BERT MOONEY AIRPORT

Bert Mooney Airport

Sustainability Plan

Introduction

We developed this Airport Sustainability Plan as a stand-alone planning document, focused on sustainability at the Bert Mooney Airport, including the airport terminal and surrounding property. From the third quarter of 2013 through 2014 the Bert Mooney Airport board of directors, airport staff, and consultants conducted audits, assessments, research, discussions, and reviews to find and establish practical, appropriate approaches to the complexity that is inherent in sustainable operations and maintenance of an airport.

With rising energy costs and an increased awareness of the value of our natural resources, we came to the realization that a Sustainability Plan is necessary for our continued success. We are excited by the possibilities we discovered in green building, natural resources preservation, and community enrichment.

The Butte-Silver Bow Community & Business Development organization is working to improve our region, encourage new business, and increase jobs. As our Airport Manager, Pat Shea remarked, "Our airport is a viable part of this community. When businesses look to relocate or expand; transportation is a key factor in making those decisions."

This Airport Sustainability plan is a resource for information, actions, and evaluation of our sustainability objectives and practices.

This plan is under direction of:

Airport Board Members

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Executive Summary

In 2012, the Bert Mooney Airport Authority recognized the need to define and adopt sustainable business practices to ensure long-term economic prosperity, operational efficiency, and to reduce environmental impacts, protect natural resources and improve community relations.

As part of a Federal Aviation Administration (FAA) program on airport sustainability planning, an Airport Improvement Grant provided funding to collect data in order to study the environmental footprint and develop a comprehensive sustainability-planning document for the Bert Mooney Airport, in Butte, Montana.

Our Airport Sustainability Plan is a companion document to our Airport Master Plan outlining sustainable business practices for the Bert Mooney Airport Authority to implement, monitor, and build upon.

During the research and development of this plan, we focused on practical sustainability opportunities and strategies given our available resources. The small size of our airport limits and/or prohibits some design and implementation processes that may be common to larger airports with more traffic. Many strategies were examined; the practical and appropriate ones for the Bert Mooney Airport form the basis of this plan.

The purpose of the Airport Sustainability Plan is to provide guidelines for Bert Mooney Airport to incorporate sustainable practices into the current operations, future planning, and decision-making processes. The airport administration will follow the Plan – Do – Check – Act cycle to ensure the Airport Sustainability Plan is incorporated into all airport operations, developments and planning now and in the future. Pat Shea, Airport Manager is the point of contact and will be responsible for the implementation of the plan.

In addition, we invite residents and business owners of Butte-Silver Bow to read and use this document. It is our hope that we serve as a good example of how to incorporate sustainable practices in our everyday lives and in our business practices.

The Airport Sustainability Plan includes strategies for Bert Mooney Airport to:

- ✓ increase economic viability of the airport
- ✓ support positive, economic growth within the region
- ✓ guide future new construction and renovation projects toward sustainable design, processes, and strategies
- ✓ operate and maintain our assets in an efficient and effective manner
- ✓ develop a facility that provides safety, health, comfort and well-being for visitors and staff, and
- ✓ preserve and maintain our valuable natural resources

Sustainability Policy

Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life. (WCED, A/42/427: Our Common Future, Chapter 2, Towards Sustainable Development, UN Documents, Geneva, Switzerland 1987)

We created this sustainability policy for our airport with consideration and knowledge of the current conditions while keeping in mind our goals for a long and prosperous future for the Bert Mooney Airport and the Butte-Silver Bow Region.

The Bert Mooney Airport Authority recognizes the opportunity for the airport to become a frontrunner in sustainability in Montana and the Butte-Silver Bow region by embracing the Triple Bottom Line management method; taking into consideration elements of Economic Strategy, Environmental Awareness, and Community Connectivity throughout all our planning, decision making, and operations.

Our Airport Sustainability Plan reflects this approach and breaks these elements down into actionable sustainability categories. Incorporating these elements into the Bert Mooney Airport's business practices, policies and programs will ensure sustainability is incorporated over time throughout administration, operations and maintenance, and all business functions.

By setting forth this policy, the Bert Mooney Airport Authority will:

- ✓ Design and implement an Airport Sustainability Plan.
- ✓ Strive to be a frontrunner in sustainable airport practices for airports similar to our size.
- ✓ Promote growth and prosperity in our region while protecting our quality of life and the environment.
- ✓ Balance present and future needs.
- ✓ Maximize operational efficiency throughout the airport.
- ✓ Proactively search for potential funding sources for projects that will assist the airport in achieving its sustainability goals, and at a minimum, a new LEED-Silver certified terminal. (Certification level is dependent upon LEED version used. LEED v4 is required after October 2016.)
- ✓ Connect with local and regional individuals, companies, organizations, clubs, and schools on sustainability projects.

Adopting sustainability into the everyday operations of the Bert Mooney Airport will ensure we not only survive, but also prosper and thrive now and in the future.

Dave Holman, Chairman of the Board
Bert Mooney Airport Authority
Butte, Montana

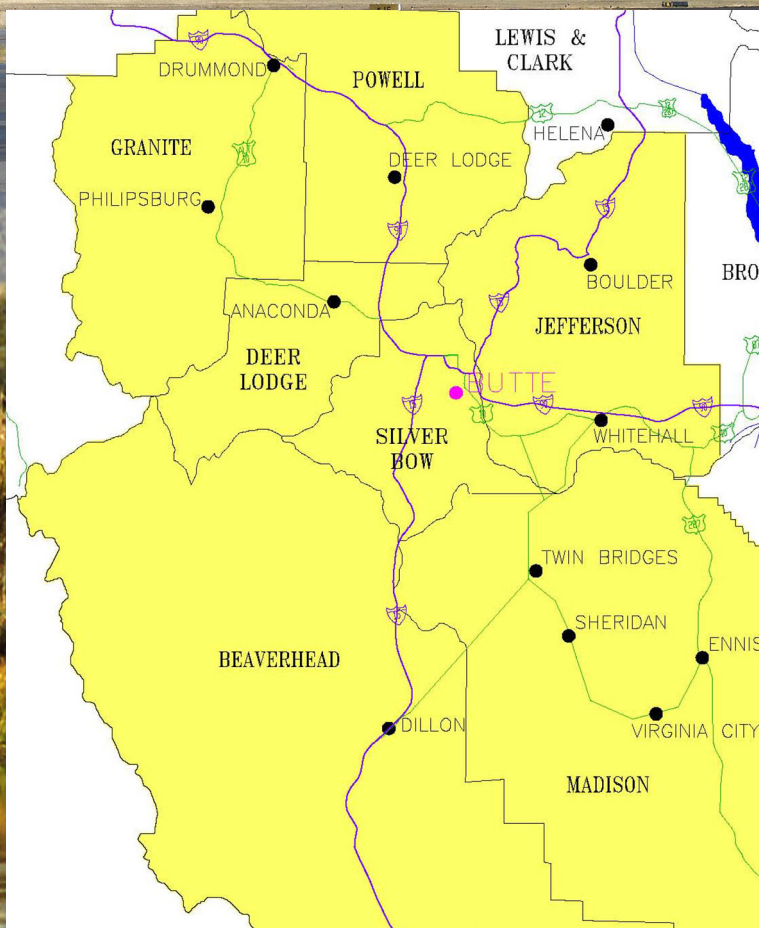
Sustainability Vision & Mission Statement

Vision Statement

Our vision for the Bert Mooney Airport is to become the hub of Southwest Montana, and a front-runner in sustainability in the Butte-Silver Bow region.

Mission Statement

Our mission is to operate the Bert Mooney Airport as a safe, efficient, and profitable business in a manner that promotes the region's prosperity and protects its quality of life.



Sustainable Categories

Economic Viability

Objective: Strive to operate as a financially viable business. Promote and encourage positive economic growth within the region.

Administration, Operations, and Maintenance

Objective: Increase sustainable practices in our daily operations, maximize operational efficiency, and reduce long-term maintenance costs.

Natural Resource Management

Objective: Work to minimize Bert Mooney Airport's impact on the biodiversity of the surrounding landscape.

Site Use and Sustainable Construction

Objectives: Review existing site usage to ensure optimal site design is in effect.
Incorporate sustainable planning, and design and construction policy objectives into all future Bert Mooney Airport projects.

Resources Efficiency: Energy – Demand Reduction & Power Generation

Objective: Reduce dependence on fossil fuels to the greatest extent feasible, and use clean and renewable energy sources to reduce greenhouse gas emissions.

Resources Efficiency: Water Quality Protection and Conservation

Objective:Maximize water efficiency, while optimizing opportunities to use free water. Minimize impacts on water quality.

Resources Efficiency: Waste Reduction and Materials Management

Objective:Reduce overall waste generated by and at the Bert Mooney Airport, and establish a sustainable materials management plan that is easy to implement.

Resources Efficiency: Atmosphere, Air, and Noise Pollution

Objective: Minimize Bert Mooney Airport's contribution to climate change, air pollution, and depletion of the ozone layer. Minimize airport related noise impacts on surrounding human and natural communities within technical, safety, and reasonable national and financial constraints.

Social and Community Relations

Objective: Continue to be a catalyst for positive economic development in the local and regional economies, a good neighbor, and a sustainable business that reflects our community's values.

Sustainability Checklist

We developed this plan as a guide for sustainable initiatives with specific action items. Our Sustainability Checklist of action items is included as Appendix A.

Economic Viability

Our objectives are to operate the Bert Mooney Airport as a financially viable business, and to promote and encourage positive economic growth within Butte-Silver Bow and southwest Montana. Economic Viability is the number one priority of the Bert Mooney Airport and the board of directors.

It is imperative that Bert Mooney Airport continues to be a financially viable airport in order to be sustainable. To continue to improve our financial viability we need to increase income by 5% over the next five years. To accomplish this, we need to:

1. Build a new LEED Silver Terminal

A contemporary airport requires specific configurations impossible to achieve in the current terminal. In order to attract additional airlines and new airport business, a new LEED Certified terminal needs to be built. LEED certification was selected to continue our commitment to become a proponent of sustainability in Butte-Silver Bow County. After evaluation of LEED v3 (2009), our consultants concluded LEED Silver Certification would be a minimum practical goal for our new terminal. The preliminary scorecard for the current preferred terminal design was developed in 2012 as part of our Master Plan (Appendix D.)

LEED certified buildings save money and resources and have a positive impact on the health of occupants and visitors, while promoting renewable, clean energy. - USGBC.org/WhyLEED

"I think if we build a nice new airport, people would use it more."

Butte High School student comment from community survey, May 2014

Economic Viability

2. Promote economic viability by exploring additional income opportunities that incorporate sustainable business practices.

Some opportunities to consider now and in the new terminal are:

a. Attract new airport business for additional income

As an additional income source, we will lease space in the new terminal to local businesses such as:

i. real estate agencies
ii. coffee shops
iii. gift stores/news agents
iv. tour operators
v. rack card operators
vi. healthy, energy efficient vending machines

b. Shuttle service for airlines to hotels (consider electric buses.)

c. Build enclosed advertising kiosks.

d. Rent wall space near baggage claim to local businesses for signage.

e. Evaluate both sides of security for potential future business opportunities.

f. Make the terminal a destination airport for private pilots.

3. Bert Mooney Airport Branding and Marketing Strategies

Develop a marketing plan that incorporates and promotes the new sustainability practices outlined in this Airport Sustainability Plan.

a. Marketing plan will emphasize sustainability, pride in the history of the Bert Mooney Airport, Butte, and Southwest Montana along with our desire to implement healthy, sustainable, long-term business practices to preserve and protect the residents and environment.
   i. Advertise our airport as a regional/community asset.
   ii. Brand the Bert Mooney Airport as a trend-setting, community airport.
   iii. Increase PR and brand awareness by joining local and national organizations that support and promote sustainability.
   iv. Plan-Do-Check-Act – use this system to ensure our marketing plan is effective. Set quantifiable goals.

b. Proactively work with Butte Chamber of Commerce, Butte Montana Visitors Bureau, Montana Office of Tourism, and Montana State Travel (visitmt.com) to promote Butte-Silver Bow County and Bert Mooney Airport.

c. Identify and apply for national, state, and local grants to support sustainability projects, tourism, and/or new local connectivity opportunities.

Economic Viability

4. Ensure local and regional businesses and residents are aware of Bert Mooney Airport's sustainable objectives and future growth plans.

a. Provide sustainability training and awareness presentations for staff and tenants.
b. Encourage private sector investment at or near the terminal.
c. Facilitate trade and tourism to the region through our marketing and by offering local businesses opportunities to advertise to travelers at the airport.
d. Communicate and actively engage with local and regional transit authorities to advance multiple transit connection opportunities.
    i. extension of city bus service through airport loop
    ii. multi-modal airport station
    iii. development on airport owned property not required for aviation
e. Continue to support local companies
    i. gas stations
    ii. restaurants
    iii. travel agencies
f. Use Bert Mooney Airport's website to advertise and communicate new sustainability practices.
    i. Include comments section for public input.

5. Offer competitive air service to regional travelers by adding at least one additional airline to our schedule.

a. Offer commercial airlines efficient and effective operations opportunities in our new terminal.
b. Design new, healthy work environments, for airline employees, which support retention of high quality, local staff.
c. Find ways to encourage other airlines to offer service at the Bert Mooney Airport.
d. Continue communications with Delta to ensure they continue their service and possibly add flights.

Administration, Operations & Maintenance

Our objectives are to increase sustainable practices in our daily operations, to maximize operational efficiency, and to reduce long-term maintenance costs.

Our strategy begins with Plan – Do – Check – Act. Our long-term objectives will require months and years of continuous analysis and action. We are currently in the first phase: Planning. This Airport Sustainability Plan is the major component of the planning phase.

1. Inventory existing Bert Mooney Airport operations and practices for comparing and reporting progress on sustainability objectives and action items.

Action Items

a. List office and administration resources usage including:
   i. supplies (Baseline Resource Usage Tables, Appendix G)
   ii. materials (Appendix G)
   iii. electricity (Appendix G)
   iv. water (Appendix G)

b. Analyze and report on existing airport usage in:
   i. utilities usage (Appendix G)
   ii. natural gas – baseline avg. of 3 yrs.
   iii. electricity – baseline avg. of 3 yrs.
   iv. water consumption – baseline 2013

c. Fuel consumption
   i. total fuel consumed by gallons (Appendix G)
   ii. airport vehicle fleet (Appendix G)
   iii. other equipment (mowers, etc.)

d. Waste volumes
   i. Grounds Maintenance
      A. irrigation
      B. fertilization
      C. human resources
   ii. Maintenance schedules
   iii. Purchasing practices (see #5 below)
   iv. Recycling efforts (see #4 below)
   v. Track maintenance costs for airport terminal, vehicles, and equipment.

