely linked to the health and productivity of building occupants. According to the EPA, indoor air is increasingly more polluted than outdoor air, even in the largest and most industrialized cities ("The Inside Story…" 2007).

The survey questioned respondents on the practices in place at their airports to address noise, thermal comfort, lighting, odor, ventilation, and vibration. Respondents from large hub airports and non-U.S. airports identified the following practices related to indoor environmental quality:

- High standard of equipment for staff.
- Thermal comfort is taken into account early in the building studies process with a double goal of energy efficiency and employee comfort.
- The airport is drafting a noise map to identify the areas affected by noise.
- All airport systems meet national and international standards for non-ionizing radiation and have been approved by the relevant authorities; the airport is developing and maintaining an inventory of all installations and systems that emit non-ionizing radiation.
- The airport maximizes the use of sunlight, uses double glazing to reduce noise, and has a computerized program to control indoor temperature and ventilation.
- Low VOC paints are used.
- The Health Safety Section provides training and supplies materials, in-house and external expertise, and resources for employees.
- The preventive maintenance program to maintain HVAC systems includes duct cleaning and high-efficiency air filters.
- The airport monitors recirculating air quality (HVAC) programs.

In Switzerland, emission levels of non-ionizing radiation are regulated by the provisions of the 2000 Ordinance on Protection Against Non-Ionizing Radiation. Non-ionizing radiation comes from the use of radar and wireless data transmission. (Unique 2006).

EMPLOYEE WELL-BEING

Companies succeed by attracting and retaining the best employees. To do this, they must offer attractive pay and benefits packages, provide opportunities for training and

development, and ensure a safe workplace that is free from harassment. Companies that encourage equal opportunities will benefit from the innovation and creativity of a diverse workforce (*Aviation and Climate Change…* 2007). Survey respondents identified the following practices that enhance employee well-being at their airports:

- Sports facilities with lockers for staff; biking opportunities.
- Airport houses an intercompany day nursery.
- Off-airport child care facility for swing-shift workers.
- All airport services can be used by employees.
- Every staff member has Internet access.
- Airport has a staff lounge with gym, television, and multifunction rooms.
- Golf course.
- Banks, shops, post office.
- Chapel.
- Police stations.
- Planters and open green space.
- Fire station has a gym.
- Meditation rooms.
- Airport is planning a fitness club in the terminal in the next five years.
- Two areas for massage.
- On-airport child care center and subsidized employee child care.

Airports can realize numerous benefits from employee satisfaction. By providing fair and equitable employee benefits related to pay, training, career development, and health and well-being, employers can ensure a happy and productive workforce, which will result in a successful and efficient business.

PASSENGER WELL-BEING

Employee satisfaction plays a crucial role in customer satisfaction, particularly with today's increased dwell times and heightened passenger sensitivity (D'Andrea 2002–2003). Survey respondents identified the following practices to enhance passenger well-being at their airports:

- Internet access.
- Golf course.
- Banks, shops, post office.
- Chapel.
- Planters and open green space.
- Park and nature trail near airport.
- Full-service Bank of America branch.
- More than 70 retail outlets.
- Main post office.
- Quiet rooms.
- Airport hotel being planned.
- Wi-fi Internet access.
- Spa facility in the terminal.
- Internet access in most terminals.
- Meditation rooms.
- Child play areas in terminal concourses.
- Dog walking park.
- Airport is planning a fitness club in the terminal in the next five years.
- Two areas for massage.

The 2,000-square-foot Plaza Shower and Relaxation Lounge at the Hong Kong International Airport includes eight shower rooms, two hair blow-dry rooms, and nine semi-private rooms for napping ("Hong Kong International Airport Passenger Guide 2007).

CHAPTER NINE

CONCLUSIONS

The survey revealed that U.S. and non-U.S. airports are implementing a number of initiatives that fit within the definition of sustainability practices.

Survey respondents cited regulations and airport policy as the key drivers for sustainability practices today; they expect stakeholder concerns and global issues such as climate change to be the key drivers in the future. Respondents from large and medium U.S. airports identified energy efficiency, carbon emission reductions, and green building practices as key focus areas for the next five years. Respondents from small and non-hub U.S. airports identified other priorities for the future related to economic growth and self-sufficiency. Respondents in Europe cited noise, aesthetics, and sustainable transportation practices as key focus areas going forward; respondents from Asia and Canada mentioned corporate social responsibility and strategic environmental management at the governance level.

For both U.S. and non-U.S. airports, funding was the number one barrier to the implementation of sustainability practices. Other barriers were lack of staffing and management support, and the absence of an environmental culture in their airport organization.

Most respondents said that environmental training is offered at their airport; fewer respondents said that economic and social sustainability training is offered.

Environmental public reporting—either as part of an annual report or in a separate document—is common. Few respondents said that their airport reported environmental, social, and economic performance together. Only four respondents (three continental European and one Canadian) said that their airport uses the Global Reporting Initiative guidelines for sustainability performance.

Most respondents from large U.S. airports and non-U.S. airports gave their environmental performance a high rating. In the United States, medium and non-hub airports rated their environmental performance lower, and small airports rated their performance lowest of all.

The survey reveals a focus on climate change, land use, water, waste, energy, and noise issues by airports. Respondents from both U.S. and non-U.S. airports said that regulations were responsible for many of the environmental practices they are implementing.

Economic sustainability practices focused more on community contributions than on sustainable procurement or investment in research and development.

Social practices in place at airports include public awareness and education, stakeholder relationships, employee practices and procedures, sustainable transportation initiatives, alleviating road congestion, ensuring accessibility, local culture and heritage, indoor environmental quality, and employee and passenger well-being. Frequently cited social practices at U.S. and non-U.S. airports included employee practices and procedures, sustainable transportation initiatives, and measures to alleviate road congestion. Measures to enhance local identity, culture, and heritage; indoor environmental quality; and employee well-being were less prevalent.

Overall, the airport industry appears to be moving toward more holistic sustainability approaches to their organizations and operations. Most emphasis is on environmental initiatives, but increasingly social and economic practices are being viewed as equally important and prioritized as highly as environmental practices. Funding is a challenge for sustainability practices, but drivers such as climate change are prompting airports to invest in managing these risks to their operations, business, and stakeholders over the long term.

Suggestions for additional research and actions include:

- Use the survey results to create sustainability guidelines for airports.
- Research the three sustainability areas (environmental, economic, and social) separately and in depth.
- Ensure that governance of sustainability practices at airports targets developing a business plan and strategy for implementation.
- Partner with the Global Reporting Initiative to develop an airport sector supplement of the G3 guidelines.
- Query the airports further on their practices and create a best practice sustainability in airports document with details on where, when, how, and why airports have implemented various practices.

- Define the business case for sustainability practices.
- Link planning and capital budgeting—determine why funding was identified as the key barrier to implementation.
- Research sustainability training in airports—internal versus external training and opportunities for external training for employees.
- Research incentives for sustainability and the success of certain practices, including analysis of incentive types and delivery methods.
- Survey the 12 stakeholders/user groups on their perceptions of sustainability at airports and compare with the airports' perceptions.
- Explore opportunities for airlines and airports to form joint interactions that promote sustainability.
- Provide incentives for tenants and customers for sustainability practices at airports.
- Determine how airports are implementing life-cycle costing for sustainability practices; identify savings/avoided costs and cost-effectiveness (or individual sustainability practices).

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TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Airport Sustainability Practices Survey

INTRODUCTION

Objective

This survey has been developed on behalf of the Transportation Research Board (TRB). TRB is a division of the United States National Research Council, which serves as an independent adviser to the federal government and others on scientific and technical questions of national importance. This survey is part of oa research project conducted by TRB into airport sustainability practices.

The objective of this survey is to collect information on sustainability practices implemented at a variety of US and international airports.

In helping the aviation industry work towards developing a framework for sustainability, TRB has identified a number of information gaps. The purpose of this survey is to help TRB develop a better understanding of the issues that affect the sustainability performance of airports and identify barriers to the achievement of sustainable airport practices.

Survey Results

The results of the survey will be collated and developed into a research report outlining response rates, performance levels and highlighted examples of best practice airport sustainability initiatives.

Access to Research Report
All of the survey respondents will receive a copy of the research report once the project is complete.

Confidentiality
All answers provided by survey respondents will be treated as confidential. The name of participating airports and specific respondants will not be disclosed in the research report.

Sustainability Practices

'Sustainability practices' is a broad term that encompasses a large number, and wide variety, of practices currently implemented at airports. For the purposes of this study, 'sustainability practices' have been defined as those airport practices or initiatives which have been implemented for the purpose of supporting one or more of the following components of sustainable development:

1. Protection of the environment, including conservation of natural resources;
2. Social progress that recognizes the needs of all stakeholders;
3. Maintenance of high and stable levels of economic growth and employment.

The three components of sustainable development listed above are often referred to as the environmental, social and economic 'triple-bottom line'.

In recent years, there has been a dramatic increase in interest in the concept of 'sustainability' and adoption of the triple-bottom line approach by businesses and organizations worldwide. The aviation industry is now also beginning to recognize the importance of sustainability to its operations and has begun implementing initiatives to improve its triple-bottom line.

Survey Content

The survey has been organized into 5 sections as follows:

1. General Information

2. Organizational Governance

3. Existing Sustainability Initiatives

3.1. ENVIRONMENTAL Sustainability
- Managing Environmental Sustainability
- Implementation of Environmental Sustainability Initiatives

3.2. ECONOMIC Sustainability
- Managing Economic Sustainability
- Implementation of Economic Sustainability Initiatives

3.3. SOCIAL Sustainability
- Managing Social Sustainability
- Implementation of Social Sustainability Initiatives

4. Other Initiatives and Barriers

5. Future Sustainability Priorities

Completing the Survey

Survey Duration

The survey should take approximately 30 minutes-1 hour to complete. This may vary with the amount of information provided by the respondent on their airports sustainability initiatives.

Survey Respondent
Ideally, the survey should be completed by the person who is responsible for implementing sustainability initiatives for the airport. If no such person exists, the survey should be completed by the most appropriate person who is able to provide information on the topics addressed by the survey.