Administration, Operations & Maintenance

2. Integrate sustainable practices into daily airport operations and maintenance.

Action Items

a. Develop language for all future leases, contracts, and agreements that supports Bert Mooney Airport's sustainability goals and objectives.

b. Develop an operations and maintenance manual outlining required procedures and schedules to maintain sustainable performances.

c. Hold regularly scheduled goal-setting meetings to establish and measure sustainability objectives.
   i. When practical, distribute meeting notes and documents electronically instead of on paper.
   ii. When printing is necessary, use recycled-content paper, and materials.

d. Emphasize the importance of our vision statement to staff, travelers, and the public by including it on our website, our marketing materials, and on signage throughout the airport.

e. Use and update the Airport Sustainability Plan regularly.

f. Evaluate and review all new programs and projects in terms of Bert Mooney Airport's sustainability objectives.

g. Establish continuous financing options for sustainability planning, evaluation and implementation.

3. Create a simple yet practical Sustainable Materials Management Plan as a guide for facility management in 2015. Include sections for the current and new terminals.

Action Items

a. Detail additional ideas for use Reduce, Reuse, and Recycle.

b. Include all materials purchased for use in operations and facilities.

c. Reduce reliance on waste disposal.

4. Reduce, reuse, and recycle.

Our airport is quite small (7 employees) and generates very little waste. For instance, our bin to collect soda cans takes more than two months to fill. The recycling program at the airport is voluntary with the staff taking the recycling in when it starts to collect. Butte-Silver Bow has initiated a new recycling program (Appendix I, and Butte-Silver Bow Website); Bert Mooney Airport will participate in and support this program as appropriate.

Action Items

a. Create a more formal recycling program designed to reduce waste and track recycling at the airport.
   i. Designate a recycling coordinator to be responsible for overseeing the Plan-Do-Check-Act Recycling Program.

ii. Utilize FAA Recycling Synthesis Document 2013 (Appendix J) and FAA Memorandum "Guidance on Airport Recycling, Reuse, and Waste Reduction Plans" 9/30/2014 (Appendix K) as guides to create the recycling program.
iii. Contact local recycling company for regularly scheduled pick-up of materials from the recycling receptacles. (Appendix I)
iv. Report on the Bert Mooney Airport website how much we recycle each month - through total weight or number of bags picked-up. This is another way to promote the airport as a sustainable business.

b. Continue to provide easily accessible recycling receptacles throughout existing and new facilities.
   i. Provide signs on or near the receptacles clearly outlining what should go into each container.
   ii. Train employees and janitorial staff to use and maintain recycling receptacles properly.

c. Airport staff will implement a Reduce, Reuse, Recycle Program in office operations.
   i. Recycle office paper.
      A. Reuse non-confidential papers as scratch pads.
      B. Put sheets back into printers that come out blank or with minimal text.
   ii. Implement electronic filing systems to reduce paper use and waste.
   iii. Set printers to default on draft settings to reduce ink use.
   iv. Refill ink cartridges on printers and copy machines at local businesses.

5. Use environmentally friendly and/or green products and equipment in all operations. Starting with the baseline year, increase the % of environmentally friendly or green/clean products 25% each year with a goal of at least 75% by 2017.

Action Items

a. Schedule meeting with current suppliers, explain our new sustainability objectives, and ask them to find out if they can provide environmentally friendly alternatives to supplies that we currently buy from them.

   If they cannot – seek out alternative local suppliers or find products online.

b. Purchase recycled content materials and items packaged in bulk and with recyclable packaging for such items as:
   i. toilet paper
   ii. paper towels
   iii. cups and utensils
   iv. garbage bags
   v. copy paper,
   vi. office supplies

c. Purchase environmentally friendly cleaning products to be used throughout the airport.
   i. Find and use local and/or regional companies to provide these products.
   ii. If not available locally, look online for distributors.

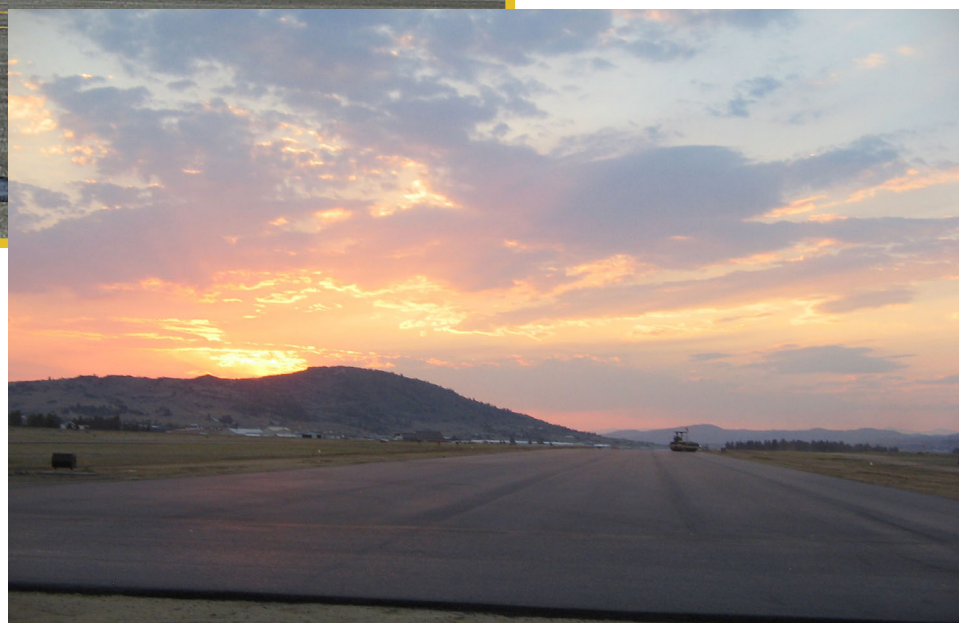
6. Encourage community involvement and support local and regional universities.

Action Items

a. Use airport property, where appropriate, for community education and enjoyment. This could include but not be limited to:
   i. school and university research projects (on topics such as environmental studies, biological/vegetation, stormwater, economic development, and aviation technology)
   ii. high school and Montana Tech internships
   iii. public educational tours on aviation and sustainability at the airport
   iv. public tours and engagements when military planes are on the grounds
   v. small social events & meetings
   vi. fund raisers (for non-profits such as Big Brothers & Big Sisters)
   vii. community connectivity (Appendix B)

b. Become known as a business environment that welcomes and encourages creative sharing of ideas and sustainable practices.

c. Engage local high school physics and Montana Tech engineering classes in Airport Sustainability Plan review.



Natural Resource Management

Our objective is to minimize Bert Mooney Airport's impact on the biodiversity of the surrounding landscape.

1. Preserve existing vegetation; maintain tree canopy, plant native trees, and shrubs in any new landscaping.

Action Items

a. No individual tree species shall exceed 10% of all future trees planted.

b. Use xeriscaping (landscaping with little or no irrigation) wherever possible.

c. Cover all open space with native plants/shrubs.

d. Do not use vegetation that attracts local wildlife.

e. Avoid using fertilizers and chemicals for landscape maintenance.

2. Reduce runoff at airport property boundaries.

Action Items

a. Install netting for erosion by 2016.

b. Build bio-swales and detention ponds for surface runoff.

c. Weed spray using environmentally friendly products by 2016.

d. Consider permeable pavement for roadways, shoulders, non-traffic pavements, maintenance roads, utility areas, and parking areas whenever possible.

e. During construction, consider removing, recycling, and reusing existing pavement that is no longer required.

3. Encourage increased human connections with the natural environment.

Action Items

a. Work with local planning board on a new sidewalk design for bike/walking route to town.

b. Make property available for community garden plots at south end of property, outside of fencing. This could mitigate wildlife challenges. Put this on the agenda to discuss at a board meeting in 2015 with a Plan-Do-Check-Act strategy for launch.

4. Minimize wildlife hazards at the Bert Mooney Airport.

Action Items

a. Use FAA Wildlife Hazard Mitigation (http://www.faa.gov/airports/airport_safety/wildlife/)

b. Participate in the FAA Wildlife Strike Database Project.
   i. Obtain and distribute "Report Wildlife Strikes" awareness posters from FAA. (http://wildlife.faa.gov/)

c. Manage wildlife in accordance with Bert Mooney Airport approved Wildlife Management Plan.

Site Use & Sustainable Construction

Our objectives are to review existing site usage to ensure optimal design and sustainability, and to incorporate sustainable planning, design, and construction policy objectives into all future Bert Mooney Airport projects.

1. Analyze runway and taxiway configurations to reduce departure delays in order to reduce fuel consumption and to provide for future increased air traffic.

Action Items

a. Create and complete a research project with Montana Tech students to provide data and information on current fuel consumption, and availability. Include recommendations for taxi and runway uses. Contact Montana Tech during first quarter 2015 to initiate this research project.

b. Create new runway approaches; move electronics so that fewer flights are canceled or diverted due to visibility.

c. Use the AEDT (Aviation Environmental Design Tool.) Contact the National Service Center (nsc@faa.gov) and request AEDT 2a in 2015. NSC will direct you to a software request form. AEDT is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise levels.

2. Establish a land acquisition program that provides for future airport growth, prevents future residential encroachment, and damage to green spaces. Include this program in any new terminal design strategy in 2015.

Action Items

a. Proactively work with the city and county to promote compatible land uses for properties adjacent to the airport.

b. Establish a relationship with a local Realtor. Ask them to consistently watch for adjacent properties coming on the market.

3. Analyze public parking design with consideration on traffic flow, increased usage, reduced idle times when exiting, and alternative options for short and long-term parking needs. Make sure this is included in any new terminal design strategy in 2015.

Action Items

a. Design parking with the traveler and staff in mind. Consider: drop-off, check-in, car rental, pick-up, long and short-term parking, and accessibility.

b. Prepare for new innovations, e.g. preferred parking for hybrids, charging stations for electric cars.

4. Design new environments for safety, health, and sustainability. Make sure this is included in any new terminal design strategy in 2015.

Action Items

a. Include the community, airport staff and tenant employees in new terminal design and evaluation process so that work environments support productivity, retention, and provide a safe, healthy, and environmentally friendly place to work.

b. In design, consider the traveler's needs in regards to food, necessities, local gifts, regional information, and access to ground transportation, Internet connectivity, electrical charging stations fueled by a photovoltaic system, easy security procedures, etc.

5. Develop a sustainable site plan for the new terminal and adjacent buildings. Make sure this is included in any new terminal design strategy in 2015.

A new terminal is desperately needed at the Bert Mooney Airport. Logistical, operations, and maintenance challenges abound. A preferred scheme/concept for a new terminal has been prepared. Reuse of salvageable parts of the existing building is paramount to providing space for support services as well as proceeding with a sustainable approach. LEED v3 (2009) will be used as an education, design, and construction sustainability tool.

The Bert Mooney Airport Authority has agreed to design and proceed through construction, toward a minimum of LEED Silver certification using LEED v3 (2009). We anticipate that once the design and construction teams are selected, a goal of LEED Gold will be pursued. The preliminary LEED Scorecard for the current preferred terminal design was developed as part of the Master Plan (Appendix D.)

6. Design and construct a water efficient terminal, and support buildings.

Action Items

a. Reduce water use in restrooms, showers, kitchen, and break rooms by at least 30% over conventional terminal building use within the first year of occupation of the new terminal. (Appendix G)

b. Reduce potable water use in landscaping around the terminal by at least 50% with a long-term goal of zero potable city water usage.

7. Design and construct energy efficient terminal and support buildings.

Action Items

a. Engage a Commissioning Authority responsible for fundamental and enhanced building systems commissioning.
   i. development of a training manual for facility managers
   ii. testing and balance of building
   iii. final sign-off that buildings meet Basis of Design (BOD) and Owner's Performance Requirements (OPRs)

b. Ensure terminal's Minimum Energy Performance exceeds International Energy Conservation Code (current version adopted by the US Department of Labor and Industry) by 20% or ASHRAE Standard 90.1 (current version) by 20%.

c. Install renewable energy systems on-site as are practical and financially feasible.

d. Reduce use of ozone-depleting refrigerants in the building systems.
    i. This includes zero use of HCFC, halon, and CFC-based refrigerants in HVAC&R equipment.
    ii. CFC phase-out conversion of current equipment and appliances

e. Install Building Monitoring Systems (BMS) as practical, to ensure measurement and verification of the building's performance.
    i. Install computer-alert/alarm capability for on and off-site facility management.

f. Support the local utility company in their efforts to use renewable power generation sources.

8. Design and construct terminal and support buildings that encourage occupant health and safety, productivity, and provide a welcoming experience for visitors.

Action Items

a. Ensure buildings meet Minimum Indoor Air Quality Performance as required in ASHRAE Standard 62.1 (current version).

b. Limit and control Environmental Tobacco Smoke (ETS) to designated areas.

c. Install outdoor delivery monitoring systems in the terminal and support buildings to ensure high quality health and safety of building occupants.

d. Ensure health and safety of airport staff, tenants, and visitors during remodeling and new construction by requiring an Indoor Air Quality (IAQ) Management Plan (Appendix E) for implementation during construction.
    i. air-quality test
    ii. building flush out prior to occupancy
    iii. install CO2 monitors during construction or remodel.

e. Choose zero- or low-emitting materials for installation in remodeled and new construction. This includes but is not limited to:
    i. adhesives
    ii. sealants
    iii. paints
    iv. coatings
    v. flooring systems
    vi. composite wood products
    vii. agri-fiber products

f. Institute indoor pollution source control by:
    i. installing walk-off mats at main entries
    ii. separately ventilate restrooms and closets where chemicals are stored or mixed
    iii. use MERV-13 or higher filters in the HVAC system to capture airborne particles

g. Ensure design of terminal and support buildings includes individual control of lighting systems and thermal comfort.

h. In multi-occupant spaces, allow lighting levels to be controlled either through a BMS, or on occupancy sensors, or utilize other strategies to facilitate delivery of appropriate daylight and/or light levels.

i. Provide views for 90% regularly occupied spaces in order to increase connection between built environments and the Butte-Silver Bow area.

9. Maximize use of recycled and sustainable materials for new construction and renovations.

Action Items

a. Recycle and reuse construction waste in accordance with the Construction Waste Management Plan (Appendix F.)
    i. Divert a minimum of 75% of construction waste from the landfill or incinerator.

b. Where practical, reuse and/or repurpose existing structures.
    i. Reuse at least 45% of existing terminal and support buildings, including but not limited to: existing walls, floors, and roof.
    ii. Salvage and reuse at least 5% of existing building materials.

c. Select materials that total, in aggregate, at least 20% recycled content (post and pre-consumer) based on total cost of materials installed in new terminal.

d. Select materials that total, in aggregate, at least 30% regionally harvested, extracted, or manufactured content within 500 miles of the airport, (percentage is based on total cost of materials installed in the project.)

e. Consider rapidly renewable materials (less than 10-year regeneration cycle) that are practical and durable for at least 2.5% of materials installed; percentage is based on total cost of materials installed in the project.

f. Work with contractors and vendors to identify a list of sustainable materials that are durable, long lasting, and natural to be considered for the project.

g. Avoid products that require frequent replacement or regular maintenance.

10. Strive for exemplary performance in sustainable design and construction of new terminal and support buildings, and any renovation projects.

Action Items

a. Training programs and regularly scheduled LEED updates will be agenda items, on at least a monthly basis, at construction meetings with contractor, and subcontractors.

b. Use new buildings as a teaching tool for the community on aviation, natural environments biodiversity, native plants), as well as sustainable design and practices.

Site Use & Sustainable Construction

11. Address regional priorities.

Action Items

a. Reduce demand and need for generation of grid-based power through a combination of public education on:
   i. the impact of human behaviors
   ii. sustainable strategies used in airport construction
   iii. efficient operations and maintenance
   iv. installation of on-site renewable energy systems

b. Establish purchasing guidelines and policies for Bert Mooney Airport construction and operations where purchasing local and regional products and services is a priority.

c. Demonstrate water conservation and efficiency through plumbing installations in:
   i. remodel and new construction
   ii. future planning for rainwater harvesting
   iii. development of a public education program

Resources Efficiency: Energy Demand Reduction

Our objectives are to reduce dependence on fossil fuels to the greatest extent feasible, and to use clean and renewable energy sources to reduce greenhouse gas emissions.

1. Reduce Bert Mooney Airport's energy consumption by 5% each year, or a total of 50% over the next ten years.

Action Items

a. Build a new LEED Silver Terminal.

b. Analyze the energy audit (Appendix H) read through recommendations to identify a comprehensive list of opportunities to reduce demand.

c. Set targets for on-site power generation.

d. Implement at least 20% of the energy conservation measures suggested in the energy audit each year (Appendix H.)

e. Establish airside lighting controls and procedures to turn off or reduce intensity of airside lighting (runway, taxiway, apron lights) at night or when not in use.

f. Implement a "Turn off your Lights and Computer" campaign to raise awareness on unnecessary energy usage in 2015.

g. Reduce dependence on fossil fuels to the maximum practical extent.

h. Open an Energy Star Portfolio Management Account and enter Bert Mooney Airport's facility information. Set a goal to increase the number each year starting with 2015. Analyze this data annually.

i. Install efficient light fixtures and controls such as LED's, daylight harvesting sensors, motion sensors, and chronologic timers throughout the airport in 2015.
    i. Use LED EXIT signs
    ii. LED runway lights
    iii. LED lights in parking lots

j. Install occupancy sensors to turn off lighting when rooms are unoccupied in the new terminal.

k. Clean or change furnace filters once a month during the heating season, starting in 2015.

l. Research efficient and variable-speed motors for baggage systems, escalators, and other airport systems for possible installation in the new terminal.

m. Encourage, recommend, and offer incentives to tenants to upgrade to Energy Star appliances. Require new concessions and tenants to use Energy Star appliances and machines ONLY.

n. Install a Building Management System to control and monitor the facility's mechanical and electrical equipment in the new terminal.

o. Commission and test the existing facility systems for the short term.

p. Reduce CFC's (chlorofluorocarbons often used as refrigerants, propellants, and solvents).

q. Reduce HFC's (hydro fluorocarbons) and HCFC's.

Resources Efficiency: Energy Demand Reduction

2. Find local and regional sources of alternative energy with an emphasis on clean and renewable energy sources.

Action Items

a. Investigate solar-powered signage for airfield, buildings, and property.
b. Investigate solar-powered and LED security lights.
c. Purchase renewable alternative energy generated off-site.
d. Use clean, renewable energy sources whenever possible.
e. Use local and regional sources whenever possible.
f. Investigate the use of wind turbines to generate electricity.
g. Analyze the possibility of installing solar photovoltaic panels on buildings or at ground level to create electricity.
h. Calculate advantages of solar thermal power to heat water.
i. Investigate alternative financing plans for installations of renewable power sources: e.g., Northwestern Energy, ESCO's, etc.

3. Investigate alternative transportation for reduction in energy use.

Action Items

a. Research conversion of airport fleet vehicles to alternative fuel models for future planning and implementation.
b. Encourage aircraft to use single-engine taxi procedures to reduce aircraft engine usage, save fuel, reduce emissions, and promote noise reduction strategies.
c. Collaborate with airlines and FBO's to investigate alternative fuel sources.
d. Promote energy efficient car rentals to both car rental companies and travelers starting in 2016.
e. Offer incentives to Bert Mooney Airport's staff, tenants, and travelers to use public transportation and alternative fuel vehicles.
f. Provide preferred parking for low-emitting, fuel-efficient vehicles, and car-pools (those vehicles carrying two or more people.)

Resources Efficiency: Water Quality Protect & Conserve

Our objectives are to maximize water efficiency, while optimizing opportunities to use free water, and minimize impacts on water quality.

1. Reduce potable city water consumption by more than 30% of calculated baseline consumption. (Appendix G)

Action Items

a. Calculate baseline consumption. (Appendix G)
b. Change three water sources currently in flat rate billing to metered rates by second quarter 2015.
c. Monitor and meter indoor and outdoor water usage.
d. Investigate systems to reclaim wash water.
e. Plan for future rainwater harvesting in landscaping. Discuss with landscaping staff in the first half of 2015.
f. Use recycled water at rental company car washes.
g. Install water efficient heating and cooling systems.
h. When repairing or replacing current fixtures, use low flow/automatic fixtures, toilets, and waterless urinals. New design plans should include these fixtures as well.
i. Install computer-controlled smart irrigation systems.
j. Install drip irrigation systems with rain gauge.
k. Limit high-maintenance landscaping. Include drought tolerant plant species in any landscaping or xeriscaping to reduce irrigation.

2. Reduce the composite runoff curve number for the site by 20%.

Action Items

a. Determine our Composite Runoff Curve Number (using NRCS TR-55 method) in 2015.
b. Develop a comprehensive stormwater pollution plan. Include on-going storm water sampling.
c. Consider designing storm water storage and conveyance systems to withstand heavier rainfall.
d. Explore rainwater harvesting for functional uses not requiring potable water for future planning and implementation.

3. Minimize the impact that wastewater disposal has on our city wastewater treatment system.

Action Items

Research and plan for future grey water use in toilet flushing.

Resources Efficiency: Waste Reduction

Our objectives are to reduce overall waste generated by and at the Bert Mooney Airport, and establish a sustainable materials management plan that is easy to implement.

1. Divert 75% of the waste stream generated by the Bert Mooney Airport offices and terminal by 2016.

Action Items

a. Create a more formal recycling program designed to reduce waste and track recycling at the airport.

b. Designate a recycling coordinator to be responsible for overseeing the Plan-Do-Check-Act Recycling Program.

c. Utilize FAA Recycling Synthesis Document 2013 (Appendix J) and FAA Memorandum "Guidance on Airport Recycling, Reuse, and Waste Reduction Plans" 9/30/2014 (Appendix K), as guides to create the recycling program.

d. Contact local recycling company for regularly scheduled pick-up of materials from the recycling receptacles. (Appendix I)

2. Continue to provide easily accessible recycling receptacles throughout existing and new facilities.

Action Items

a. Provide signs on or near the receptacles clearly outlining what should go into each container.

b. Train employees and janitorial staff to use and maintain recycling receptacles properly.

3. Support waste diversion through reducing use, maximizing recycling, and reusing materials throughout the terminal and facility operations.

Action Items

a. Educate staff and travelers on the benefits of reduced use of materials.

b. Bulk purchase office supplies to reduce packaging waste.

c. Set printers to default on draft settings to reduce ink use.

d. Refill ink cartridges on printers and copy machines at local businesses.

e. Install energy-efficient electric hand dryers to replace paper towels.

f. Explore cost effective methods of capture, filtration, and reuse of deicing glycol if current levels of service continues to rise.

g. Recycle oil, batteries, and pavement waste.

h. Use noise-reduction, mulching mowers to reduce landscape debris.

Resources Efficiency: Air & Noise Pollution

Our objectives are to minimize Bert Mooney Airport's contribution to climate change, air pollution, and depletion of the ozone layer. It is essential that we also minimize airport - related noise impacts on surrounding human and natural communities within technical, safety, and reasonable national and financial constraints.

1. Reduce noise impacts with the following actions.

Action Items

a. Use FAA Airport Noise Compatibility Planning Toolkit in 2015 http://www.faa.gov/airports/environmental/
b. Determine goal for reduced noise levels.
c. Continue to track noise complaints and formalize record keeping.
d. Post military exercise schedule on Bert Mooney Airport's and local news' websites, to warn neighbors of increased noise at those times.
e. When replacing airport operations and maintenance vehicles and equipment, purchase low-noise options.

2. Improve outside air quality with the following actions.

Action Items

a. Use FAA Air Quality Handbook http://www.faa.gov/airports/environmental/
b. Use VALE (Voluntary Airport Low Emissions Program). This program helps airports meet their air-quality objectives.
c. Use AIP funds and PFC's to finance low emission vehicles, refueling and recharging stations, and other airport air-quality improvements.
d. Reduce idling of planes, cars, delivery trucks (deliveries to planes and terminal.)
e. Use electric powered tugs to tow aircraft.
f. Use hybrid vehicles, ATV's, and/or golf carts throughout the airport.
g. Research the possibility of purchasing buses for a shuttle service to and from hotels and other businesses in Butte.
    i. Discuss bus service with Butte-Silver Bow Transit.
    ii. Explore possible shuttle routes for air travelers, and Bert Mooney Airport staff, taking into consideration flight arrivals and departures.
h. Develop preferred car rental parking or lot locations for car rental companies that offer low-emissions vehicles.
i. Encourage FBO's to install vapor recovery technology to recover evaporative hydrocarbons to prevent them from escaping into the atmosphere.
j. Enforce the No Smoking Policy.

Resources Efficiency: Air & Noise Pollution

3. Improve inside air quality in the new terminal.

Action Items

a. Follow an Indoor Air Quality (IAQ) Management Plan (Appendix E).

b. Follow LEED indoor air-quality principles:
   i. for HVAC operation, housekeeping, and maintenance,
   ii. for minimizing pollutants associated with renovations, painting, and pest control,
   iii. and for installed ductwork products that can be easily cleaned and protect against mold/fiber shredding

c. Install CO2 monitoring systems in the new terminal.

d. Use only low-emitting paints, sealants, adhesives, interior design materials, and cleaning supplies starting in 2015.

Social & Community Relations

Our objectives are to continue to be a catalyst for positive economic development in the local and regional economy, a good neighbor, and a sustainable business that reflects our community's values.

1. Economic Development

Action Items

a. Include Butte-Silver Bow and Southwest Montana in marketing and branding materials to increase business viability and image of the airport, and the area.

b. Reach out to local businesses interested in sustainability, e.g. Eco-friendly hotels

c. Increase our Diversity Suppliers for new projects (new terminal), and for products and businesses inside the new terminal during and after construction.

d. Encourage increased visitors and businesses to the area.

e. Foster partnerships between Bert Mooney Airport's new restaurant and concessions and local organic farmers (in the new terminal).

2. Education and Increased Awareness

Action Items

a. Collaborate with local schools and universities to help promote and advance Bert Mooney Airport's sustainability initiatives and educational opportunities and experiences (see Action Item #6a on page 13)

b. Effectively communicate all Bert Mooney Airport's sustainability initiatives to airport employees, airlines, tenants, travelers, delivery personnel, and residents of Butte-Silver Bow, starting in 2015.

c. Expand our education program. Include subjects on sustainability, airport history, and the history of mining in our community.

d. Offer internships to students from local high schools and Montana Tech.

e. Provide education and sustainability tours, and presentations on changes made to improve sustainability.

f. Hold public awareness gatherings with food & drinks out on the lawn with Sustainability Stations using LEED categories of Site, Water, Energy, etc., or use Airport Sustainability Plan categories in 2015. Make this a laid-back, community event with participation by the airport board and staff, and sustainability consultants. Include Montana Tech, and Butte high school if appropriate. A community event will be scheduled annually.

3. Social & Community Involvement

Action Items

a. Support local, social sustainability initiatives. For example, San Diego Airport has "Our Quieter Home Program" funded through FAA grants, which has sound-insulated nearly 2500 homes affected by airport operations.

b. Include political leaders, Bert Mooney Airport Authority Board, airlines, tenants, staff, and local community members in on-going airport improvement initiatives.

c. Consider hosting community events on Arbor Day or Earth Day to encourage involvement, education, and awareness. Communicate with Montana organizations conducting such events.

d. Proactively encourage public involvement in sustainability procedures and process. At a minimum, two presentations, open to the public, will be held at the airport once the new terminal is complete.

e. Beautify the airplane in front of the airport. Explore alternative ways to utilize the monument.

f. Voluntarily include the public to enhance Bert Mooney Airport's reputation as a transparent, responsible, sustainable local business.

g. Hold public meetings at convenient times.

h. Let the public know their opinions have been heard. Report on public meetings through Bert Mooney Airport's website and post board meeting minutes. Put Sustainability Checklist (Appendix A) on the website with an online comments section for public response.

i. Address motivations (of Bert Mooney Airport Authority, politicians, staff, residents), find synergies where they occur naturally and focus on those ideas.

j. Post plaques and photos on the walls of the terminal showing:
    i. things to do, places to go in the Butte-Silver Bow area
    ii. nature, landscapes, wildlife
    iii. historical mining images
    iv. educational plaques on sustainability, history of Butte, history of mining in Butte, aviation, etc.

k. Make creating education and community partnerships part of the Airport's standard operating procedures.

l. Collaborate with community health improvements led by organizations such as Butte Cares Coalition, Butte-Silver Bow Tobacco Prevention, Butte-Silver Bow Environmental Health Division, St. James Health Care, Community Health Center, Mercury Street Medical, Rocky Mountain Clinic, A.W.A.R.E., Western Montana Mental Health Services, Department of Family Services, and the Butte Literacy Program.

m. Request and schedule community input presentations at Elks Lodge, American Legion, Belmont Senior Citizen Center, Silver Bow Kiwanis, Butte Gun Club, Butte Local Development Corporation, and other public speaking opportunities.