User ID and Password
Each respondent has been provided with a unique User ID and Password to access the survey. This ensures that the respondent has specific access to the survey they are completing. The User ID and Password can be passed on if necessary to allow others access to the same survey.

Entering and Re-entering the Survey
If respondents are unable to complete the survey in one sitting, they can exit the survey by simply closing the browser window. This will save the responses. Respondents can then re-enter the survey at a later time using the User ID and Password and a browser window will open at to the point where the last question was completed ready to continue the survey.

Viewing Survey Responses
Respondents can select the "Previous Page" and "Next Page" buttons at the bottom of each page to navigate to previous or future responses. Please note - once the "Submit Survey" button on the final page has been clicked, respondents will be unable to view responses, return to the survey or submit a second survey.

Progress Bar
A progress bar is displayed beside the "Next Page" and "Previous Page" buttons at the bottom of each page. This bar will show the percentage of the survey which is complete as respondents progress through the survey.

Performance Scale

In order to make the response process simple and timely, a “self assessment” approach has been adopted for the majority of questions in this survey. This allows the respondent to choose a pre-determined performance level for their airport.

Management Performance Scale
In order to determine each airport's performance level for the three triple bottom line issues of environmental, social and economic sustainability, the respondent can select from five criteria on a management performance scale. This scale describes varying degrees of management for sustainability issues as follows:

	1	2	3	4	5
Program and Policies	No formal policy or program in place.	Limited program or policy in place to address issues.	Policy or program is well-developed and reflects good practice.	Policy or program embedded in airport operations and reflects best practice.	Industry-leading policy or program. Long-term planning horizon.
Performance Monitoring and Reporting	Risks have not been assessed and performance is not monitored.	Risks have been assessed and a baseline established. No on-going monitoring of performance.	Goals and targets established. Performance is monitored but is not reported either internal or external to the organization.	Continuous monitoring of performance against goals and targets that are updated regularly. Performance is reported internally within the organization.	Includes mechanism for continuous performance improvements. Performance goals aligned with strategic planning / corporate-level goals and targets. Performance is reported externally to stakeholders and general public.
Incentives and awareness	Issue not on radar screen, relevancy to the organization undetermined. No budget allocation for activity.	Problems identified. Stakeholders take the lead in raising issue. Limited budget allocation for managing issue.	Some awareness of issue inside organization. Policy or program is communicated and enforced. Funding allocation to manage issue established on annual basis.	Strong internal awareness, recognition and understanding of issue. Investment deemed a priority.	Feedback loops in place, continuous surveying of stakeholders. Performance goals incentivized.

This scale will be displayed throughout the survey for the respondent to refer to when completing their responses. It is also recommended to print a hardcopy of this scale now for reference. Simply right click anywhere on this page and select "Print".

Implementation Performance Scale
In order to gather information on specific airport sustainability initiatives, a series of sub-topics have been developed under the three areas of environmental, social and economic sustainability. For example "water" is a sub-topic in the environmental sustainability section and "stakeholder relationships" is a sub-topic in the social sustainability section.

The respondent will be provided with an implementation performance scale in a matrix question. This allows the respondant to select which level of implementation their airport has acheived for each of the sub-topics. The implementation performance levels are as follows:

- Not Applicable: The sub-topic does not apply to the respondents particular airport.
- Planned: No sustainability initiatives in place for the sub-topic at present, however there are plans for initiatives to be implemented in the future.
- In Place: There are initiatives being actively implemented and managed for the sub-topic.

No Implementation: If the airport is not addressing the sub-topic, we request that none of the implementation levels be ticked or marked.

Capturing Best Practice

A key objective of the research project is to capture examples of airport sustainability best practice initiatives. Following the implementation scale for each sub-topic, the respondent is provided with a text box to document those "In Place" sustainability initiatives of which their airport is particularly proud.

Please provide detail for each initiative on a separate line within the text box and ensure that the initiatives are specifically related to the sub-topic being addressed. While upfront text is preferred, additional web links or details on where to find resources will also be accepted (such as links to reports published by your airport).

Next Page 3%

TRANSPORTATION RESEARCH BOARD
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Airport Sustainability Practices Survey

1. GENERAL INFORMATION

1.1 Respondent Profile

Name and Contact Details:

Owner/Constitution of the Airport:

Name of Key Respondent:

Title/Position of Respondent:

Telephone Number: Include country code & area code

Email Address:

Annual Number of Passengers:

- <5M
- 5M-15M
- 15M-25M
- 25M-35M
- >35M

Traffic Sectors:

Select One

Annual Number of Aircraft Movements:

- <100 000
- 100 000 - 200 000
- 200 000 - 300 000
- 300 000 - 400 000
- > 400 000

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Airport Sustainability Practices Survey

1.2 Expenditure and Employment

Annual expenditure on non-regulatory/compulsory initiatives to improve your airport's performance with regard to environmental protection, contribution to the local economy, community relations or efficient use of natural resources:

- ◯ $0 - $10 000
- ◯ $10 000 - $50 000
- ◯ $50 000 - $250 000
- ◯ $250 000 - $1M
- ◯ $1M+

Number of employees at the airport who are directly employed by the airport operator (ie: are paid directly by the airport operator):

- ◯ <5000
- ◯ 5000 - 10 000
- ◯ 10 000 - 15 000
- ◯ >15 000

Number of employees at the airport who are employed by the airport tenants, airlines or transport providers:

- ◯ <5000
- ◯ 5000 - 10 000
- ◯ 10 000 - 15 000
- ◯ >15 000

Total square feet of retail area in your airport:

- ◯ <100 000
- ◯ 100 000 - 250 000
- ◯ 250 000 - 500 000
- ◯ >500 000

Major tenants/leasees who reside in your airport (tick all that apply):

- [ ] Food and Beverage
- [ ] Retail
- [ ] Car Rental Agencies
- [ ] Hotel or Accommodation
- [ ] Freight or Distribution
- [ ] Fuel Station Operators
- [ ] Plane Maintenance Services
- [ ] Tourist Information Services
- [ ] Other (please specify)

If you selected other, please specify:

Previous Page Next Page 8%

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Airport Sustainability Practices Survey

2. ORGANIZATIONAL GOVERNANCE

2.1 Responsibility for Sustainability Initiatives

Is there one person with overall responsibility for sustainability issues at your airport?

◯ One Person ◯ More than one person

Please provide details of up to 3 key people in your organization who are responsible for sustainability issues?

Name:
Title:
Reports directly to CEO (Y/N)?
Reports to Other Management (Y/N)?

Name:
Title:
Reports directly to CEO (Y/N)?
Reports to Other Management (Y/N)?

Name:
Title:
Reports directly to CEO (Y/N)?
Reports to Other Management (Y/N)?

Previous Page Next Page 10%

Airport Sustainability Practices Survey

2.2 Reporting and Policies

Does your organization publicly report on performance for any of the following issues?

	As Part of Annual Report	As Separate Report	Use Global Reporting Initiative (GRI) Guidelines
Protection of the environment, including conservation of natural resources	☐	☐	☐
Social progress that recognizes the needs of all stakeholders	☐	☐	☐
Maintenance of high and stable levels of economic growth and employment	☐	☐	☐

Additional comments:

Please list any sustainability groups your organization is a member of (eg: World Business Council for Sustainable Development, UK Sustainable Aviation Initiative):

Does your organization provide training for staff on any of the following issues?

- ☐ Protection of the environment, including conservation of natural resources
- ☐ Social progress that recognizes the needs of all stakeholders
- ☐ Maintenance of high and stable levels of economic growth and employment
- ☐ Other (please specify)

If you selected other, please specify:

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Airport Sustainability Practices Survey

3. EXISTING SUSTAINABILITY INTIATIVES

3.1 Drivers

Please rank the top five (5) drivers of your EXISTING sustainability initiatives:

1) Select One
2) Select One
3) Select One
4) Select One
5) Select One

Previous Page Next Page 15%

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Airport Sustainability Practices Survey

3.2 ENVIRONMENTAL Sustainability

Managing Environmental Sustainability

	1	2	3	4	5
Program and Policies	No formal policy or program in place.	Limited program or policy in place to address issues.	Policy or program is well-developed and reflects good practice.	Policy or program embedded in airport operations and reflects best practice.	Industry-leading policy or program. Long-term planning horizon.
Performance Monitoring and Reporting	Risks have not been assessed and performance is not monitored.	Risks have been assessed and a baseline established. No on-going monitoring of performance.	Goals and targets established. Performance is monitored but is not reported either internal or external to the organization.	Continuous monitoring of performance against goals and targets that are updated regularly. Performance is reported internally within the organization.	Includes mechanism for continuous performance improvements. Performance goals aligned with strategic planning / corporate-level goals and targets. Performance is reported externally to stakeholders and general public.
Incentives and awareness	Issue not on radar screen, relevancy to the organization undetermined. No budget allocation for activity.	Problems identified. Stakeholders take the lead in raising issue. Limited budget allocation for managing issue.	Some awareness of issue inside organization. Policy or program is communicated and enforced. Funding allocation to manage issue established on annual basis.	Strong internal awareness, recognition and understanding of issue. Investment deemed a priority.	Feedback loops in place, continuous surveying of stakeholders. Performance goals incentivized.

To what extent is your airport managing ENVIRONMENTAL sustainability ie: protection of the environment, including conservation of natural resources?