Resources

FAA Resources

FAA – Environmental Program/Airport Sustainability: http://www.faa.gov/airports/environmental/sustainability/

FAA – Environmental Staff - Planning and Environmental Division: http://www.faa.gov/about/office_org/headquarters_offices/arp/offices/app/app400/environmental/

FAA - Report on the Sustainable Master Plan Pilot Program and Lessons Learned, 2012: http://www.faa.gov/airports/environmental/sustainability/media/SustainableMasterPlanPilotProgramLessonsLearned.pdf

FAA – Voluntary Airports Low Emissions Program: http://www.faa.gov/airports/environmental/vale/

FAA – Airport Improvement Programs – GRANTS: http://www.faa.gov/airports/aip/

FAA Interim Guidance Sustainable Master Plan, Elliott Black, 2010: http://www.faa.gov/airports/environmental/sustainability/media/interim_guidance_sustainable_master_plan_pilot.pdf

Airport Master Plans, FAA Advisory Circular 150/5070-6B:

http://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.cur rent/documentNumber/150_5070-6

FAA – Guidance on Airport Recycling, Reuse, and Waste Reductions Plans, Frank SanMartin & Danielle Rinsler, September 30, 2014 (See Appendix K)

FAA – *Recycling, Reuse, and Waste Reduction at Airports – A Synthesis Document,* April 24, 2013 (See Appendix J)

Airports Studied

1. Hartsfield-Jackson Atlanta International Airport http://www.atlanta-airport.com/docs/Airport/Sustainability/Sustainable%20Management%20Plan.pdf

2. Ithaca Tompkins Regional Airport http://flyithaca.com/content/view/sustainable-airport-master-plan.html

3. Teterboro Airport – Teterboro Sustainable Management Plan

4. Newton City-County Airport http://www.faa.gov/airports//environmental/sustainability/media/EWKSustainableMasterPlan.pdf

5. Northeast Florida Regional Airport http://www.flynf.com/p58-Sustainability-Management-Plan.aspx

6. Chicago - Chicago Department of Aviation Sustainable Airport Manual (SAM)

Environmental Purchasing Policy

Seattle http://www.portseattle.org/Environmental/Materials-Management/Green-Purchasing/Pages/default.aspx

Resources

Online & Other Resources

U.S. Green Building Council – www.usgbc.org LEED NB&C 2009 (v3)

Airports Going Green: http://www.airportsgoinggreen.org/sustainable-airport-manual.aspx

ACRP's Sustainability Synthesis 10 Report, *Airport Sustainability Practices*, 2008:

http://www.trb.org/CRP/ACRP/ACRP.asp

Environmental Protection Agency – Sustainability: http://www.epa.gov/Sustainability/

Airports Council International, North America – Environmental Affairs Committee:

http://www.aci-na.org/committees/enviro_main

Sustainable Airport Guidance Alliance (SAGA): http://www.airportsustainability.org/

SAGA Sustainability Spreadsheet – Sustainable Measures for the Aviation Industry

Chicago Department of Aviation Sustainable Airport Manual (SAM)

Florida Airports Sustainability Initiatives: http://www.floridaairports.org/sustainability.cfm

Airport Deicing Effluent Guidelines: http://water.epa.gov/scitech/wastetech/guide/airport/

Transportation Research Board – Guidebook for Managing Small Airports Report #16 http://www.trb.org/main/blurbs/162145.aspx

Noise abatement Procedures Plan

Seattle http://www.portseattle.org/Environmental/Noise/Noise-Abatement/Pages/Procedures.aspx

San Francisco http://www.flysfo.com/community-environment/noise-abatement

Financial Assistance

Financial Assistance Matrix on Programs Available to Fund Water, Wastewater, and Solid Waste Projects in Montana - PDF from 2011

Montana Department of Commerce - Community Development Block Grant: http://cdbged.mt.gov/default.mcpx

Butte-Silver Bow County Resources

Butte Uptown Urban Renewal Plan – 2014 PDF

City and County of Butte-Silver Bow Recycling: http://co.silverbow.mt.us/475/Recycling

Butte Bus System http://www.buttebus.org

APPENDICES

APPENDIX A – Sustainability Action Items Checklist & Inventory

Sustainability Action Items - Checklist & Inventory
Bert Mooney Airport (BMA), Butte, Montana
2014

P = In Progress, C = Complete, F = Future **Page Numbers Reference BMA Su**

Pgs. 7-9	Economic Viability	Comments
C	Shuttle service for airline personnel to hotels	
C	Wireless Internet Service	Complimentary
C	Rent billboard signage space on walls near baggage claim	Have some, more planned for new terminal
C	Facilitate trade and tourism to the region	Increased advertising throughout SW MT
P	Develop Airport Sustainability Plan	BMA Sustainability Management Plan (ASP)
P	Provide sustainability training and awareness presentations for staff and tenants	Presentations to staff, board and informally tenants
P	Build a new LEED Terminal – minimum Silver	Plan to bid first quarter 2015
P	Encourage private sector investment at or near the terminal	
P	Communicate with local transit authorities - city bus service	1 city bus will make loop through airport
P	Continue to support local companies (gas, restaurants, travel agencies, etc.)	
P	Use website to communicate new sustainability practices	Blog started, will update more often with ne terminal construction
F	Create a new branding & marketing plan announcing new sustainability practices	
	Proactively work with Chamber of Commerce, Visitors Bureau, MT Office of Tourism, Montana State Travel	
	Apply for national, state and local grants to support sustainability projects, tourism, or new connectivity opportunities	Small Community Air Service Development Program Grant Application (http://www.airlineinfo.com/ostpdf84/805.pd
F	Build ad kiosks for local businesses to advertise and market to travelers	Planned for new terminal
F	Evaluate both sides of security for business opportunities	New terminal, secure side energy efficient vending machines
F	Prioritize projects that improve and encourage airport connectivity	New terminal
F	Create physical facilities for efficient and effective operations	New terminal
F	Offer working environment that retains high quality local staff	New terminal

Sustainability Action Items - Checklist & Inventory
Bert Mooney Airport (BMA), Butte, Montana
2014

P = In Progress, C = Complete, F = Future **Page Numbers Reference BMA Su**

Pgs. 10-13	Administration, Operations & Maintenance	Comments
C	Distribute meeting notes and documents electronically (no paper)	
C	Create a sustainability vision & mission statement	See page 2 of BMA ASP
C	Inventory operations and practices for reporting progress	See Energy Audit and this Checklist
P	Integrate sustainable practices into airport operations & maintenance	
P	Hold regularly scheduled goal-setting meetings to establish and measure sustainability goals	
P	Use and update the sustainability management plan (BMA ASP) regularly	
P	Evaluate and review all new programs and projects in terms of BMA's sustainability goals.	
P	Seek out and include staff, tenant, and visitor input on sustainability	
P	Establish continuous financing options for sustainability planning	Grants, sponsors, state or national funding, VALE
P	List office and administration resources usage including: supplies, materials, electricity, water	Data collected, future analysis with new terminal
P	Utilities: natural gas, electricity, water	
P	Fuel consumption: airport vehicles, other equipment; mowers, etc.	
P	Waste volumes	
P	Grounds Maintenance: irrigation, fertilization, human resources	
P	Maintenance schedules	
P	Purchasing practices	
P	Recycling efforts: office supplies & products, staff use (water bottles, etc.)	
P	Track maint. costs for terminal, vehicles and equipment	
	Reduce, Reuse, Recycle	
P	Provide recycling receptacles with signage	
P	Train employees and janitorial staff to use and maintain receptacles	
P	Local recycling company can pick-up materials at the terminal	
P	Encourage restaurant inside the terminal to buy recycled products: plates, cutlery, cups, lids, etc.	
P	Use environmentally friendly products and equipment in all operations.	Pursuing financial incentives for electric vehicles

P = In Progress, C = Complete, F = Future		Page Numbers Reference BMA Su
P	Purchase recycled content materials: toilet paper, paper towels, cups & utensils, garbage bags, etc.	
P	Use airport property, where appropriate, for community education and enjoyment. This could include but not be limited to:	
P	school and university research projects (on topics such as environmental studies, biological/vegetation, stormwater, economic development, and aviation technology)	
P	high school and Montana Tech internships	
P	public educational tours	
P	small social events & meetings	
P	fundraisers	Big Brothers & Big Sisters
P	community connectivity	
P	Become known as a business that welcomes and encourages creative sharing of ideas and sustainable practices. Use examples in the new marketing program.	Severely limited by total airline approval requirement for all ads
F	When printing, use recycled content paper and materials	
F	Purchase environmentally friendly cleaning products for the airport	
F	Emphasize importance of vision & mission statements by using on signage throughout airport	
F	Develop language for all future leases, contracts, and agreements that supports BMA's sustainability goals and objectives.	
F	Develop an operations & maintenance manual with required procedures and schedules to maintain sustainable performance	Part of commissioning on new terminal
Pg. 14	**Natural Resource Management**	**Comments**
C	Cover open space with native plants	
C	Avoid vegetation that attracts local wildlife	
C	Reduce runoff at property boundaries	
C	Install erosion netting	
C	Build bio-swales	Detention ponds
C	Manage wildlife in accordance to BMA approved Wildlife Management Plan	See BMA Wildlife Management Plan
P	Preserve existing vegetation	
P	No individual tree species shall exceed 10% of trees planted	
P	Use xeriscaping where possible	
P	Avoid using fertilizers and chemicals for landscaping	

P = In Progress, C = Complete, F = Future		Page Numbers Reference BMA Su
P	Weed spray	Reduced to 1x per year, required by County
P	During Construction, consider removing, recycling and reusing pavement that is no longer required.	
P	Minimize wildlife hazards	
P	Participate in the Wildlife Strike Database	http://wildlife.faa.gov/
P	Obtain and distribute "Report Wildlife Strikes" awareness posters from FAA	Contact FAA for new posters
P	Work with state wildlife agencies to ensure wildlife habits, pathways, and environments are considered in regard to safe airport operations	
F	Use permeable pavement for roadways, shoulders, non-traffic, maint. roads, utility areas, and parking when possible	
F	Encourage human connections with natural environment.	
F	Connect bike-walking trail to town	
F	Make property available for community garden plots at south end of property, outside of fencing. Could mitigate wildlife challenges.	
F	Use FAA Wildlife Hazard Mitigation Website	http://www.faa.gov/airports/airport_safety
Pgs. 15-19	**Site Use & Sustainable Construction**	**Comments**
C	continued development of property for quantity and quality control, if allowable by Bert Mooney Airport Wildlife Management Plan	See BMA Wildlife Management Plan
C	Analyze runway and taxiway configurations to reduce departure delays in order to reduce fuel consumption	See BMA Master Plan
C	Establish a land acquisition program that provides for future growth, prevents residential encroachment and damage to green spaces, and supports development of wetlands/natural environment.	
C	Proactively work with city and county to promote airport compatible land uses for adjacent properties	
C	Analyze public parking design, consider future traffic flow, reduced idle times, alternative options for short and long-term parking	Parking lot construction 2014
C	Design parking with traveler in mind. Consider drop-off, check-in, car rental, passenger pick-up, various parking, and accessibility	
P	Develop a sustainable site plan for new terminal and adjacent buildings	
P	Evaluate upcoming innovations: solar powered charging stations, electricity stations, preferred parking for hybrids	Investigating AIP funds and VALE

P = In Progress, C = Complete, F = Future		Page Numbers Reference BMA Su
P	Include staff and tenants in new terminal design and evaluation process to support productivity, retention and a safe, healthy, pleasing place to work	Daylight and views for all full-time staff - essential
P	In design, consider the traveler's needs: food, necessities, local gifts, regional activities, lodging, access to ground transport., Internet connectivity, electrical charging stations, easy security procedures, etc.	
P	Design and construct a water efficient terminal, and support buildings.	
P	Reduce water use in restrooms, showers, kitchen, and break rooms by at least 30% over conventional terminal building use.	
P	Reduce potable water use in landscaping around the terminal by at least 50% with a long-term goal of zero potable city water usage.	
P	Design and construct energy efficient terminal and support buildings.	
P	Engage a Commissioning Authority responsible for fundamental and enhanced building systems commissioning.	
P	development of a training manual for facility managers	
P	testing and balance of building	
P	Ensure terminal's Minimum Energy Performance exceeds International Energy Conservation Code by 20% or ASHRAE Standard 90.1 by 20%.	
P	Install renewable energy systems on-site as are practically and financially feasible	
P	Reduce use of ozone-depleting refrigerants in the building systems.	
P	This includes zero use of HCFC, halon, and CFC-based refrigerants in HVAC&R equipment.	
P	CFC phase-out conversion of current equipment and appliances	
P	Install Building Monitoring Systems (BMS) to ensure measurement and verification of the building's performance.	
P	Install computer-alert/alarm capability for on and off-site facility management.	
P	Support the local utility company in their efforts to use renewable power generation sources.	
P	Construct a terminal to encourage occupant health and safety, productivity and enjoyment	
P	Ensure buildings meet Minimum Indoor Air Quality Performance as required in ASHRAE Standard 62.1	
P	Limit and control Environmental Tobacco Smoke (ETS) to designated areas	
P	Install outdoor delivery monitoring systems to ensure high quality health and safety of occupants	

P = In Progress, C = Complete, F = Future		Page Numbers Reference BMA Su
P	Ensure health and safety of airport staff, tenants, and visitors during remodel and new construction by using an Indoor Air Quality (IAQ) Management Plan	
P	air-quality test	
P	building flush out prior to occupancy	
P	install CO2 monitors during construction or remodel	
P	Choose Zero or low-emitting materials for installation, including:	
P	adhesives	
P	sealants	
P	paints	
P	coatings	
P	flooring systems	
P	composite wood products	
P	agri-fiber products	
P	Institute indoor pollution source control by:	
P	installing walk-off mats at main entries	
P	separately ventilate restrooms and closets where chemicals are stored or mixed	
P	use MERV-13 or higher filters in the HVAC system to capture airborne particles	
P	Ensure building design includes individual control of lighting systems and thermal comfort.	
P	Provide views for 90% regularly occupied spaces in order to increase connection between built environments and the natural environment	
P	Maximize use of recycled and sustainable materials for new construction and remodels	
P	Management Plan	
P	Divert a minimum of 75% of construction waste from the landfill or incinerator.	
P	Where practical, reuse and/or repurpose existing structures.	
P	Reuse at least 45% of existing terminal and support buildings, including but not limited to: existing walls, floors, and roof.	
P	Salvage and reuse at least 5% of existing building materials.	
P	Select materials that total, in aggregate, at least 20% recycled content (post and pre consumer) based on total cost of materials installed in new terminal.	