1 2 3 4 5

Additional comments:

Previous Page Next Page 18%

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Airport Sustainability Practices Survey

Implementation of Environmental Sustainability Initiatives

EN1. MEASURING AND MONITORING

Does your organization implement environmental/ sustainability performance monitoring using any of the following methods:

- ☐ Environmental Management System (EMS) certified to ISO14001
- ☐ Environmental Management System (EMS) uncertified
- ☐ Eco-Management & Audit Scheme (EMAS)
- ☐ Sustainability Management System (SMS)
- ☐ Other (please specify)

If you selected other, please specify:

Previous Page Next Page 21%

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Airport Sustainability Practices Survey

EN2. WATER CONSERVATION

To what extent is your airport conserving water through initiatives associated with:

	Not Applicable	Planned	In Place
Increasing Potable Water Efficiency?	○	○	○
Collecting and Reusing Greywater (ie: wastewater from kitchen, laundry and bathroom basins)?	○	○	○
Collecting and Reusing Rainwater or Stormwater?	○	○	○
Reducing Irrigation Water Demand (eg: use of native/indigenous species)?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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EN3. WATER QUALITY

To what extent is your airport ensuring protection of watersheds and water quality through:

	Not Applicable	Planned	In Place
Collecting and treating stormwater on-site eg: detention ponds, sand filtration?	○	○	○
Collecting and treating wastewater/sewage on-site?	○	○	○
Controlling polluting processes eg: refuelling practices, deicing practices?	○	○	○
Minimizing Flood Risk (eg: porous paving, swales)?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 26%

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EN4. CLIMATE CHANGE

To what extent is your airport seeking to reduce its impact upon the global climate through initiatives to:

	Not Applicable	Planned	In Place
Demonstrate Industry Leadership eg: partnerships, research, Voluntary Low Emissions Program	○	○	○
Reduce Emissions from Aircraft on Ground eg: reducing taxiing and engines on standby	○	○	○
Reduce Emissions from Aircraft in Air eg: influencing descent or stacking patterns	○	○	○
Reduce Emissions from Airport Ground Vehicles eg: purchasing electric luggage or food trucks	○	○	○
Reduce Emissions from Passenger Surface Access Traffic eg: subsidizing public transit for passengers	○	○	○
Monitor and Manage Greenhouse Gas Emissions associated with airport operations	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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EN5. AIR QUALITY

To what extent is your airport maintaining and improving air quality through initiatives to:

	Not Applicable	Planned	In Place
Monitor Air Quality	○	○	○
Manage Air Quality	○	○	○
Demonstrate Industry Leadership	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 31%

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EN6. LAND USE

To what extent is your airport ensuring sustainable use of land through initiatives to:

	Not Applicable	Planned	In Place
Avoid and/or Remediate Contaminated Land	○	○	○
Long Term Strategic Sustainable Land Use Planning (eg: maximise brownfield/minimise greenfield development)?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 33%

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EN7. BIODIVERSITY

To what extent is your airport enhancing biodiversity/ conserving wildlife through:

	Not Applicable	Planned	In Place
Implementing programs within the airport boundary (eg: setting aside areas for nature conservation)?	○	○	○
Implementing programs ouside of the airport boundary (eg: ownership and maintenance of land away from the airport for nature conservation purposes)?	○	○	○
Partnerships with non-governmental organizations or wildlife organizations?	○	○	○
Programs for bird control which use non-lethal techniques?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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EN8. MATERIALS

To what extent is your airport actively selecting sustainable materials such as:

	Not Applicable	Planned	In Place
Renewable Resources (eg: timber instead of concrete)?	○	○	○
Environmentally-sensitive materials (eg: biodegradable, non-toxic)?	○	○	○
Socially-responsible materials (eg: fair trade, organic)?	○	○	○
Materials with high recycled content?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 38%

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EN9. WASTE

To what extent is your airport implementing waste management initiatives to:

	Not Applicable	Planned	In Place
Reduce, reuse or recycle waste from administrative areas eg: paper recycling?	○	○	○
Reduce, reuse or recycle waste from terminal areas eg: prohibiting food outlets from using disposable plates/cutlery?	○	○	○
Reduce, reuse or recycle waste from planes eg: minimising packaging from food/beverage services	○	○	○
Gain value from waste eg: composting, waste to energy?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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EN10. NOISE AND AESTHETICS

To what extent is your airport reducing and mitigating aesthetic and/or noise impacts through initiatives to:

	Not Applicable	Planned	In Place
Reduce noise from airborne planes eg: influencing descent patterns?	○	○	○
Reduce noise from ground bourne planes eg: altering taxiing/take off patterns, installing triple glazing etc?	○	○	○
Reduce negative aesthetic impacts for neighbouring properties or key viewpoints?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 44%

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EN11. ENERGY

To what extent is your airport reducing energy use through initiatives to:

	Not Applicable	Planned	In Place
Improve energy efficiency eg: installing efficient lighting/equipment?	○	○	○
Utilize low carbon energy sources eg: LPG, biofuels?	○	○	○
Utilize zero carbon energy sources eg: photovoltaics, solar thermal heating?	○	○	○
Implement green building principles eg: insulation?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 46%

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EN12. GREEN BUILDINGS

To what extent is your airport seeking to achieve green building certification (eg: LEED, BREEAM, HKBEAM, Green Star) of:

	Not Applicable	Planned	In Place
Existing Buildings?	○	○	○
Renovations or Retrofits?	○	○	○
New Buildings?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 49%

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Airport Sustainability Practices Survey

3.3 ECONOMIC Sustainability

Managing Economic Sustainability

	1	2	3	4	5
Program and Policies	No formal policy or program in place.	Limited program or policy in place to address issues.	Policy or program is well-developed and reflects good practice.	Policy or program embedded in airport operations and reflects best practice.	Industry-leading policy or program. Long-term planning horizon.
Performance Monitoring and Reporting	Risks have not been assessed and performance is not monitored.	Risks have been assessed and a baseline established. No on-going monitoring of performance.	Goals and targets established. Performance is monitored but is not reported either internal or external to the organization.	Continuous monitoring of performance against goals and targets that are updated regularly. Performance is reported internally within the organization.	Includes mechanism for continuous performance improvements. Performance goals aligned with strategic planning / corporate-level goals and targets. Performance is reported externally to stakeholders and general public.
Incentives and awareness	Issue not on radar screen, relevancy to the organization undetermined. No budget allocation for activity.	Problems identified. Stakeholders take the lead in raising issue. Limited budget allocation for managing issue.	Some awareness of issue inside organization. Policy or program is communicated and enforced. Funding allocation to manage issue established on annual basis.	Strong internal awareness, recognition and understanding of issue. Investment deemed a priority.	Feedback loops in place, continuous surveying of stakeholders. Performance goals incentivized.

To what extent is your airport managing ECONOMIC sustainability ie: maintenance of high and stable levels of economic growth and employment?

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Additional comments:

Previous Page Next Page 51%

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Airport Sustainability Practices Survey

Implementing Economic Sustainability Initiatives

EC1. HIRING AND PURCHASING

To what extent is your airport maximizing economic sustainability through initiatives to support:

	Not Applicable	Planned	In Place
Local hiring by your organization or airport?	☐	☐	☐
Local hiring by tenants?	☐	☐	☐
Local purchasing by your organization or airport?	☐	☐	☐
Local purchasing by tenants?	☐	☐	☐
Purchasing goods or services from businesses who adopt environmentally-friendly practices?	☐	☐	☐
Purchase goods or services from small or disadvantaged businesses?	☐	☐	☐

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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EC2. COMMUNITY CONTRIBUTIONS

To what extent is your airport providing monetary or in-kind support to the following groups:

	Not Applicable	Planned	In Place
Industry groups eg: UK Sustainable Aviation Initiative	○	○	○
Academic Institutions?	○	○	○
Charitable Organizations?	○	○	○
Community Organizations?	○	○	○
Other? (please provide detail below)	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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EC3. QUANTIFYING SUSTAINABILITY

To what extent is your airport quantifying the value of sustainability initiatives by:

	Not Applicable	Planned	In Place
Considering life cycle costs?	○	○	○
Quantifying monetary savings eg: reduced energy bills from implementing energy initiatives?	○	○	○
Undertaking strategic long term planning with sustainability scenarios in mind eg: insurance costs due to climate change impacts?	○	○	○
Linking capital and operational/maintenance budgets?	○	○	○
Quantifying non-monetary benefits eg: tonnes of CO2 emissions avoided from implementing energy efficiency measures?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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EC4. CONTRIBUTION TO RESEARCH AND DEVELOPMENT

To what extent is your airport investing in or supporting Research and Development and Innovation which contributes towards:

	Not Applicable	Planned	In Place
Protection of the environment, including conservation of natural resources	○	○	○
Social progress that recognizes the needs of all stakeholders	○	○	○
Maintenance of high and stable levels of economic growth and employment	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 62%

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EC5. INCENTIVIZING SUSTAINABLE BEHAVIOR

To what extent is your airport providing incentives to encourage adoption of sustainable behavior by:

	Not Applicable	Planned	In Place
Staff of the airport operator eg: awareness and training on environmental issues such as water/energy?	○	○	○
Tenants and their employees eg: incentivising public transport use?	○	○	○
Passengers eg: encouraging separation and recycling of waste?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 64%

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Airport Sustainability Practices Survey

3.4 SOCIAL Sustainability

Managing Social Sustainability

	1	2	3	4	5
Program and Policies	No formal policy or program in place.	Limited program or policy in place to address issues.	Policy or program is well-developed and reflects good practice.	Policy or program embedded in airport operations and reflects best practice.	Industry-leading policy or program. Long-term planning horizon.
Performance Monitoring and Reporting	Risks have not been assessed and performance is not monitored.	Risks have been assessed and a baseline established. No on-going monitoring of performance.	Goals and targets established. Performance is monitored but is not reported either internal or external to the organization.	Continuous monitoring of performance against goals and targets that are updated regularly. Performance is reported internally within the organization.	Includes mechanism for continuous performance improvements. Performance goals aligned with strategic planning / corporate-level goals and targets. Performance is reported externally to stakeholders and general public.
Incentives and awareness	Issue not on radar screen, relevancy to the organization undetermined. No budget allocation for activity.	Problems identified. Stakeholders take the lead in raising issue. Limited budget allocation for managing issue.	Some awareness of issue inside organization. Policy or program is communicated and enforced. Funding allocation to manage issue established on annual basis.	Strong internal awareness, recognition and understanding of issue. Investment deemed a priority.	Feedback loops in place, continuous surveying of stakeholders. Performance goals incentivized.

To what extent is your airport managing SOCIAL sustainability ie: social progress that recognizes the needs of all stakeholders?