Sustainability Action Items - Checklist & Inventory
Bert Mooney Airport (BMA), Butte, Montana
2014

P = In Progress, C = Complete, F = Future		Page Numbers Reference BMA Su
P	Select materials that total, in aggregate, at least 30% regionally harvested, extracted, or manufactured content within 500 miles of the airport	
P	Consider rapidly renewable materials (less than 10-year regeneration cycle) that are practical and durable for at least 2.5% of materials installed	
P	Work with contractors and vendors to identify a list of sustainable materials that are durable, long lasting, and natural for the project	
P	Avoid products that require frequent replacement or regular maintenance.	
P	Strive for exemplary performance in sustainable design & construction	
P	Use new buildings as a teaching tool on aviation, natural environments (wetlands, biodiversity, native plants, etc.), as well as sustainable design and practices.	
P	Address regional priorities	
P	Reduce demand and need for generation of grid-based power through a combination of public education on:	
P	the impact of human behaviors	
P	sustainable strategies used in airport construction	
P	efficient operations and maintenance	
P	installation of on-site renewable energy systems	
P	Establish purchasing guidelines and policies for BMA construction where purchasing	
P	Demonstrate water conservation and efficiency through plumbing installations in:	
P	remodel and new construction	
P	future planning for rainwater harvesting	
P	develop a public education program	
F	Create research project with MT Tech students to provide data on current fuel consumption.	
F	Obtain the AEDT (Aviation Environmental Design Tool) through the National Service Center.	

Sustainability Action Items - Checklist & Inventory
Bert Mooney Airport (BMA), Butte, Montana
2014

P = In Progress, C = Complete, F = Future **Page Numbers Reference BMA Su**

Pgs. 20-21	Energy - Demand Reduction & Power Generation	Comments
P	Reduce energy consumption by 5% each year, or 50% in next 10 years	
P	Conduct a thorough energy audit to identify opportunities to reduce demand	This will be completed prior to FINAL draft o the BMA ASP
P	Set targets for on-site power generation	
P	Implement at least 20% of the measures suggested in the energy audit each year.	
P	Establish airside lighting controls and procedures to turn off or reduce intensity of airside lighting (runway, taxiway, apron lights, etc.) at night or when not in use	
P	Reduce dependence on fossil fuels to the maximum practical extent.	
P	Open an Energy Star Portfolio Management Account with BMA's facility information. Set a goal to increase the number each year. Analyze data annually.	
P	Install efficient light fixtures and controls such as LED's, daylight harvesting sensors, motion sensors, and chronologic timers throughout the airport.	
P	Install occupancy sensors to turn off lighting when rooms are unoccupied.	
P	Clean or change furnace filters once a month during heating season	
P	Research efficient and variable-speed motors for baggage systems, moving walkways, escalators, and other airport systems.	
P	Encourage, recommend, and offer incentives to concessions and tenants to upgrade to Energy Star appliances.	
P	Install a Building Management System (BMS) to control and monitor the facility's mechanical and electrical equipment.	
P	Commission and test the existing facility systems	
P	Reduce CFC's (chlorofluorocarbons often used as refrigerants, propellants, and solvents).	
P	Reduce HFC's (hydro fluorocarbons) and HCFC's	
P	Find local and regional sources of alternative energy sources	
P	Install solar-powered signage for airfield, buildings, and property.	
P	Install solar-powered security lights.	
P	Purchase renewable alternative energy generated off-site.	
P	Use clean, renewable energy sources whenever possible.	
P	Use local and regional sources whenever possible.	

P = In Progress, C = Complete, F = Future **Page Numbers Reference BMA Su**

P	Investigate the use of wind turbines to generate electricity.	
P	Analyze solar photovoltaic panels to create electricity.	
P	Calculate advantages of solar thermal power to heat water.	
P	Investigate alternative financing plans for installations of renewable power sources: e.g., Northwestern Energy, ESCO's, etc.	
P	Investigate alternative transportation possibilities for reduced energy usage.	
P	Research conversion of airport fleet vehicles to alternative fuel models for future planning and implementation.	
P	usage, save fuel, reduce emissions, and promote noise reduction strategies.	
P	Collaborate with airlines and FBO's to investigate alternative fuel sources.	
P	Promote energy efficient car rentals to both car rental companies and travelers.	
P	Offer incentives to BMA's staff, tenants, and travelers to use public transportation and alternative fuel vehicles.	
P	Provide preferred parking for low-emitting, fuel-efficient vehicles, and car-pools (those vehicles carrying two or more people.)	
F	Implement a "Turn off your Lights & Computer" campaign to raise awareness of unnecessary energy usage.	From FAA Sustainability Planning Pilot Progr
F	Use LED EXIT signs	
Pg. 22	**Water Quality Protect & Conserve**	**Comments**
C	Limit high-maintenance landscaping. Include drought tolerant plant species in any landscaping or xeriscaping to reduce irrigation.	
P	Reduce potable city water consumption by more than 30% of calculated baseline consumption	
P	Calculate baseline consumption.	
P	Monitor and meter indoor and outdoor water usage.	
P	Investigate systems to reclaim wash water.	
P	Plan for future rainwater harvesting in landscaping.	
P	Use recycled water at rental company car washes.	
P	Install water efficient heating and cooling systems.	
P	When repairing or replacing current fixtures, use low flow/automatic fixtures, toilets, and waterless urinals. New design plans should include these fixtures.	

P = In Progress, C = Complete, F = Future | Page Numbers Reference BMA Su

P	Install computer-controlled smart irrigation systems.	
P	Install drip irrigation systems with rain gauge.	
P	Reduce the composite runoff curve number for the site by 20%	
P	Determine our Composite Runoff Curve Number (using NRCS TR-55 method.)	
P	Develop a comprehensive stormwater pollution plan. Include on-going storm water sampling.	
P	Minimize the impact that wastewater disposal has on city wastewater treatment system.	
F	Consider designing storm water storage and conveyance systems to withstand heavier rainfall.	
F	Explore rainwater harvesting for functional uses not requiring potable water for future planning and implementation.	
F	Study and plan for future grey water use in toilet flushing	
Pg. 23	**Waste Reduction**	**Comments**
C	Recycle oil, batteries, and pavement waste.	
P	composting food waste, and investigate additional waste stream management	
P	Educate staff and travelers on the benefits of reduced use of materials.	
P	Divert 75% of the waste stream generated by the BMA offices and terminal by 2015.	
P	Recycle office paper.	
P	Reuse non-confidential papers as scratch pads.	
P	Put sheets back into printers that come out blank or with minimal text.	
P	Implement electronic filing systems to reduce paper use and waste.	
P	Bulk purchase office supplies to reduce packaging waste.	
P	Set printers to default on draft settings to reduce ink use.	
P	Refill ink cartridges on printers and copy machines at local businesses.	
P	Install energy-efficient electric hand dryers to replace paper towels.	
P	Explore successful methods of capture, filtration, and reuse of deicing wastewater.	
P	Encourage supply chain and waste contractors to recycle and recover.	
F	Implement 100% disposal of used de-icing fluid within a 25-mile radius of the airport by 2015.	
F	Use noise-reduction, mulching mowers to reduce landscape debris.	

P = In Progress, C = Complete, F = Future | Page Numbers Reference BMA Su

F	Create an effective Sustainable Materials Management Plan as a guide for facility management.	
F	Explain ideas for use reduction, reuse, and recycle.	
F	Include all materials purchased for use in operations and facilities.	
F	Minimize reliance on waste disposal.	
Pgs. 24-25	**Air and Noise Pollution**	**Comments**
C	Research the possibility of purchasing buses for a shuttle service to and from hotels and other businesses in Butte.	
C	Discuss bus service with Butte-Silver Bow Transit.	Plan for city bus on Harrison to loop into air
C	Explore possible bus/shuttle routes for air travelers, and staff, taking into consideration flight arrivals and departures.	Service to 5 hotels
C	Consider airport-hotel shuttle schedules for over-night airline staff.	
C	Develop preferred car rental parking or lot locations for car rental companies that offer low-emissions vehicles.	Future challenge: appropriate recreational v
C	Develop an Indoor Air Quality (IAQ) Management Plan.	Appendix B of BMA ASP
P	Use VALE (Voluntary Airport Low Emissions Program), includes financing options.	faa.gov/airports/environmental/vale/
P	Reduce noise impact	
P	Use FAA Airport Noise Compatibility Planning Toolkit	http://www.faa.gov/airports/environmenta
P	Continue to track noise complaints and formalize record keeping.	
P	Improve outside air quality	County monitor in place, overseen by Count
P	Use FAA Air Quality Handbook	http://www.faa.gov/airports/environmenta
P	Reduce idling of planes, cars, delivery trucks (deliveries to planes and terminal.)	
P	Use electric powered tugs to tow aircraft.	Actively pursuing funds for electric vehicles
P	Enforce the No Smoking Policy.	
P	Improve inside air quality	
F	When replacing airport operations and maintenance vehicles and equipment, purchase low-noise options.	
F	Use hybrid vehicles, ATV's, and/or golf carts throughout the airport.	
F	Encourage FBO's to install vapor recovery technology to recover evaporative hydrocarbons to prevent them from escaping into the atmosphere.	
F	Follow LEED indoor air-quality principles:	

P = In Progress, C = Complete, F = Future **Page Numbers Reference BMA Su**

F	For HVAC operation, housekeeping, and maintenance as well as minimizing pollutants associated with renovations, painting, and pest control.	
F	Install ductwork products that can be easily cleaned and protect against mold/fiber shredding.	
F	Install permanent CO2 monitoring systems.	
F	Use only low-emitting paints, sealants, adhesives, interior design materials, and cleaning supplies by 2015.	
Pgs. 26-27	**Social & Community Relations**	**Comments**
P	Increase community involvement	
P	Collaborate with schools and universities (see #6a, pg. 13 of BMA ASP)	
P	Encourage BMA's restaurant and concessions to purchase organic food from local farmers	
P	Inform and involve the community	
P	Effectively communicate all BMA's sustainability initiatives to airport employees, airlines, tenants, travelers, delivery personnel, and residents of Butte-Silver Bow.	
P	Include political leaders, BMA's Authority Board, airlines, tenants, staff, and local community members in on-going airport improvement initiatives.	
P	Voluntarily include the public to enhance BMA's reputation as a transparent, responsible, sustainable local business.	
P	Hold public meetings at convenient times.	
P	Let the public know their opinions have been heard. Report on public meetings through BMA's website.	
P	Address motivations (of BMA Authority, politicians, staff, residents), find synergies where they occur naturally and focus on those ideas.	
P	Offer internships to students from local high schools and Montana Tech.	
P	Provide education and sustainability tours, and presentations on changes made to improve sustainability.	
P	Encourage visitors to the area.	
P	Include Butte-Silver Bow and Southwest Montana in marketing and branding materials to increase business vitality and image of the airport, and the area.	

APPENDIX B - Community Surveys

Questions for students:

The Bert Mooney Airport Authority is working on a Sustainability Plan in an effort to improve our operations and facilities, and become a frontrunner in sustainability in the Butte-Silver Bow region. As the future generation of leaders in our community, we would like your ideas, comments, and feedback on the draft version of this plan.

In addition, we would like your answers to the following questions:

1. If you were designing the new airport terminal at Bert Mooney Airport, what would your top priorities be in regards to our sustainability categories of: (include as many as you wish)
    a. Economic Viability

    b. Environmental Awareness

    c. Community Connectivity

2. What businesses and services do you think would be useful in a new terminal to travelers to this area?

3. What kind of information do you think should be at the terminal to show travelers what Butte-Silver Bow County has to offer?

4. If the Airport Authority started new programs in conjunction with your school, would you be interested in participating in any of the following: (Circle YES or NO)
    a. Research projects (on topics such as environmental studies, biology/vegetation, natural habitats, energy conservation, alternative energy sources, stormwater, economic development, and aviation technologies). YES NO (circle topic if interested)
    b. Student internships YES NO
    c. Public educational tours on sustainability, airport history, and regional history & information YES NO

5. Think 20-50 years from now. How would you like to be able to describe the airport? If you and your family were taking a tour, what would you like to see in the buildings and in the operations and maintenance process?

Summary of Student Survey

Bert Mooney Airport Sustainability Plan

Social & Community Relations

Summary of Student Questionnaires

QUESTION #1

Priorities for new airport terminal

Economic Viability	Recycling	
	Trash bags	
	A lot of money	
	Safety	
	Bring people into the community	
	It would be good for our community to spend money on things like this	
	Kill the herd of deer in the field by the airport	
	More people, more money	
	Go green, more arrivals and fly out times for more places	
	Hotel	
	Improve airport restaurant	
	More outlets for charging phones, Wi-Fi	
	More stores	
	Too expensive but enough to make people happy when they need to go to the airport	
	More food and bathroom choices	
	Do we need another terminal? Taxpayer's money along with federal funds for what? Another terminal to Salt Lake at 4 a.m.?	
	I have no idea what economic stuff is going on.	
	Economic vitality is important. It would bring more money.	x
	Yes, I think if we build a new nice airport, people would use it more.	
Environmental Awareness	No littering	x
	Solar Panels	x
	People learning about Montana	
	Keep animals away or in a fence	
	Shopping mall	
	More travel destinations	
	More convenient times	
	More monuments	
	Fence instead of killing the deer	
	Don't destroy any environmental or habitats that are important.	
	That should be a concern	
	Use local materials	

Community Connectivity	Bringing families together	
	Bulletin board with community activities	
	Make community more visible	
	Make the airport more of a social place like in larger cities	
	If we had a big airport, more people would come here	
	Signs and pictures showing where airport is	
	Swimming pool and bar	
	Free Wi-Fi	xx
	Make it a social area. Give us something to do rather than just sit there.	
	If there was community connectivity…"People would come to Butte so much more. People would go to our airport way more."	
	Put another staircase/escalator in	
	Have more connecting airports	
	More people	
	More places to socialize.	
	If we had a bigger airport, more people & business would come in.	

QUESTION #2

What businesses and services would be useful in a new terminal?