1 2 3 4 5

Additional comments:

Previous Page Next Page 67%

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Airport Sustainability Practices Survey

Implementing Social Sustainability Initiatives

SO1. PUBLIC AWARENESS AND EDUCATION

To what extent is your airport raising public awareness and education of:

	Not Applicable	Planned	In Place
Protection of the environment, including conservation of natural resources	○	○	○
Social progress that recognizes the needs of all stakeholders	○	○	○
Maintenance of high and stable levels of economic growth and employment	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 69%

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SO2. STAKEHOLDER RELATIONSHIPS

To what extent is your airport maintaining and enhancing relationships with the following stakeholders:

	Not Applicable	Planned	In Place
Community/ Neighbourhood Groups	○	○	○
Airlines	○	○	○
Transport Bodies (eg: American Institute of Aeronautics and Astronautics)	○	○	○
Non-Governmental Organizations (eg: PARTNER - Partnership for Air Transportation Noise and Emissions Reduction)	○	○	○
Federal/National Government	○	○	○
State/Regional Government	○	○	○
Local Government	○	○	○
Tenants	○	○	○
Employee Unions	○	○	○
Employees employed by the airport operator	○	○	○
Employees employed by airlines/tenants	○	○	○
Local Businesses	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

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SO3. EMPLOYEE PRACTICES AND PROCEDURES

To what extent is your airport addressing employee practices and procedures such as:

	Not Applicable	Planned	In Place
Equal Opportunities and Diversity	○	○	○
General Training	○	○	○
Job-Specific Training	○	○	○
Career Development	○	○	○
Pay and Benefits eg: pay benchmarking, performance-related pay, vacation, sick leave, pensions	○	○	○
Job Flexibility eg: full time, part time, casual	○	○	○
Health and Wellness eg: providing sport facilities, supporting employee sport programs	○	○	○
Support for Families eg: childcare	○	○	○
Retirement Plans or Programs	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 74%

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SO4. SUSTAINABLE TRANSPORTATION

To what extent is your airport supporting sustainable transportation through initiatives to:

	Not Applicable	Planned	In Place
Enhance Pedestrian Access eg: safe, accessible footpaths, zebra crossings?	○	○	○
Enhance Cyclist Access and Facilities eg: bike paths, locked/secure storage, showers?	○	○	○
Support Public Transport eg: shuttle bus, rail link?	○	○	○
Implement Clean Transport Technologies eg: converting vehicles to alternative fuels	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 77%

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SO5. ALLIEVIATING ROAD CONGESTION

To what extent is your airport helping to allieviate road congestion through initiatives to:

	Not Applicable	Planned	In Place
Reduce car journeys by employees working at the airport eg: charge parking?	○	○	○
Reduce car journeys by passengers using the airport eg: high-occupancy lanes	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 79%

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SO6. ACCESSIBILITY

To what extent is your airport maximizing accessibility for all passengers within and to your airport terminal(s) through initiatives to:

	Not Applicable	Planned	In Place
Enhance accessibility for physically impaired persons eg: disabled toilet facilities, ramps, signage for visually impaired?	○	○	○
Enhance accessibility for families (eg: accessibility for prams/strollers)	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 82%

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SO7. LOCAL IDENTITY, CULTURE AND HERITAGE

To what extent is your airport enhancing local identity, culture and heritage through initiatives to:

	Not Applicable	Planned	In Place
Acknowledge and celebrate indigenous sites?	○	○	○
Acknowledge and celebrate local historical sites?	○	○	○
Create or enhance local identity eg: native landscaping, public art which reflects local history	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 85%

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SO8. INDOOR ENVIRONMENTAL QUALITY

To what extent is your airport actively managing indoor environmental quality through initiatives to address:

	Not Applicable	Planned	In Place
Lighting?	○	○	○
Ventilation?	○	○	○
Noise?	○	○	○
Thermal Comfort?	○	○	○
Odor?	○	○	○
Vibration?	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 87%

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SO9. EMPLOYEE WELLBEING

To what extent does your airport provide a variety of facility types to enhance well being for employees such as:

	Not Applicable	Planned	In Place
Accessible Open and/or Green Space?	○	○	○
Essential Services eg: banks, shops, post office, places of worship, meditation rooms?	○	○	○
Support Facilities eg: childcare, internet access?	○	○	○
Leisure or Recreation facilities eg: sport facilities or social spaces	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 90%

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SO10. PASSENGER WELLBEING

To what extent does your airport provide a variety of facility types to enhance well being for passengers such as:

	Not Applicable	Planned	In Place
Accessible Open and/or Green Space?	○	○	○
Essential Services eg: banks, shops, post office, places of worship, meditation rooms?	○	○	○
Support Facilities eg: childcare, sleeping facilities, showers, internet access?	○	○	○
Leisure or Recreation facilities eg: wellness or spa facilities	○	○	○

If you have selected "In Place" for any of the above sub-topics, please provide further detail of any best practice initiatives of which your airport is particularly proud.

Previous Page Next Page 92%

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4. OTHER INITIATIVES AND BARRIERS

4.1 Other Sustainability Initiatives

If there are any other sustainability initiatives that are being implemented at your airport that have not been captured by this survey, please list them in the below space:

4.2 Barriers to Sustainability Initiatives

Please list three barriers to implementing environmental, economic or social sustainability initiatives for your airport (eg: lack of funding, lack of support from management, time, corporate/contractual agreements, technology):

1
2
3

Previous Page Next Page 95%

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5. FUTURE SUSTAINABILITY PRIORITIES

5.1 Future Priorities

Please list three sustainability priorities (environmental, economic or social) for your airport in the next 5 years:

1
2
3

5.2 Drivers

Please rank the top five (5) drivers of your FUTURE sustainability initiatives:

1) Select One
2) Select One
3) Select One
4) Select One
5) Select One

Previous Page Next Page 97%

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Airport Sustainability Practices Survey

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY.

If you have any questions about the results of this survey or future stages of the project, please contact:

Gail R. Staba
Keck Center of the National Academies
Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001
USA
GStaba@nas.edu
Ph: 1 202 334 2116

PLEASE CLICK ON THE 'SUBMIT SURVEY' BUTTON NOW.

Previous Page Submit Survey 100%

APPENDIX B

MANAGEMENT PERFORMANCE SCALE

	1	2	3	4	5
Program and Policies	No formal policy or program in place.	Limited Program or policy in place to address issues.	Policy or programs are well-developed and reflects good practice	Policy or program embedded in airport operations and reflects best practice.	Industry-leading policy or program. Long-term planning horizon.
Performance Monitoring and Reporting	Risks have not been assessed and performance is not monitored.	Risks have been assessed and a baseline established. No on-going monitoring of performance.	Goals and targets established. Performance is monitored but is not reported either internal or external to the organizations.	Continuous monitoring of performance against goals and targets that are updated regularly. Performance is reported internally within the organization.	Includes mechanism for continuous performance improvements. Performance goals aligned with strategic planning/corporate level goals and targets. Performance is reported externally to stakeholders and general public.
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APPENDIX C

LIST OF 25 AIRPORTS RESPONDING TO SURVEY

U.S. AIRPORTS RESPONDING TO SURVEY
NAME OF AIRPORT CITY STATE OWNER/ CONSTITUTION OF THE AIRPORT

LARGE HUB

- San Francisco International Airport/San Francisco, California/San Francisco International Airport
- Los Angeles International Airport/Los Angeles, California/City of Los Angeles
- Denver International Airport/Denver, Colorado/ City and County of Denver
- Sky Harbor Airport/Phoenix, Arizona/City of Phoenix Aviation Department
- Tampa International Airport/Tampa, Florida/TPA Aviation Authority
- Salt Lake City International Airport/Salt Lake City, Utah/Salt Lake City Corporation
- Dallas/Fort Worth International Airport/Dallas, Texas/Dallas/Fort Worth International Airport
- Logan International Airport/Boston, Massachusetts/ Massachusetts Port Authority
- Seattle-Tacoma International Airport/Seattle, Washington/Port of Seattle

MEDIUM HUB

- Reno-Tahoe International Airport/Reno, Nevada/ Reno–Tahoe Airport Authority
- Portland International Airport/Portland, Oregon/ Port of Portland
- Columbus Regional Airport/Columbus, Ohio/ Columbus Regional Airport Authority
- Allegheny County Airport/Pittsburgh, Pennsylvania/Allegheny County Airport Authority

SMALL HUB

- Tallahassee Airport/Tallahassee, Florida/City of Tallahassee
- Quad City International Airport/Moline, Illinois/ Quad City International Airport

NON-HUB

- Redding Municipal Airport/Redding, California/ City of Redding

NON-U.S. AIRPORTS RESPONDING TO SURVEY
NAME OF AIRPORT CITY COUNTRY OWNER/ CONSTITUTION OF THE AIRPORT

MAINLAND EUROPE

- Various Airports/Paris, France/Aéroports de Paris
- Zurich International Airport (Flughafen Zürich AG) Zurich Switzerland Unique (Flughafen Zürich AG)
- Frankfurt International Airport/Frankfurt, Germany/Fraport AG
- Brussels Airport/Brussels, Belgium/The Brussels Airport Company
- Amsterdam Schipol Airport/Amsterdam, Netherlands/Amsterdam Schipol Airport

ASIA

- Hong Kong International Airport/Hong Kong, China/Airport Authority Hong Kong

UNITED KINGDOM

- Various Airports/London, England/British Airports Authority

CANADA

- Toronto Pearson International Airport/Toronto, Canada/Greater Toronto Airports Authority
- Vancouver International Airport/Vancouver, Canada/Vancouver International Airport Authority

APPENDIX D

LIST OF SUSTAINABILITY PRACTICES CAPTURED BY SURVEY

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
SUB-TOPIC	NON-US AIRPORT RESPONDENTS	US AIRPORT RESPONDENTS			
		LARGE HUB	MEDIUM HUB	SMALL HUB	NON HUB
ENVIRONMENT SUSTAINABILITY					
EN1. MEASURING AND MONITORING	• EMS integrated with Health and Safety Management • First airport with certified ISO14001EMS in North America	• EMS • ISO EMS • EMS compliant with US EPA model, audited • Permit tracking system • Best Management Practices (BMP) plans and training of staff/tenants	• Long range master plan incorporates sustainability principles as a principal element of the plan • Long term environmental goals being developed which will be incorporated into strategic plan • Effort to consolidate sustainability practices into integrated program is underway	• Stormwater Pollution Prevention Plan (SWPPP)	
EN2. WATER CONSERVATION	• Low flow outlets in toilets, low-flow fixtures • Saving outlet tapwater system • Automatic flow systems • Monitoring system on airport waterways to measure and avoid potable water leakages • Buffering and partially infiltrating rainwater • Automatic hand wash basins • Greywater collected from kitchens and aircraft wash and treated for irrigation • Tracking consumption and upgrading facilities • Waterless urinals • Green roof • Xericscape entrance-way • Stormwater facility connected to irrigation system • Landscaping guidelines require drought tolerant species	• Automatic shutoff fixtures in nearly every public restroom • Low-flow devices on all toilets and sinks with phone numbers prominently posted in all restrooms to notify maintenance staff if leaky faucets or other water problems are encountered • Recycled water used for on-airport car washes • Number of landscaped areas served limited to those areas accessible to the reclaimed water supply pipeline • Irrigation system monitored and controlled through centralized computer-controlled irrigation control center • Xeriscaping (landscaping that does not require supplemental irrigation eg: native plants and low water landscaping)	• Restroom fixtures to reduce water use • "Smart" irrigation controls and non-potable water use • Recycled water for vehicle/bus washing • Central heating and cooling systems designed for water efficiency • Regular water conservation audits	• Low flow/reduced flow toilet and lavatory equipment • Replacement of non-native species during construction and/or mitigation projects	

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
SUB-TOPIC	NON-US AIRPORT RESPONDENTS	US AIRPORT RESPONDENTS			
		LARGE HUB	MEDIUM HUB	SMALL HUB	NON HUB
EN3. WATER QUALITY	• On-site stormwater collection • Waste treatment plants • Deicing spots and collectors • 15% of area is water collection area • Increasing area of impermeable surfaces (runways, taxiing lanes, buildings, etc) has involved regulating rate of discharge according to the environmental absorption rate rather than constant rate - watchdog committee known as "water law" established 2003 to organize consultations between various parties - following a preliminary stage, an initial consensus was reached • New facility for reprocessing highly concentrated waste water from de-icing operations by means of distillation - distillate is disposed of via spray irrigation system and remainder is re-cycled and turned into de-icing agent for reuse • On-site sewage treatment plant • Deicing water collected separately and will be treated as from 2009 • Spill traps and oil separator pumping stations installed to cover all apron areas • Good spill management and chemical management - flooding is a big risk • Central deicing pad • Storm water management facilities designed to retain water for sediment/fuel control and divert glycol to Publicly Owned Treatment Works • Flood risk managed by dyking system	• Wastewater treated on-site at sanitary and industrial wastewater treatment plants - discharges in 2006 met or exceeded National Pollutant Discharge Elimination System Permits quality standards • Stormwater vaults that catch and release water into streams to improve salmon habitat • Deploying Clean Water Act water efficient equipment and facilities • Stormwater runoff diverted to detention ponds and pumped to wastewater treatment plant for treatment • Stormwater runoff from a small area flows into bioswales (grassy channels) before being discharged to wetland area • All airport and tenant construction projects must submitted a Stormwater Pollution Prevention Plan during permitting process • Stormwater Pollution Prevention staff conduct routine inspections of all airport facilities to ensure compliance with Best Management Practice (BMPs) plans - citations and warning letters issued if any deficiencies in the BMPs are observed at a site • Sampling and analysis of stormwater discharges at each outfall is also required during two major storm events in each wet season • Stormwater detention basin captures 100% of non-stormwater flows and first flush of storm events - water is treated and sent to the City WW Treatment Plant • Committment to reduce impervious pavement on the airport • Best management practices for all airport activities to prevent stormwater pollution including tarmac cleaning • Largest reverse osmosis treatment facility in North America	• State of the art deicing system (further enhancements planned) • In ground hydrant system for fueling and tenant training for spill prevention • Increased flood storage capacity through drainage system design		• Fuel and maintenance activities performed using industry accepted best practices

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
SUB-TOPIC	NON-US AIRPORT RESPONDENTS	US AIRPORT RESPONDENTS			
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EN4. CLIMATE CHANGE	• Electric baggage trucks • 40% public transportation, comprehensive public transportation network in place to discourage use of private vehicle • Investment of $300 million for light rapid transit to airport • Promotion of public transport • Company-wide "quota unit" set up to control and manage CO2 emissions • Strategic decisions use energy management as a key indicator - use all revenue generated by savings in CO2 emissions into energy management as soon as internal organization permits - for accounting year 2005, 10,000 tonnes of CO2 were sold under prior virtuous practices • Developing a clean vehicles program using electricity and LPG • Studies underway to evaluate airport operations emissions more precisely • Track and reduce airport energy consumption • Airport people mover - intra airport train • Actively supporting ICAO & Eurocontrol (European Organiasation for the Safety of Air Navigation) methodology of monitoring global emissions by calculating emissions for each flight from take-off at the airport to landing at the destination airport • Emissions from handling activities and infrastructure reduced through conversion of heating systems throughout the airport from oil to gas and installation of stationary aircraft energy supply systems • Air Emissions Charge: most highly-polluting aircraft incur the highest charges - revenue (2 million annually) used to finance air pollution monitoring stations, fixed ground power stations, measures to reduce road transport to/from airport and emissions-reducing aircraft approach/departure system • Green Apron Policy - aims to replace existing 43 vehicle fleet with alternative fuel or low emission vehicles over the next 5 years (to date 3 LPG and 4 hybrid vehicles), fixed ground power and pre-conditioned air supply at each frontal gate so aircraft can shut down their auxillary power units while parked at gate • Planning to partner with community on airport centred eco-industrial zone • Constructing a taxiway to reduce taxi distances from terminal to runway • Taxi incentive for clean vehicles	• Member of California Climate Action Registry - publicly report greenhouse gas inventory online • Participating in the City's Zero Emissions 2020 Plan, which commits the City to developing a clean air plan for public transit • AirTrain - electric automated people mover that links airport terminals, parking garages, and rental car center • Jointly conducted the first aircraft towing trial in North America with Virgin Atlantic, Boeing and FAA - an aircraft was towed from gate closer to the runway reducing time that engines of aircraft were running on taxiway • Second largest airport-based alternative fuel vehicle (AFV) program in the world - over 600 AFVs which represent 60% of fleet and goal is to expand to 100% by 2015 - alternative fuels include liquefied natural gas (LNG), compressed natural gas (CNG), electricity, propane, solar power and hydrogen with plans to begin utilizing ethanol and biodiesel • Flyaway program providing parking and reduced rate bus service from remote locations to the airport (reduced emissions by over 1,000 tons last year) • Large CNG bus program, provision of a public CNG fueling station and conversion of shared-ride vans to CNG • Pushback of aircraft and 98% ground power and air • Greenhouse gas inventory (non-airline equipment) is planned • All gates have Ground Power Units • Electric vehicles for maintenance staff and electric charging stations at airside terminals for airlines • Large fleet of electric Ground Support Equipment (GSE) and airport/airline partnership to deploy electric GSE and recharging infrastructure • 92% of airport vehicle fleet of 589 vehicles are clean fuel vehicles • Encourage reduced engine taxiing where appropriate and safe • Continous Descent Approaches (CDA) program under consideration • Alternative fuel Ground Support Equipment (GSE) equipment goals • Subsidize public transport buses and bus rapid transit to all terminals • Tracking of greenhouse gases pending • Active participation of airport staff in local, regional, state, and national climate change research and programs	• Use of biodiesel and compressed natural gas (CNG) for vehicles • Conversion of CUP from oil to natural gas • Efficient airfield layout for taxiing • Light rail to airport and bike routes/parking • Projects to reduce congestion in parking garage and access roadway • Include greenhouse gas emissions in air emission inventory	• Airport provides 400 Hz power and pre-conditioned air at all terminal parking positions - reduces need for auxillary power unit operations during loading and unloading	• Tenant airlines utilize electric tugs • Ground power is provided to reduce auxillary power unit run times

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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EN5. AIR QUALITY	• External area is monitored • Take part in a large-scale European research project called AIRPUR - aims to provide accurate description of pollutants emitted by aircraft on the ground - several metering campaigns run at our airport since 2005 • Supporting ICAO in developing new guidance governing the calculation of all emission sources at airports • Series of tests carried out relating to the equipping of special vehicles with particle filters to fulfil requirements set forth by the federal authorities, • Federal Department of the Environment, Transport, Energy and Communications (DETEC) specify NOX threshold of 2,400 tonnes - NOX emissions resulting from flight operations, handling and infrastructure at our airport are only 50% of threshold (1,208 tonnes) • Three air quality monitoring stations to measure airport emissions • On-site air quality monitoring • In process of updating air quality management plan • Initiatives underway to contribute to improved air quality by reducing emissions and improving energy efficiency (e.g. fleet management to alternative fuels)	• Comprehensive air quality enhancement program addressing air quality impacts from aircraft emissions, associated ground service equipment, cars and buses driving in and around the airport and fuel and energy use at the airport • Largest publicly accessible CNG refuelling complex in northern California • "Transit First Policy" gives priority to public and private High Occupancy Vehicles (HOV) traveling to the airport • “Trip Reduction Rule” added to airport’s official Rules and Regulations in 1993 - aimed at reducing employee trips to the airport in single occupancy vehicles • Adopted "Clean Air Vehicle Policy" in 2000 mandating 50% of fleet vehicles use clean fuels by 2005, 100% by 2012 - state and federal grant funding provided • Financial and non-financial incentives for clean vehicles - preferential trip fees for courtesy shuttles, “head of the line” privileges for CNG taxicabs, levy high fees for non-compliance vehicles, pre-tax deduction service to employees who purchase monthly public transit passes • Selected as one of 10 airports in the US to participate in Inherently Low-Emission Airport Vehicle (ILEAV) program where U.S. Department of Transportation (DOT) provides 50% of cost of low-emission vehicles and cost to construct refueling and recharging stations up to a total of $2 million • Air quality group staffed with 5 environmental specialists monitors annual emissions and develops programs to reduce emissions • Teamed with numerous research institutions and resource agencies to develop industry leading approaches to addressing air quality issues • Planning for development - emissions in the State Implementation Plans (plan for complying with the federal Clean Air Act) • Active dust control, permitting, and conformity analysis programs • Air quality management program tied to 20 year master plan development projects	• Estimating greenhouse gas emissions • Managing strategies for emission reduction • Participation in Airport Cooperative Research Project's (ACRP) Hazardous Air Pollutants (HAPs) study and sustainability survey • Participation in ACI environment committee and sustainability steering team/task force		