A map, GPS	xx
Different cultures and systems	
Starbucks	xxxxxx
Cinnabon	xxxxx
Restrooms beyond security	xxxxxx
Food beyond security	x
Free Wi-Fi	xxxxxxx
Small gift shop	xx
Vending machines beyond security	xxxxx
More services at arrival and departure times	x
Shopping	x
Restaurant open at all times	xx
Good food	
Small bakery	x
ATMs	
More charging stations using solar panels	
Pinball machines or arcade of any sort	
Room to nap in between flights	x
Clothing with "Butte" on it	
24-hour services	
Electronic focus	
More flights	x
Coffee shop	

Food court, Jack In the Box	
Smoking room	
Places to sit	
Less rodents	
Later flights	
More municipal transport	
Fox News Store	
More runways	
Make the architecture more eye catching	
Butte history spot with pictures, brochures, a bit of history that tells how this town has come and is	

QUESTION #3

What kind of information should be at the terminal, to show travelers what Butte-Silver Bow County has to offer.

Tourist attractions	xx
Show we are friendly and we know business	
History	xxxx
Show what mining has done for our community	xxxx
Maps, brochures, photos	xx
Monument of some sort	
Information of things to do and see	
Pictures of "cool things" in Butte	xxx
A mini head frame covered in pictures of Butte attractions	
Lots of local food	
Tour schedule	
Historical locations in the area	
Berkley Pit pamphlets, Butte history, Lady of Rockies, History of Columbia Gardens	xx
Statues	
Posters of Butte and Butte history	
Help to get them where they need to go	
Show different towns that formed as one	
An electronic pamphlet	
More windows	
Cool things Butte has to offer today	x
Mining souvenirs, sell vials of acid water	
Brookstone store or Sharper Image store	
Photos of hunting, rivers, mountains	xx
Flying lessons and pilot license information	

QUESTION #4

Are you interested in participating in any of the following at the airport?

Research projects		
Yes	12	particularly natural habitats (3), aviation technologies (2), alternative energy sources, environmental studies, energy conservation
No	9	
Student internships		
Yes	13	
No	7	
Public education tours		
Yes	11	
No	10	

QUESTION #5

How would you like to describe the airport 20-50 years in the future?

I'm not exactly sure since I don't know what airports look like. I haven't been in one since I was 2 or 3 years old.

Everyone likes using it because it is the best airport around. Lots of room and had food and drinks available.

The airport should be a bigger part and give back to Butte.

I would like our airport to be more like the ones in larger cities. I think it would be good for our community in all aspects.

A couple of stores, bigger building, information about Butte and the different things you can see, be more connected to other airports in bigger cities like New York and Washington

New, bigger, good food, more service from airlines.

Larger, more flights, more connects, more food/entertainment.

I would like to be able to say it is one of the best airports that I ever been in,

I would like to see a nice building that shows how great Butte is. I want to be able to show people a great place to view.

I would want an up-to-date airport with more services that captures Butte history and how it is.

I would like to see more Butte's historical figures.

A place that is big and full of stores and restaurants. Somewhere you can have fun between flights. Somewhere that really represents Butte.

No, honestly I am not crazy about learning about "airport history." I want an airport that is safe and social place for my family and children.

A nice but rodent free; nicely decorated and enjoyable.

Kinda like Bozeman's; animals like most people would remember; a big bear over most things.

I would like to say how big and clean it is and how nice the workers are.

A well remembers building; some sort of attractions like a mine cart ride or something. Hopefully a smooth maintenance process; no lost bags or confusion.

Like a mini mall with a Starbucks, restaurants, stores, and more comfortable waiting chairs.

Copper!!

BERT MOONEY AIRPORT

Questions for students: Lauren

The Bert Mooney Airport Authority is working on a Sustainability Plan in an effort to improve our operations and facilities and become a frontrunner in sustainability in the Butte-Silver Bow region. As the future generation of leaders in our community, we would like your ideas, comments and feedback on the draft version of this plan/checklist.

In addition, we would like your answers to the following questions:

1. If you were designing the new airport terminal at Bert Mooney Airport, what would your top priorities be in regards to our sustainability categories of: (include as many as you wish).
   Economic Viability— Recycling and trash barges
   Environmental Awareness— No Littering
   Community Connectivity— ~~Staff~~ & Bulletin Board with community activities
2. As a traveler to this area, what businesses and services do you think would be useful in a new terminal? A map, GPS,
3. What kind of information do you think should be at the terminal to show travelers what Butte-Silver Bow County has to offer? Tourists attractions
4. If the Airport Authority started new programs in conjunction with your school, would you be interested in participating in any of the following: (Circle YES or NO)
   a. Research projects (on topics such as environmental studies, biology/vegetation, natural habitats, energy conservation, alternative energy sources, stormwater, economic development, and aviation technologies). YES NO (circle topic if interested)
   b. Student internships YES NO
   c. Public educational tours on sustainability, airport history, and regional history & information YES NO
5. Think 20 or 50 years from now. How would you like to be able to describe the airport? If you and your family were taking a tour, what would you like to see be in the buildings and in the operations and maintenance process? I'm not exactly sure. Since I don't know what Airports look like I haven't been in one Since I was 2 or 3 years old.

APPENDIX C – Lessons Learned

Airport Sustainability Plan - Lessons Learned

1. There was great value for Bert Mooney Airport (BMA) in research on other airports; BMA had not labeled their current strategies as "green" or "sustainable" until research showed other airports did so.

2. Opportunities are often available based on size of airport--BMA can do some sustainable strategies that larger airports cannot; BMA cannot afford to do many sustainable strategies that larger airports do routinely.

3. Development and implementation of sustainable strategies takes a team of stakeholders, particularly in small airports.

4. Commitment by airport leadership is key to success in changing policies and practices toward sustainability.

5. Butte High School students care about the environment. They are proud of the area history and the impact that mining had on Butte.

6. Providing incentives or rewards for sustainable actions and community outreach to staff, board members, tenants, and contractors, was strongly recommended, particularly in informal survey/conversations.

7. Partnerships with the community are frequently mentioned as essential for regional and airport progress.

Airport Sustainability Plan - Lessons Learned (*cont.*)

8. It was appropriate and beneficial to do the Master Plan first, followed by the Airport Sustainability Plan. When we start to implement the action items from the Airport Sustainability Plan, we will have a better understanding of where we've been too aggressive in our goals and objectives.

9. Through the process of developing the Airport Sustainability Plan, we are more connected to the local community and appreciate how much they care about sustainability.

10. We have come to realize that involving community stakeholders early and often is beneficial.

11. Through this process and with community involvement, we have a clearer understanding of our demographic.

12. By developing this plan and reaching out to the community, we are now recognized as a major part of the infrastructure of our region. We have become a bigger part of the conversation on the future of our region.

APPENDIX D - LEED N. C. Scorecard 2009

The current version of the international green building rating system, Leadership in Energy and Environmental Design, is version 2009 and will be available to projects that register prior to May 31, 2015. LEED, as the system is referred to, has been chosen as the guide for design and construction of the new terminal.

LEED V.2009 will be used as a goal-setting and educational tool during the design and construction process. One of the qualifications for design and construction team members will be their experience with applying LEED principles to a commercial project. A preliminary scorecard has been prepared as a starting point. The scorecard lists 51 attainable points in the terminal project, as a high performance building. This means the new terminal would achieve LEED Silver upon third-party verification by the Green Building Certification Institute (GBCI). An additional 38 points are possible to attain, however, these require the input of the design and construction teams, which have not been selected to date.

The sustainable site (SS) credits requiring input involve public transportation access, bicycle storage, and changing rooms, parking capacity (new lot under construction), stormwater quality control, and light pollution reduction.

The water efficiency (WE) credits requiring input involve water efficient landscaping and water use reduction in the terminal.

The energy and atmosphere (EA) credits requiring input involve optimizing energy performance, on-site renewable energy opportunities, enhanced commissioning of systems, enhanced refrigerant management, and the purchase of green power as an offset to terminal use.

The materials and resources (MR) credits requiring input involve percentage of current terminal building to be reused, percentage of recycled content available in new materials, use of rapidly renewable materials and certified wood.

The indoor environmental quality (IEQ) credit requiring input is the appropriateness of increasing ventilation in the new terminal beyond standard performance levels.

LEED awards exemplary performance, innovations, and focus on regional priorities. These opportunities need the input and guidance of the design and construction team at the appropriate time.

Conservatively, the new terminal will achieve LEED Silver. With a strong commitment from the airport ownership, Butte-Silver Bow County, and an experienced design/construction team, this project could achieve LEED Gold or Platinum.

LEED 2009 for New Construction and Major Renovation
Project Scorecard

Project Name: Bert Mooney Airport
Project Address: Terminal Alternative 5

January 15, 2013

Yes	?	No			
12	11	3	**SUSTAINABLE SITES**		**26 Points**
Y			Prereq 1	**Construction Activity Pollution Prevention**	**Required**
1			Credit 1	**Site Selection**	**1**
5			Credit 2	**Development Density and Community Connectivity**	**5**
		1	Credit 3	**Brownfield Redevelopment**	**1**
	6		Credit 4.1	**Alternative Transportation** - Public Transportation Access	**6**
	1		Credit 4.2	**Alternative Transportation** - Bicycle Storage and Changing Rooms	**1**
3			Credit 4.3	**Alternative Transportation** - Low-Emitting and Fuel-Efficient Vehicles	**3**
	2		Credit 4.4	**Alternative Transportation** - Parking Capacity	**2**
		1	Credit 5.1	**Site Development** - Protect or Restore Habitat	**1**
1			Credit 5.2	**Site Development** - Maximize Open Space	**1**
1			Credit 6.1	**Stormwater Design** - Quantity Control	**1**
	1		Credit 6.2	**Stormwater Design** - Quality Control	**1**
		1	Credit 7.1	**Heat Island Effect** - Nonroof	**1**
1			Credit 7.2	**Heat Island Effect** - Roof	**1**
	1		Credit 8	**Light Pollution Reduction**	**1**

Yes	?	No			
4	2	2	**WATER EFFICIENCY**		**10 Points**
					4
Y			Prereq 1	**Water Use Reduction**	**Required**
2	2		Credit 1	**Water Efficient Landscaping**	**2 to 4**
				2 Reduce by 50%	2
				No Potable Water Use or Irrigation	4
		2	Credit 2	**Innovative Wastewater Technologies**	**2**
2			Credit 3	**Water Use Reduction**	**2 to 4**
				2 Reduce by 30%	2
				Reduce by 35%	3
				Reduce by 40%	4

10	18	3	**ENERGY & ATMOSPHERE**		**35 Points**
Y			Prereq 1	**Fundamental Commissioning of Building Energy Systems**	**Required**
Y			Prereq 2	**Minimum Energy Performance**	**Required**
Y			Prereq 3	**Fundamental Refrigerant Management**	**Required**
10	9		Credit 1	**Optimize Energy Performance**	**1 to 19**
				Improve by 12% for New Buildings or 8% for Existing Building Renovations	1
				Improve by 14% for New Buildings or 10% for Existing Building Renovations	2
				Improve by 16% for New Buildings or 12% for Existing Building Renovations	3
				Improve by 18% for New Buildings or 14% for Existing Building Renovations	4
				Improve by 20% for New Buildings or 16% for Existing Building Renovations	5
				Improve by 22% for New Buildings or 18% for Existing Building Renovations	6
				Improve by 24% for New Buildings or 20% for Existing Building Renovations	7
				Improve by 26% for New Buildings or 22% for Existing Building Renovations	8
				Improve by 28% for New Buildings or 24% for Existing Building Renovations	9
				10 Improve by 30% for New Buildings or 26% for Existing Building Renovations	10
				Improve by 32% for New Buildings or 28% for Existing Building Renovations	11
				Improve by 34% for New Buildings or 30% for Existing Building Renovations	12
				Improve by 36% for New Buildings or 32% for Existing Building Renovations	13
				Improve by 38% for New Buildings or 34% for Existing Building Renovations	14
				Improve by 40% for New Buildings or 36% for Existing Building Renovations	15
				Improve by 42% for New Buildings or 38% for Existing Building Renovations	16
				Improve by 44% for New Buildings or 40% for Existing Building Renovations	17
				Improve by 46% for New Buildings or 42% for Existing Building Renovations	18
				Improve by 48%+ for New Buildings or 44%+ for Existing Building Renovations	19
	3		Credit 2	**On-Site Renewable Energy**	**1 to 7**
				1% Renewable Energy	1
				3% Renewable Energy	2
				3 5% Renewable Energy	3
				7% Renewable Energy	4
				9% Renewable Energy	5
				11% Renewable Energy	6
				13% Renewable Energy	7
	2		Credit 3	**Enhanced Commissioning**	**2**
	2		Credit 4	**Enhanced Refrigerant Management**	**2**
		3	Credit 5	**Measurement and Verification**	**3**
	2		Credit 6	**Green Power**	**2**

LEED 2009 for New Construction and Major Renovation
Project Scorecard

Project Name: Bert Mooney Airport
Project Address: Terminal Alternative 5

January 15, 2013

Yes	?	No			
6	2	3	**MATERIALS & RESOURCES**		14 Points
Y			Prereq 1	**Storage and Collection of Recyclables**	Required
1			Credit 1.1	**Building Reuse** - Maintain Existing Walls, Floors and Roof	1 to 3
	1			Reuse 55%	1
				Reuse 75%	2
				Reuse 95%	3
		1	Credit 1.2	**Building Reuse** - Maintain Interior Nonstructural Elements	1
2			Credit 2	**Construction Waste Management**	1 to 2
				50% Recycled or Salvaged	1
	2			75% Recycled or Salvaged	2
		2	Credit 3	**Materials Reuse**	1 to 2
				Reuse 5%	1
				Reuse 10%	2
1			Credit 4	**Recycled Content**	1 to 2
	1			10% of Content	1
				20% of Content	2
2			Credit 5	**Regional Materials**	1 to 2
				10% of Materials	1
	2			20% of Materials	2
	1		Credit 6	**Rapidly Renewable Materials**	1
	1		Credit 7	**Certified Wood**	1
Yes	?	No			
14		1	**INDOOR ENVIRONMENTAL QUALITY**		15 Points
Y			Prereq 1	**Minimum Indoor Air Quality Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
		1	Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction Indoor Air Quality Management Plan** - During Construction	1
1			Credit 3.2	**Construction Indoor Air Quality Management Plan** - Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials** - Adhesives and Sealants	1
1			Credit 4.2	**Low-Emitting Materials** - Paints and Coatings	1
1			Credit 4.3	**Low-Emitting Materials** - Flooring Systems	1
1			Credit 4.4	**Low-Emitting Materials** - Composite Wood and Agrifiber Products	1
1			Credit 5	**Indoor Chemical and Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems** - Lighting	1
1			Credit 6.2	**Controllability of Systems** - Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort** - Design	1
1			Credit 7.2	**Thermal Comfort** - Verification	1
1			Credit 8.1	**Daylight and Views** - Daylight	1
1			Credit 8.2	**Daylight and Views** - Views	1
Yes	?	No			
2	4		**INNOVATION IN DESIGN**		6 Points
1	4		Credit 1	**Innovation in Design**	1 to 5
				Exemplary Performance: TBD	1
				Exemplary Performance: TBD	1
				Exemplary Performance: TBD	1
				ID Credit: Green Education	1
				ID Credit: TBD	1
1			Credit 2	**LEED® Accredited Professional**	1
Yes	?	No			
3	1		**REGIONAL PRIORITY**		4 Points
3	1		Credit 1	**Regional Priority**	1 to 4
				EA Credit 1 at 48% new/44% existing	1
	1			MR Credit 5 Regional Materials 20%	1
	1			SS Credit 2, 5.1, and/ 5.2	1
	1			WE Credit 3 at 40% or one of two SS Credits	1
Yes	?	No			
51	38	12	**PROJECT TOTALS (Certification Estimates)**		110 Points

Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80+ points

APPENDIX E – Indoor Air Quality Management Plan

Control Measures for After Construction-Before Occupancy

HVAC Protection

a. during construction
b. during clean-up of site, prior to occupancy

Sign off: General Contractor

Plan must include and document (through photos) at least five of the six areas of the national standards developed by the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

1. HVAC Protection
    a. The following systems will be covered with plastic and protected until ready for use:
        i. radiant heat
        ii. air to air heat exchanger
        iii. bathroom exhaust fans

2. Source Control
    a. All paints, carpet, composite wood, adhesives, and sealants are low or no VOC, and meet the requirements of IEQ Credit 4.
    b. Since no noxious substances will be used, no actions are required. Cut sheets showing all installed materials will be submitted to USGBC when LEED certification is pursued.

3. Pathway Interruption
    a. During construction, work areas will be isolated from clean or occupied spaces.
    b. When weather permits, 100% outside air will be used to exhaust contaminated air from units.

4. Housekeeping
    a. During construction, building materials will be protected from weather and stored in a clean area prior to unpacking for installation.
    b. All materials will be stored on pallets – raised above the ground or floor.
    c. Prior to occupancy, the units will be cleaned with non-toxic substances to remove contaminants.
    d. All coils, air filters, ducts, and fans should be cleaned before performing testing and balancing.

5. Scheduling
    a. Applications of wet and odorous materials should be completed before installing absorbent materials. For example, paints, sealants, and coatings should be thoroughly dried and curing times adhered to prior to installation of "sink" materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric covered finishes.
    b. Curing times, as recommended by manufacturers, will be strictly adhered to throughout this project.

6. Flush-out
    a. The LEED team will submit a Credit Interpretation Request (CIR) to review teams to obtain directives because the building has:
        i. Minimal HVAC and all ductwork – again limited – will be protected during the final stages of construction.
        ii. All materials used are low or no VOC.
        iii. Construction flush out is expected to be completed when optimal use of operable windows will be used to "flush" the building.

APPENDIX F – Construction Waste Management Plan

Waste Management Goals:

The goal of this waste management plan is to exceed the guidelines set forth in federal government policy that all publicly funded projects strive to meet the target goals of Executive Order 13423 *Strengthening Federal Environmental, Energy, and Transportation Management* and the most recent Executive Order 13514 *Federal Leadership in Environmental, Energy, and Economic Performance.*

These goals include the following:

- Diverting at least 50% of non-hazardous solid waste, excluding construction and demolition debris (C&D Waste) by the end of fiscal year 2015 (EO 13514);
- Diverting at least 50% of construction and demolition materials and debris (C&D Waste) by the end of fiscal year 2015 (EO 13514); and
- Recycling the following commodities unless significant barriers exist: white paper, mixed paper/newspaper, cardboard, aluminum, plastic (#1 PET, #2 HDPE), glass, pallets, scrap metal, toner cartridges, and consistent with applicable hazardous waste regulations, fluorescent lamps, lamp ballasts, batteries, used oil, antifreeze and tires (EO 13423). [1]
- Airport construction projects will recycle, repurpose, or salvage for reuse a minimum of 50% by weight of the waste generated on-site. The ultimate goal would be to salvage or recycle 75%.
- Waste reduction will be achieved through building design, best practices in securing on-time delivery of supplies, and reuse and recycling efforts maintained throughout the construction process.

Waste Prevention Planning:

Compliance with and/or exemplary performance in the current version of U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) rating systems for the storage and collection of recyclables. General recyclables include at a minimum:

- paper
- corrugated cardboard
- plastics
- glass
- metal

Compliance with the Bert Mooney Airport's solid waste disposal guidelines, including, but not limited to:

- no disposal of tires
- appliances

- yard waste
- mandatory recyclables
- pallets
- hazardous waste
- batteries
- fluorescent tubes
- lamp ballasts
- batteries
- used oil
- antifreeze
- any large metal items

Project Construction Documents: Requirements for waste management will be included in all work. The General Contractor will contractually require all subcontractors to comply with LEED recycling requirements.

The Construction Waste Reduction Plan shall be implemented and executed as follows and as on the chart (below):

- Salvageable materials will be diverted from disposal where feasible and reused on the construction site.
- Excess materials that cannot be used in the project, nor returned to the vendor, will be offered to the owner, site workers, or donated to charity if feasible.
- A designated area on the construction site will be reserved for a row of dumpsters each specifically labeled for respective materials.
- Before proceeding with any removal of construction materials from the construction site, Recycling Coordinators will inspect containers for compliance with LEED requirements.
- Woodcutting will occur in centralized locations to maximize reuse and make collection easier. A reuse bin will be used as a collection point for all wood.
- A licensed hazardous waste vendor will manage hazardous waste.

Using simple precautions and proper storage techniques for materials will reduce the amount of waste generated.

- This will include covering and storing construction materials away from weather conditions that can damage and ruin them.
- Proper planning for dimensional materials in order to prevent cutoff waste

All waste materials created on construction sites will be treated as a reusable product, unless obviously unusable, at which time it will be considered a recyclable product.
Possible resources for reuse are:

- Community non-profits, such as Habitat for Humanity
- Construction site services that grind sheetrock byproducts for soil amendments
- Construction firms employed on-site that will be able to reuse scrap material on future projects

Communication & Education Plan:

The General Contractor will conduct an on-site, pre-construction meeting with subcontractors. Attendance will be required for the subcontractor's key field personnel.

The purpose of the meeting is to emphasize to subcontractor's key field personnel the commitments made by their companies with regard to the project goals and requirements.

- Waste prevention and recycling activities will be discussed at the beginning of each weekly subcontractor coordination meeting to reinforce project goals and communicate progress to date.

- As each new subcontractor comes on-site, the Recycling Coordinator will present him/her with a copy of the Waste Management Plan and provide a tour of the recycling areas.

- Subcontractors will be expected to ensure sure all their crewmembers comply with the Construction Waste Management Plan.

- All recycling containers will be clearly labeled. Containers will be located in close proximity to the building(s) under construction in which recyclables/salvageable materials will be placed.

- Lists of acceptable/unacceptable materials will be posted throughout the site.

- All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.

- Recycling Coordinators shall inspect the containers on a daily basis to insure that no contamination is occurring and precautions will be taken to deter any contamination by the public.

- Monthly progress reports showing waste generated and the facility used will be kept and submitted to the LEED Coordinator. A final version will be submitted at the end of the project. Receipts, weight tickets, and/or letters must include the quantity and weight of each haul salvaged, reused, recycled, or disposed of from the construction site, the final haul location, and the use of the material.

Expected Project Waste, Disposal, and Handling

The following chart identifies waste materials expected on this project, their disposal method, and handling procedures:

Material	Disposal Method	Handling Procedure
Interior finishes / deconstructed	Keep separate for donation or sell	Keep separated in designated areas on-site.
Furniture/Mattresses	Keep separate for donation – mattresses possibly part of fire training burn	Keep separated in designated areas on-site.
Clean dimensional wood and palette wood	Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects.	Keep separated in designated areas on-site. Place in "Clean Wood" container.
Plywood, OSB, particle board	Reuse, donate, sell	Keep separated in designated areas on-site. Place in "Trash" container.
Painted or treated wood	Reuse, donate, sell	Keep separated in designated areas on-site. Place in "Trash" container.
Concrete	Recycle, reuse	Keep separated in designated areas on-site.
Concrete Masonry Units	Keep separate for reuse by on-site construction or employees	Keep separated in designated areas on-site
Metals	Recycle at appropriate recycler	Keep separated in designated areas on-site. Place in "Metals" container.
Gypsum drywall (unpainted)	Recycle at appropriate recycler	Keep scraps separate for recycling – stack on pallets provided on-site. All scrap drywall will be taken back by contractor to drywall supplier
Paint	Reuse or donate to Habitat for Humanity or construction site workers	Keep separated in designated areas on-site
Insulation	Reuse, sell, donate or landfill	Keep separated in designated areas on-site
Flooring	Reuse or donate to Habitat for Humanity or construction site workers	Keep separated in designated areas on-site
Carpet and pad	Reuse or recycle with appropriate recycler	Keep separated in designated areas on-site
Glass	Recycle at an authorized recycling center	Keep separated in designated areas on-site
Plastics	Recycled at an authorized recycling center	Keep separated in designated areas on-site. Place in "Plastic Only" container

1 www.nps.gov/sustainability/pollution

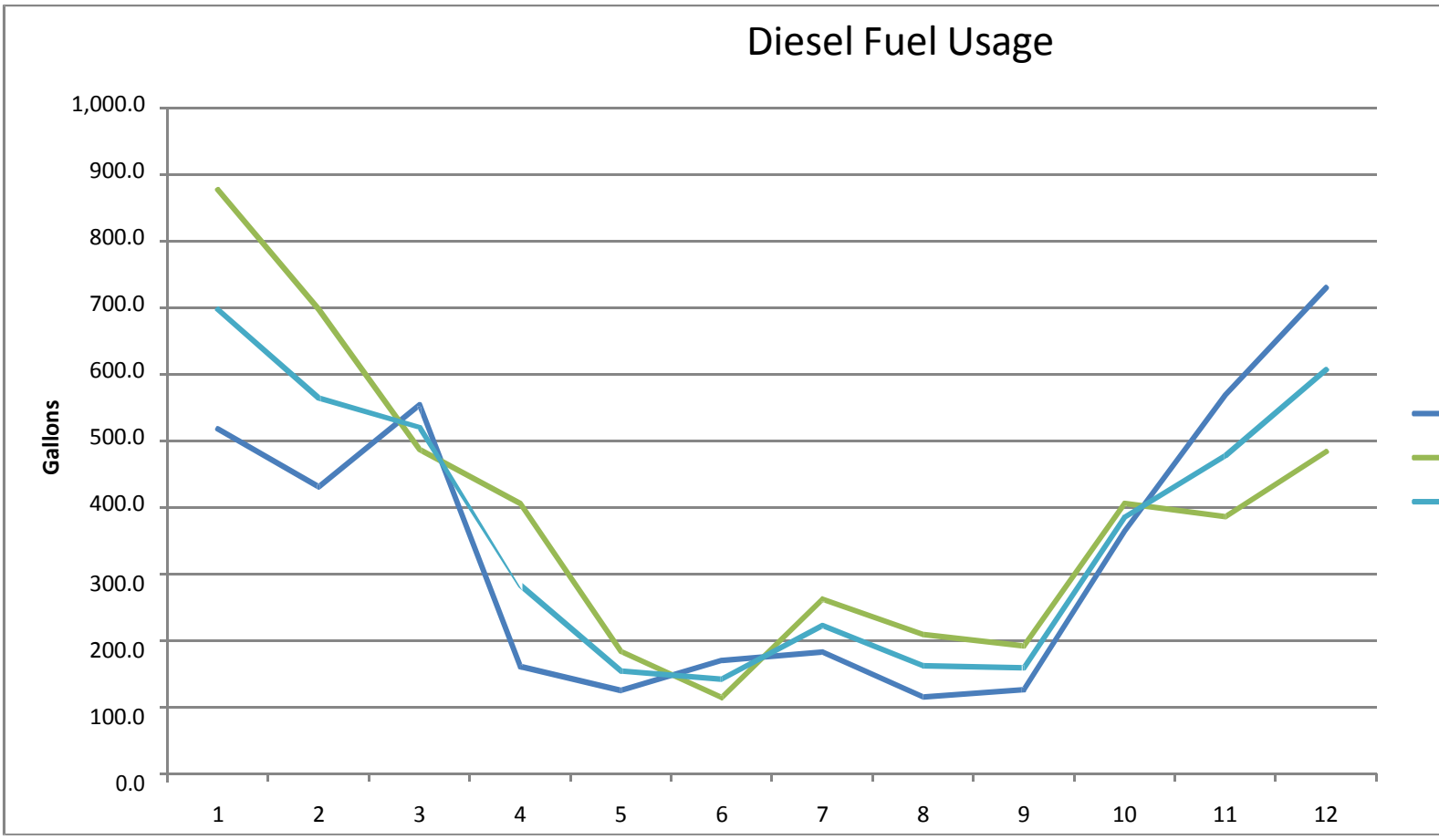
APPENDIX G - Baseline Resource Usage Tables

1. Diesel Fuel Usage 2012-2013
2. Gas Fuel Usage 2012-2013
3. Natural Gas Usage & Electricity Usage 2012-2014
4. Water Usage (3 Meters) 2012-2014
5. Materials & Resources 2014