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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		• Air quality initiatives including fleet vehicles, ground service equipment, energy efficiency, stationary source reductions, Transport Demand Management process improvements • Voluntary 15-year Air Quality Initiative strives to maintain NOx emissions at or below 1999 levels • Dedicated staff and monitoring infrastructure to monitoring and managing air emissions			
EN6. LAND USE	• Clean land act in place controlled by the Environment Department • Spills immediately handled • Several measurements campaigns to evaluate soil pollutions at several areas within the airport • Polluted sites at airport illustrated in "cadastre of polluted sites at aerodromes" (published by the Swiss Federal Office of Civil Aviation) and is available to the general public • Except 5, all contaminated sites on the airport (55) have either been cleaned up or examined and found to be relevant only in connection with construction projects • Extensive survey is under way on contaminated sites • Effective decontamination of polluted zones is taking place • Active on-site soil bio-remediation for the last 10 years (only 2 known areas left) • Virtually no greenfield areas left • Planning to partner with community on airport centred eco-industrial zone	• Soil and groundwater clean up • Hazardous materials management • Hazardous materials group staffed with 4 environmental specialist who monitor contamination on our and tenants property • Installed groudwater monitoring program to monitor the quality of our groundwater and avoid contamination - inspects each facility on an annual basis to ensure no spills and/or leaks have occured • Developed and received a 'Prospective Purchaser Agreement' with EPA for certain contaminated land acquisitions • Very active 'contaminated site cleanup' program • Environmental cleanup program to remediate contaminated soils • System of monitoring wells • Collaborative program with local cities to redevelop land acquired for noise into job-producing land uses	• Planned future developments incorporate greenspace as much as possible		• U.S. Army Corps of Engineers working in cooperation with airport staff to remove WWII era Underground Storage Tanks (USTs) • Agressive land acquisition program - seeks to prevent residential encroachment and preserve wetlands and green spaces

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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EN7. BIODIVERSITY	• Airport equipped with noise systems to scare birds - can be both fixed on cars or on the ground • Regulations demand installation of nets on water storages for the purification system • More than half airport area consists of greenery, 80% for operations and 20% nature conservation zones, woodlands and bodies of water - annual plan implemented by our own greenery maintenance service, annual monitoring based on the provisions of the Federal Animal Feed Ordinance • To prevent collisions between aircraft and birds, unsealed areas of airport are managed as extensive grassy meadows - promotes development of valuable ecological zones that provide habitat for rare and endangered flora and fauna • Other nature conservation areas created and financially supported by the airport as ecological/compensation measures • Dolphin sanctuary/marine park to protect endangered dolphin species and member of Marine Mammals Conservation Committee • Use of crackers for scaring birds • Supporting the local green belt trust and outreach programme - involves staff in habitat improvement • Protect and enhance foreshore habitat during dyke repairs • Finance to Nature Conservancy to manage local nature reserve • Non-lethal techniques for bird control include habitat management, monitoring, movement of birds away from aircraft (noise makers, dogs)	• Wildlife Hazard Management Plan • Construction Management • Wetland Mitigation Program • Research Support • Vegetation Management/Habitat Protection • 300 acre dunes preservation area - largest remaining coastal dune fragment in Southern California, home to endangered El Segundo Blue Butterfly - 2 landscape technicians removing noxious/invasive and reestablishing native species, biologist annually monitors endangered species health • Partnership with the with local conservation group to fund the restoration of 21 acres of grassland habitat • Contract with United States Department of Agriculture • Paid for mitigation to land bank for 404 Permit (Clean Water Act) for Wildlife Management Plan • Relocating threatened species to preservation area • Wildlife Management Program • Designed new landscaping program to minimize bird attractiveness		• On-site conservation area for Gopher Tortoise (species of concern) • Remediation of area of Bent Golden Aster (endangered) during construction • Establishment of tree bank and use of native species in area where residences were demolished for noise mitigation purposes • Bird Control Plan uses habitat modification and harrassment as primary means of reducing threat to aircraft	

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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EN8. MATERIALS	• All material checked for highest degree of recycle • Goal = 20% recycled waste material • Products selected by group of experts • "Work Safety" service has been tracking harmful chemicals for 15 years, developed database of all chemical products and enters records into database when "Chemical Products" work group encounters a new product • Recycled paper and other green products • Free-trade coffee is purchased for offices • Some building design incorporated use of strawboard instead of gyprock • Re-used building materials on-site • Very high reuse of concrete and asphalt during construction projects	• City Composting Resolution urges City Departments with food service operations (including airport) to purchase compostable food serviceware • Resource Conservation Ordinance (RCO) for the City directs all departments of the City, including the airport to maximize purchase of recycled products • 90% of all paper used contains 30% post-consumer recycled paper • Use soy-based ink, a renewable resource that emits less volatile organic compounds than traditional inks • Interior of the International Terminal Building contains 21,000 square feet of Forest Stewardship Council (FSC) certified cherry wood paneling - one of the world's largest installations of veneer from certified forests • Purchase environmentally sensitive products such as Green Seal custodial products and non-toxic pest control products • Purchases products such as paper, carpeting, antifreeze etc that have high recycled content • Purchase of paper with no less than 35 % recycled content • Some environmentally preferrable and recycled content purchasing in place - more planned	• Select lower Biochemical Oxygen Demand (BOD) deicing materials • Restroom paper products with high recycled content • Paper products with recycled content		
EN9. WASTE	• Paper, wood and plastic seperated and collected to go to recycle plants • Choice of waste disposal contractor made with aim of encouraging recovery of separated waste materials as much as possible - each tenant can choose number of waste types to separate at source and cost reflects degree of separation - this provides financial incentive for good practices • Waste disposal logistics (landside and airside) revised during 2007 due to required adjustments to EU regulations relating to the Schengen Agreement • Waste disposal services optimised through the use of new providers (shorter journeys to and from the airport) and more efficient means of transport (e.g. vehicles with trailers in order to reduce the required number of journeys)	• Resource Conservation Ordinance (RCO) for the City mandates reduction of solid waste, City Composting Resolution urges food service operations to participate in the food scraps composting program and City Resource Efficient Building Ordinance (REB) mandates that adequate space be provided for the collection, storage, and disposal of recyclable materials • Waste containers around the airport for passengers and tenants - transferred to on-site dumpsters and compactors then transported to an off-site processing facility • Pilot programs for food/trash waste separation at concessionaires, reducing bathroom paper towel use, separating solid waste types at point of generation • Reducing number of copier machines by 12% airport-wide	• Pre and post consumer food waste program in place with material going to composting • Recycling foreign periodicals from international flights to educational institutions who teach foreign languages		• Passenger terminal recycling program

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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	• Feasibility study concerning separate disposal of on-board waste eg: newspapers/paper from aircraft cabins and on-board catering recyclables • Waste minimization program for paper, cardboard, aluminum cans, plastic bottles, plastic sheets, fluorescent tubes, lube oil, food waste for composting, CDs • Food waste composting to organic soil conditioner for airport landscape	• Engineering/architectural contracts and bid documents reproduced on CDs and work orders submitted electronically • Recycling and Source Reduction Program recycles waste and scrap materials from airport and airline, cargo and construction activities - on the way to meet Mayor's goal of 70% recycling by the year 2015 • Planning participation in pilot program with other west coast airports to target the recycling aircraft in-flight operation paper waste • 30 different waste types recycled at airport • Offices at airport recycle paper • Airport-wide cardboard, wood pallet, scrap metal, batteries, used oil recycling • Improvements planned to increase aircraft waste/terminal passenger recycling • Compost coffee grounds from an airline for use on airport landscape			
EN10. NOISE AND AESTHETICS	• Seperate pricing for low sound classified planes • Housing scheme for noise insulation • Local regulations limit neighbourhood constructions and air traffic • Only quietest aircraft authorized to fly at night • Airport Sound Proofing Program - approximately 1,950 properties have been protected with the aid of sound proofing measures • Altered take off patterns imposed by the authorities • Limitations on taxiing and motor testing • Noise walls constructed • Engine run-up pad to attenuate noise from engine testing • Phased out chapter 2 aircraft that produce more noise	• "Fly Quiet Program" promotes participatory approach in complying with noise abatement procedures by grading airline performance, making scores available to the public and presenting awards to high achievers • Permanent noise monitoring system to monitor noise levels in communities around airport (29 stations) • Noise Abatement Office maintains a database of all complaints received regarding noise nuisance from nearby communities • Working with FAA Air Traffic Control (ATC) to suggest changes to approach and departure procedures to reduce noise impacts for neighboring residents • Working with the Boeing, FAA and United Airlines on "Oceanic Tailored Arrivals" (OTA) to reduce noise from arriving flights from the Pacific Rim • Working group (community, FAA and airlines) to address noise issues • Study to implement continuous decent approach procedure • Preferrential runway use policy - limits departures to runways on interior of the airport	• Operate VHF Omni Range (VOR) radio beacon to guide aircraft on noise abatement route • Ground run-up enclosure built in 2000 to contain noise from maintenance testing		

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		LARGE HUB	MEDIUM HUB	SMALL HUB	NON HUB
		• Arrivals and departures occur over ocean and not over the residential • Residential noise mitigation program - acoustic modifications to over 8,000 homes in past 7 years • Spent over $100 million on enhancement program- over half on parkways and green belts along airport peremiter as attractive buffer to the community • Noise mitigation program for residential, schools and other sensitive public buildings • Noise mitigation program with full time staff and extensive noise monitoring system • Residential sound insulation program			
EN11. ENERGY	• Efficient system for reducing electricity consumption eg: automatic lights, motor and HVAC control • Use of excessive heat for cooling • Commitment to reduce energy consumption in terminals by 20% by 2010 compared with 2005, 8-point programme of energy saving awareness campaigns implemented through ISO14001 EMS • Improvements made during redevelopment of buildings (efficient bulbs, automatic lighting levels, uncoupling strip lights, insulation, automatic doors, hot air curtains, airflow return etc) • Regulations related to insulation, energy efficiency, CO2 emissions are becoming stronger - working group formed to examine further possibilities • Terminal building designed to maximize sunlight • Energy saving lighting and light intensity meter/auto-lighting system • Flights grouped to a certain area of concourse during non-peak hours - allows shut off air conditioning and lighting at unused part of concourse • Energy reduction team identifies opportunities to improve energy efficiency eg: LED airfield lighting; escalator sleep mode; carbon monoxide monitors (reduce unnecessary HVAC), solar hot water panels (reduce natural gas consumption as boilers not required in summer)	• Two CNG fueling stations that are available for use by airport and non-airport patrons • 2,000 square feet of solar photovoltaic panels on the roof an airport building (20 kW capacity) • Indoor lighting improvement program - incandescent to fluorescent • Preliminary Energy Audit • Retrofitting existing buildings with energy efficient lighting fixtures, ballasts, and bulbs during remodeling • Ongoing program to upgrade building air-handling units with variable speed drives and soft-start controls • Agreement with the Department of Water and Power for 15% Green Power in all facilities • Plans to build a solar photovoltaic system • 30+ year history of aggressive energy efficiency • Alliance to Save Energy, Star of Energy Efficiency Award recipient in 2005 • Invested $7M over 5 years to reduce electricity consumption by $1.7M per year • Energy Star energy efficient equipment	• Lighting systems computer operated - adjust based on ambient lighting and occupancy • All new construction at airport uses highly efficient glass and insulation	• Switched terminal heating source from fuel oil to natural gas	

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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EN12. GREEN BUILDINGS	• HEQ (High Environmental Quality) culture is managerial approach to curbing construction and operation environmental impact of buildings - 14 target areas earmarked for action broken down into eco-building, eco-management, comfort and health - project leaders attended awareness-raising and training sessions - company joined HEQ think-tank association in 2005 • 1 LEED silver building in-place • Policy to assess feasibility of LEED for all new buildings and major renovations • Developing green building policy to guide future renovations and developments	• City's Green Building Ordinance specifies construction projects greater than 15,000 square feet should achieve a minimum LEED™ rating of Silver • Grid-connected solar photovoltaic panels • Forest Stewardship Council certified wood • Ground landscaping comprised of native plants and trees grown in local nurseries specifically for the airport • Terminal building design 30% more efficient than required under Federal law (Title 24 – Nonresidential Building Energy Standards) - high performance glazing, enhanced daylight, energy efficient fixtures, efficient entryways, efficient ventilation, outside air economizer, energy management and control system, variable flow chilled and hot water systems, • Sustainabile building policy requires all construction to achieve the highest practical LEED certification • Sustainable Design Guidelines for all design and construction projects • Use of natural light • LEED for all new buildings	• Incorporate green building concepts into designs and remodels but do not necessarily seek certification		
ECONOMIC SUSTAINABILITY					

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
SUB-TOPIC	NON-US AIRPORT RESPONDENTS	US AIRPORT RESPONDENTS			
		LARGE HUB	MEDIUM HUB	SMALL HUB	NON HUB
EC1. HIRING AND PURCHASING	• Schooling system in place for low educated people • "Business Development Opportunities in Economic Communities" project aims to analyse the territorial impact of purchases made by the major airport principals and make airport-specific purchases more visible • Green procurement in place whenever possible and reasonable • ISO 14001 EMS gives preference for other ISO businesses • Incorporated social and environmental sustainability criteria in Request for Proposals (RFPs) • Attract business by promoting the regional assets	• Airport jobs represented 11% of jobs for county • Purchase services from contractors that utilize environmentally friendly practices eg: waste hauling contractors use alternative fuel vehicles • Contracts have Medium/Womens/Disadvantaged Business Enterprise requirements • "First Source Hiring Program" requires tenants and contractors to use airport impact area (local communities) to provide a first opportunity for airport jobs • City regulations on small business enterprises • Diversity study to identify areas to improve contract opportunities for Medium and Women Business Enterprises • Local job fairs • Airport "Means Business Program" - help local small business owners get better access to airport purchasing dollars and share in revenue that the ariport generates for regional economy • Preference for local businesses, contractors in public solicitations • Outreach to affected communities • Provide airport jobs center to assist tenants in recruiting employees and to assist employees in filling out job applications			
EC2. COMMUNITY CONTRIBUTIONS	• Established foundation in 2003 to coordinate social sponsorship schemes and pursue structured long-term subsidizing policy - backs projects directly rather than subsidizing the associations behind them • Sponsor community projects such as organic farming • Provide job opportunities for summer or short term employment in neighboring communities • We are a not-for profit and do this in a a small way • Comprehensive corporate support program provides funding to local charities and organizations	• Office of Employment and Community Partnerships (ECP) coordinates programs linking welfare-to-work recipients, unemployed, and under-employed city residents to airport jobs • Student Employment Program offers intern programs to high school and college students and recent masters graduates • Support Airport Council International-North America and participate on all committees • Partnered with local universities to establish aviation academies • Provide substantial support on an annual basis to charitable and communities organizations • ACI-NA and AAAE • Contracts with Arizona State University • In-kind contributions to airport community groups • Support local K-12 educational institutions • Payments in lieu of taxes to local municipalities • Severely restricted by law from providing money to other organizations	• Present regularly to community groups and academic institutions (speakers bureau) • Prohibited by law from giving charitable donations although employees participate in giving campaigns • Sponsor a cleanup day and contribute substantial donation to charity • Recycling of foreign periodicals from international flights to educational institutions teaching foreign language		• Staff members encouraged to provide volunteer time to a variety of local organizations eg: schools, universities, charitable organizations and community organizations such as sports clubs

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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EC3. QUANTIFYING SUSTAINABILITY	• All new projects require life cycle costing before implementation • Quantify reductions in CO2 from on-site transportation and car sharing initiatives • Quantifying monetary and non- monetary benefits part of every business case and Net Present Value evaluation • Every project reviewed with prudent commercial and life cycle analyses before approval • 20 year master plan utilizes a sustainability matrix to assess possible projects	• Perform life cycle cost analysis for all new construction projects • Quantify emissions reductions from energy savings • Quantify diverted waste from landfill through waste management initiatives • Quantify water efficiency as water reductions per passenger • Quantify success of wastewater treatment measured as % improvement above regulated levels	• Capital projects are required to predict O&M costs • Asset management program considers energy costs • Annual objectives and targets include quantification on non-monetary benefits		
EC4. CONTRIBUTION TO RESEARCH AND DEVELOPMENT	• Participate in aircraft emissions measurement, monitoring and modelling - have own lab that contributes to research programs such as AIRPUR • AERONET - thematic network of the european commission on aircraft emissions reduction technologies • Funded monitoring and conservation programs for endangered species • Community involvement consultations, participated in "one company one job" employment programs	• Currently funding research projects through the University of Southern California and UCLA looking at air quality impacts • Full-time individual acts as a community benefits coordinator/liason with local stakeholders. • Work with Arizona State University • Very active community soundproofing and acquisition program within 65Ldn neighborhood around airport. • Limited testing of innovative strategies and technologies - collaboration with state energy and environmental agencies planned • Forming regional coalition of similar sized organizations to benchmark each others sustainability initiatives			

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EC5. INCENTIVIZING SUSTAINABLE BEHAVIOR	• Programs at the airport available to show impacts • Environmental Club of the airport encourages employees' awareness raising During the National week of Sustainable Development - many tenants participate • Developed leaflets to inform stakeholders on environmental good practices • Web site accessible to all the tenants developed in 2005 to raise employees and managers awareness - contains diagnostic and information. • Strong collaboration with public transport companies (bus) to improve public transport network • Annual green office competition for staff, airport environmental best practice competition for airport business partners • Separate waste receptacles for collecting recyclables in terminal building • Emissions and noise charging • Choice of waste disposal contractor made with aim of encouraging recovery of separated waste materials as much as possible - each tenant can choose number of waste types to separate at source and cost reflects degree of separation - this provides financial incentive for good practices • Seperate pricing for low sound classified planes • Subsidize public transport buses and bus rapid transit to all terminals • Commuter Rebate program provides financial incentive to carpool/bus/bike to work	• Signage • Free recycling services to all airport tenants • Passengers encouraged to recycle through use of in-terminal recycling containers • Public transporation passes at reduced rates • Transportation Management Association (TMA) to encourage HOV travel to airport facilities • Regular staff/tenant training and issues updates • Education and incentives for employees to use public transporation eg: discount for train fares • Provide subsidized van pools • Free public transist passes to employees who take public transit • Subsidize "Flyaway" project where passengers park in remote locations, check in (incl luggage) and ride a high occupancy vehicle to airport - last year over 1 million people utilized the two existing flyaway locations • Active Transportation Management Association facilitates ride matching, van pooling incentives and transit subsidies	• Subsidize public transit passes substantially (cost without subsidy = $500, employee cost = $25) • Charge for employee parking		
SOCIAL SUSTAINABILITY					
SO1. PUBLIC AWARENESS AND EDUCATION	• Annual public awareness event on Sustainable Development in collaboration with local University • Provides local residents with three day course on sustainable development • Exhibitions on the airport's environmental program held periodically • Public consultation on major development projects • Extensive sustainability reporting explictly addressing social, environmental, economic and governance issues - 2005 sustainability report won many awards	• Entered into "Community Benefits Agreement" with Coalition for Environmental, Economic and Educational Justice - includes programs for outreach to stakeholders, environmental improvements, and programs to improvement acoustic performance of local schools • Annual report and speaking at functions • Active community program for noise mitigation around the airport and advertisement for ecomonic impacts of the airport • Annual environmental reports • Environmental pages on website • Periodic economic benefits reporting	• Routinely include economic impact numbers in public communications; speakers bureau and website		

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
SUB-TOPIC	NON-US AIRPORT RESPONDENTS	US AIRPORT RESPONDENTS			
		LARGE HUB	MEDIUM HUB	SMALL HUB	NON HUB
SO2. STAKEHOLDER RELATIONSHIPS	• First annual Corporate Responsibility Report based on stakeholders, their demands and how the airport has built relationships with stakeholders through sustainable development strategy • In constant contact with all stakeholders • Strategic plan with the main airline undertaken - includes an important chapter on sustainable development. • Regular meetings with groups of business partners • Community programs such as caring for the elderly, organic farming • Regular communication with local government • Member of and active participation in Airports Council International • Project initiatieves can be started by the staff or local community • Launched Environmental Club for tenants based on the airport to voice environmental concerns and suggestions	• Customer Service Office search for ways to improve services and systems to suit customer needs and desires • Customer Comment Cards provided at convenient locations and contain prepaid postage - responded to within seven business days - Airport Director reads all customer comment cards.weekly • Established e-mail system on website, recieve complaints globally the majority of which are responded to within the same day - improvements implemented on basis of customer comments include family or companion restrooms, wheelchair assistance, free assistance in parking garages for cars with flats, dead batteries, no fuel, designated "meeting points" to eliminate greeter/traveler confusion, additional seating, dog relief areas for service animals and family pets, foreign-language line at information desks, e-mail contact to the lost and found for overseas travelers, baby changers in all restrooms (including men's) • Monthly standing area advisory committee meeting comprised of numerous community members • Bi-monthly Noise Roundtable meeting with community members • Meet monthly with airlines through our airline operating committee • Conduct quarterly business forums with local business			
SO3. EMPLOYEE PRACTICES AND PROCEDURES	• Having already endorsed equal opportunity agreement, now seeking to achieve the Equality Label (offered by AFAQ AFNOR, an international auditing company) - introducing paternity leave, intercompany day nurseries, seminar on the theme of equal work opportunities as a factor of performance • Performance related pay only available to non union employees	• Airport's Equal Employment Opportunity, Diversity and Training office promotes employee recognition, development and employee appreciation day • Employee Recognition Awards recognize merit, safety, security, length of service, valor and undertaking exceptional tasks not included in their normal course of duty • First Aid, CPR and automatic external defibrillator training offered free of charge to all employees - classes offered on all shifts to accommodate 24-hour workforce • Health and wellness workplace policy incorporates nutrition, exercise and education to improve health and reduce sick time • Active safety committees resulted in lower injury rates • Expanded the use of on-line computer based training to provide flexibility in addressing efficient use of employee time • As a city agency all employess fall under City's employment guidelines including equal opportunity and diversity and retirement program • On-site child care facility and subsidize child care for employees	• Performance related pay and pay benchmarking • Public employee retirement program with fixed benefit • Telecommute policy		

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
SUB-TOPIC	NON-US AIRPORT RESPONDENTS	US AIRPORT RESPONDENTS			
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SO4. SUSTAINABLE TRANSPORTATION	• Non mineral oil for transport • Sport facilities for staff with lockers and biking opportunities • Participate actively in public debate to implement new rail link between city and airport • Study underway to create a strong culture of "clean" vehicles - approximately 30% of the vehicles are LPG or electric • Pedestrians walkways and automated people movers • Running trail • Bus, rail and ferry transportation • Low emission and alternative fuel vehicles • 2.5 miles of pedestrian/cycle trails being constructed through the airport land but foot and cycle access to terminals is discouraged • New intra airport passenger train • Cycle facilities started but much more required • Significant investment ($300 million) into public light rapid transit line to airport	• Zebra crossing and footpaths for access to taxis • Built a train station and bus access • 100% of our shuttles converted to CNG or biodiesel • Second largest airport-based alternative fuel vehicle (AFV) program in the world - over 600 AFVs • Employee rideshare program has been awarded EPA's Gold Medal for the past two years - 28% of our employees participate • Provide subsidized van pools • Free public transist passes to employees who take public transit • Maintain bike access to our facilities • CNG stations on property • Inter-terminal, rental car center • Parking lot bus fleet is 100% CNG • 33 CNG buses with over 10,000,000 miles travelled	• Bike path to airport and bike racks/showers • Light rail to airport • Corporate fleet includes some hybrid vehicles		
SO5.ALLEIVIATING ROAD CONGESTION	• Global Compact Best Practice Car sharing being developed to reduce employee's car transport - website being used for car sharing and communication for all employees • Commuter Rebate program provides financial incentive to carpool/bus/bike to work • HOV and airport priority lanes • Significant investment ($300 million) into public light rapid transit line to the airport	• Education and incentives for employees to use public transporation eg: discount for train fares • Passengers can choose many forms of public transport eg: train, bus, shuttles, taxis • Subsidize "Flyaway" project where passengers park in remote locations, check in (incl luggage) and ride a high occupancy vehicle to airport - last year over 1 million people utilized the two existing flyaway locations • Providing reduced parking and bus fees to encourage ridership • To reduce passenger cars, provide dedicated waiting areas, 'Cell Phone Lots' and an are planning for an automated train • Work on regional transit projects like airport train station and Bus Rapid Transit • Active Transportation Management Association facilitates ride matching, van pooling incentives and transit subsidies • Aggressive HOV goals being met through express bus services and transit to terminals	• Subsidize public transit passes substantially (cost without subsidy = $500, employee cost = $25) • Charge for employee parking • Light rail to airport • Active transportation planning to minimize congestion overall • Sufficient parking • Cell-phone waiting lot		

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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SO6. ACCESSIBILITY	• Separate handicap toilets and transport opportunities • A specific service exists for physically impaired person: it is taking care of disabled persons up to the lift in the plane • Currently employ 223 disabled persons or 2.8% of the workforce and committed to increase to 6% to meet statutory requirements - hiring a disabled person forces managers to adopt a more rigorous procurement approach • In 2005 airport management institute organized two sessions on role of disabled in company proving that disability and striving for efficiency are not mutually exclusive • Human Resources division includes Disability Mission that provides information and advice in connection with the professional integration of disabled workers (comprises social workers, medical officers, architects/experts in ergonomics, IT and training - convenes on regular basis to examine occupational circumstances and propose solutions to problems) • First european airport to implement new regulations related to Physical and Rehabilitation Medicine (or PRM, which is a recognized medical specialty in all European count • Disabled toilets, nursing rooms, extra large toilet stalls, changing tables • Handicap accessibility is the law • Barrier Free Program providing access for people with disabilities is a signficant design aspect of airport terminals • Airport offers vehicles at very low cost to employees based on the airport - providing transport to work that people could not afford	• All of our facilities comply with the Americans with Disabilities Act (ADA) Standards for Accessible Design and continue to improve access • Provide family rooms for taking care of newborns • Conducted ADA survey of all facilities and are retrofitting all locatons where accessibility is limited • Developed ADA program			

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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SO7. LOCAL IDENTITY CULTURE AND HERITAGE	• Preserved archeological finds during airport construction • Maintain natural coast line of airport island • Native art exhibited throughout the airport • Archaelogical procedure for all construction ensures existing sites protected	• Built museum of commercial aviation at new international terminal by replicating 1930s terminal - first airport to be accredited by the American Association of Museums • Planted native plants and trees thorughout facility • Art collection comprises more than 75 pieces of art by artists of local, national and international acclaim - in line with city's "percent for art ordinance" - art enrichment allocation equivalent to 2% of the construction cost of a new or renovated civic structure • New landscaping policies require use of native vegitation • Local art program requires percentage of all construction projects go to public art - rotating local art exhibit in terminal locations • Historical property display in airport • Arts Program is nationally known • Archeology required for all construction • Historic preservation assessments being done for the residential purchase near the airport • Public/local community art at various locations in terminals	• Work with State Historical Preservation Office when sites are found • In-terminal museum/educational display regarding local river history • Art on one concourse celebrates local region by incorporating map of river basin into floor design		
SO8. INDOOR ENVIRONMENTAL QUALITY	• High standard equipment for staff • Thermal comfort taken into account early in building studies process with a double goal of energy use optimization and employee thermal comfort • Noise map is being draft of airport to localise the main areas impacted by noise • All airport systems meet national and international standards for non-ionising radiation (from radar and wireless data transmission) and have been approved by the relevant authorities - currently developing and maintaining inventory of all installations and systems that emit non-ionising radiation • Maximize use of sunlight, double glazing to reduce noise, computerized program to control indoor temperature and ventilation. • Low VOC paints	• Health Safety Section provides training, supplies material, in-house and external expertise and resources for emplyees • Ongoing preventative maintenance program to maintain HVAC systems including duct cleaning and high efficiency air filters • Monitors recirculating air quality (HVAC) programs			

AIRPORT SUSTAINABILITY PRACTICES MATRIX					
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SO9. EMPLOYEE WELLBEING	• Sport facilities for staff with lockers and biking opportunities • Airport houses an intercompany day nursery • All airport services can be used by employees • Every staff member has internet access • Staff lounge with gym, TV, multi-function rooms • Internet access • Golf course • Banks, shops, post office • Chapel • Police stations • Planters and open green space	• On-airport childcare center and subsidize employee childcare • Chapel • Fire Station has gym • Started employee wellness program • Meditation rooms • Off airport child care facility for swing shift workers • Park and nature walking trail near airport			
S010. PASSENGER WELLBEING	• Internet access • Golf course • Banks, shops, post office • Chapel • Planters and open green space	• Park and nature walking trail near airport • Full serivce Bank Of America branch • More than 70 retail spots • Main post office • Quiet rooms • Airport hotel being planned • Wi-fi internet access • Spa facility in terminal • Internet access in most terminals • Meditation rooms • Child play areas in terminal concourses • Dog walking park	• Planning fitness club within terminal in the next 5 years • Wireless internet • Two areas for massage		

Abbreviations 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
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
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

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