Diesel Fuel Usage

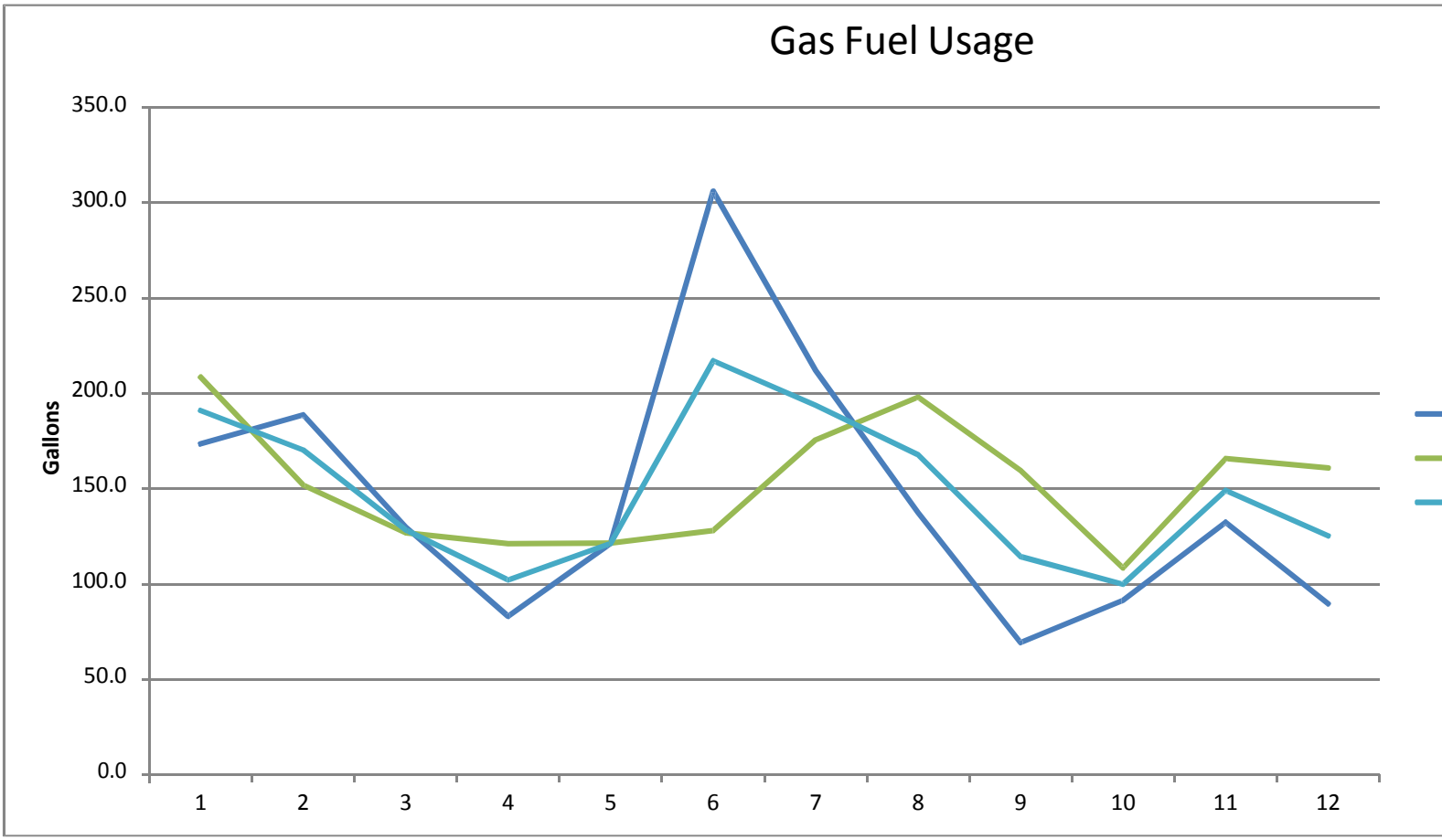
Diesel Fuel for Airport Vehicles and Equipment

Bert Mooney Airport Actual Diesel Fuel Usage by Month (Gallons)										
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
2012	517.6	430.7	554.0	160.5	124.7	169.6	182.6	114.9	125.8	
2013	876.7	697.3	486.8	405.8	183.2	114.0	262.0	208.6	191.7	
Average	697.2	564.0	520.4	283.2	154.0	141.8	222.3	161.8	158.8	



Gas Fuel Usage

Bert Mooney Actual Gas Fuel Usage by Month (Gallons)										
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
2012	173.6	188.8	130.0	83.2	121.4	306.2	212.1	137.5	69.4	
2013	208.6	151.9	126.9	121.2	121.5	128.2	175.7	198.2	159.7	
Average	191.1	170.4	128.5	102.2	121.5	217.2	193.9	167.9	114.6	



Natural Gas & Electricity Usage

Natural Gas for heating and kitchen appliances

Bert Mooney Airport Natural Gas Usage			
Year	Month	Usage (therms)	Charge ($)
2012	March	939	$ 792.07
2012	April	536	$ 437.16
2012	May	263	$ 221.84
2012	June	81	$ 91.72
2012	July	7	$ 40.91
2012	August	5	$ 39.42
2012	September	30	$ 57.39
2012	October	160	$ 150.28
2012	November	1007	$ 777.39
2012	December	1261	$ 977.54
2013	January	1855	$ 1,439.68
2013	February	1254	$ 984.80
2013	March	1522	$ 1,178.97
2013	April	1438	$ 1,145.07
2013	May	499	$ 429.08
2013	June	198	$ 189.72
2013	July	55	$ 82.36
2013	August	32	$ 64.09
2013	September	N/A	N/A
2013	October	342	$ 288.16
2013	November	919	$ 720.82
2013	December	2055	$ 1,618.19
2014	January	1647	$ 1,357.38
2014	February	4044	$ 3,326.90

Electricity is for Airport Terminal and Runway Lights

Bert Mooney Airport Electricity Us			
Year	Month	Usage (KWH)	Demand (KW)
2012	April	35,136	117
2012	May	33,600	113
2012	June	37,440	108
2012	July	33,024	104
2012	August	32,448	96
2012	September	31,488	94
2012	October	28,032	106
2012	November	30,912	104
2012	December	35,904	113
2013	January	38,976	106
2013	February	37,632	109
2013	March	33,408	100
2013	April	31,872	108
2013	May	32,448	98
2013	June	31,104	94
2013	July	30,336	96
2013	August	34,176	108
2013	September	37,632	103.68
2013	October	30,144	103.68
2013	November	34,560	96
2013	December	35,520	103.68
2014	January	39,552	103.68
2014	February	32,640	94.08
2014	March	37,248	117.12
2014	April	35,328	111.36

Water Usage

Meter ID 1440080220

Bert Mooney Airport Water Usage				
Year	Month	Usage (CCF)	Usage (Gal)	Charge ($)
2014	March	0	0	$ 72.30
2014	February	13	10000	$ 72.30
2014	January	13	10000	$ 72.30
2013	December	0	0	$ 72.30
2013	November	13	10000	$ 72.30
2013	October	0	0	$ 72.30
2013	September	13	10000	$ 72.30
2013	August	27	20000	$ 83.54
2013	July	174	130000	$ 387.03
2013	June	80	60000	$ 206.64
2013	May	67	50000	$ 178.61
2013	April	40	30000	$ 116.56
2013	March	27	20000	$ 83.54
2013	February	27	20000	$ 83.54
2013	January	27	20000	$ 83.54
2012	December	27	20000	$ 83.54
2012	November	13	10000	$ 72.30
2012	October	27	20000	$ 83.54
2012	September	40	30000	$ 116.56
2012	August	94	70000	$ 236.82
2012	July	94	70000	$ 236.82
2012	June	67	50000	$ 178.61
2012	May	80	60000	$ 206.64
2012	April	27	20000	$ 83.54
2012	March	40	30000	$ 116.56

Meter ID 1440080266

Historical Bert Mooney		
Year	Month	Usage
2014	March	
2014	February	1
2014	January	
2013	December	
2013	November	
2013	October	
2013	September	
2013	August	1
2013	July	1
2013	June	
2013	May	
2013	April	
2013	March	
2013	February	
2013	January	
2012	December	
2012	November	
2012	October	
2012	September	1
2012	August	1
2012	July	1
2012	June	
2012	May	
2012	April	1
2012	March	

Meter ID 1440081294

Bert Mooney Airport Water Usage				
Year	Month	Usage (CCF)	Usage (Gal)	Charge ($)
2014	March	0	0	$ 50.58
2014	February	1	1000	$ 50.58
2014	January	1	1000	$ 50.58
2013	December	1	1000	$ 50.58
2013	November	1	1000	$ 50.58
2013	October	1	1000	$ 50.58
2013	September	1	1000	$ 50.58
2013	August	3	2000	$ 50.58
2013	July	1	1000	$ 50.58
2013	June	3	2000	$ 50.58
2013	May	1	1000	$ 50.58
2013	April	1	1000	$ 50.58
2013	March	3	2000	$ 50.58
2013	February	1	1000	$ 50.58
2013	January	3	2000	$ 50.58
2012	December	3	2000	$ 50.58
2012	November	9	7000	$ 50.58
2012	October	1	1000	$ 50.58
2012	September	1	1000	$ 50.58
2012	August	3	2000	$ 50.58
2012	July	3	2000	$ 50.58
2012	June	4	3000	$ 50.58
2012	May	1	1000	$ 50.58
2012	April	1	1000	$ 50.58
2012	March	3	2000	$ 50.58

Materials & Resources Table

Bert Mooney Airport Sustainability Plan

Baseline Assessments Materials & Resources Usage Table Using action ite

Resources	What/Where is it used?	Current Quantity	Goals for Reduce/
Paper	Employees recycle paper & newspapers	Employees take recycling in on a rotating basis	Hire local recycling comp recycling
Ink	Employees purchase recycled ink, return cartridges	Minimal	Continue with recycled i minim
Plastic			Start collecting and recyc terminal
Deicing	Glycol/fluid runs off into grassy swale and breaks down from ultraviolet rays	Minimal, 1 plane per day during winter.	If service increases, use c and filtration methods.
Electricity	See Electricity Usage Table in ASP		
Water	See Water Usage Table in ASP		
Natural Gas	See Natural Gas Usage Table in ASP		
Fuel & Diesel	See Fuel Usage Tables in ASP		
Waste Materials			
Recycling			Hire local company fo
Purchasing Practices			Purchase recycled an friendly products wi

Baseline Data Assessment
Office/Terminal Resource Usage Details

A. Paper – how much is used, what percentage is recycled or reused, do you buy recycled paper?

B. Ink – how much is used, do you recycle cartridges, do you buy recycled cartridges, do you use draft mode on printers whe

C. Plastic – how much is used and for what purposes, how much is purchased, can it be replaced?

D. Deicing – how much is used over the winter?

E. Electricity – how much is used and for what purposes, can you break it down by office use versus terminal use, how often turned off when not in use, can anything be unplugged over the weekend, etc.

F. Water – how much is used and for what purposes, can you break it down between landscaping, terminal use, office/admi tarmac or runway…

G. Natural Gas – how much is used and for what purposes?

H. Fuel Consumption – how much is used and for what purposes, break it down to what vehicles are driven to the airport by number of miles driven), vehicles used around the airport terminal, etc.

I. Waste Material Volumes – how much garbage and waste materials are generated by the airport and by the passengers (h weekly by the garbage trucks), can a percentage of this be redirected to recycling (paper, plastic, cardboard)?

J. Recycling Efforts – is anything done now? If so, how much is collected and what.

K. Purchasing Practices – look at paper purchases, ink, other items used throughout the terminal what is purchased, and fro be made by buying in bulk and storing it? This also saves waste materials by reducing packaging. Find environmentally fr

APPENDIX H – Airline Terminal Energy Audit

Project Information – BERT MOONEY MAIN TERMINAL FACILITY

Facility:

Bert Mooney Main Airport Terminal
101 Airport Road
Butte, MT 59701

Contact:

Bert Mooney Airport
101 Airport Road
Butte, MT 59701

Phone: (406) 494-3771

Morrison-Maierle, Inc.:
Mechanical Engineer: Brad Kastelitz, P.E.
Morison-Maierle, Inc.
125 School House Loop
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Email: bkastelitz@m-m.net

Introduction

The purpose of this report is to identify energy conservation deficiencies, provide energy savings, calculate simple payback, and to make recommendations for energy conservation measures (ECM's) to be implemented at the Bert Mooney Main Terminal, Butte MT. All energy consumption and savings calculations were developed using a building model simulation using Carrier's Hourly Analysis software, MEANS Construction Cost Estimating software, and Leadership in Energy and Environmental Design (LEED) conservation concepts.

The existing HVAC and electrical systems were evaluated to create a baseline model used to analyze various energy conservation measures. The baseline model depicts the existing facility based on a history of utility data. Identified energy conservation measures (ECM's) were identified and modeled, to be compared to the baseline model. The proposed annual energy cost savings of the ECM's are compared to the initial construction cost to determine a simple payback for comparison.

Executive Summary

A detailed energy audit of the Bert Mooney Main Terminal was performed to determine the energy consumption of mechanical and electrical systems. The table below outlines the energy conservation measures (ECM's) that have been compared in this energy analysis. The table summarizes the energy savings (Annual Savings), first cost (Construction Cost), and simple payback (Payback Period) of each individual ECM's studied.

Energy Conservation Measure Summary			
Energy Conservation Measure	Construction Cost	Annual Savings	Payback Period
ECM #1 - Boiler Replacement	$119,702	$2,282	> 20 Years
ECM #2 - Boiler Replacement and AHU Coil Replacement	$142,388	$2,602	>20 Years
ECM #3 - Replace Chiller	$130,000	$4,632	> 20 Years
ECM #4 - Replace Hydronic Pumps and 3-way Valves	$78,177	$797	> 20 Years
ECM #5 - Demand Controlled Ventilation	$6,000	$821	7 Years
ECM #6 - Runway/Taxiway Lighting Replacement	$201,960	$366	> 20 Years

For the study of HVAC equipment and lighting, the energy simulation software utilized for this project was Carrier's E20-II Hourly Analysis Program (HAP). Utilization of HAP software allows for a detailed study and full annual simulation of the applicable ECM's and the possible interactive results on each other.

A "baseline" was developed using HAP software. The baseline model is a computer model that closely represents the existing conditions of the facility. This baseline was calibrated to match the current energy consumption data for the existing facility.

Facility

The Bert Mooney Main Terminal was originally constructed in 1962. Four additions have been made to the building with its largest in 1992. The facility is includes ticket and baggage receiving, a lobby, a restaurant, a security area, gate waiting area, baggage claim, office areas, and storage and mechanical spaces.

Architectural

The facility is constructed with both a slab on grade floor for portions of the building and an elevated floor system over a crawlspace at the north end of the building. Interior spaces consist of large vaulted rooms that communicate with one another from space to space. The exterior walls are constructed of multiple layers of gypsum board, batt insulation, and rigid foam insulation with a stucco finish. The building has a combination of sloped cedar shake roofs and flat built up roofs.

HVAC Systems

The building has single boiler plant and a single air-cooled chiller plant that produces hot water and chilled water for multiple terminal units around the building including air handlers, fan coils, and finned tube radiators. In the building, a network of hydronic piping distributes the hot and chilled water. Both the boiler and chiller are piped in a primary direct fashion with large constant volume hydronic pumps and 3-way valves at each terminal unit.

There are two main air handling units ducted to server the office areas, kitchen/dining areas, security, gates, and the lobby/baggage claim area. One of the air-handling units is zoned; however, both provide heating, cooling/economizer cooing, and ventilation to the spaces they serve. Additional fan coils, both ducted and non-ducted, are scattered throughout the building providing heating and cooling to the remaining spaces.

HVAC/Lighting Controls

The building is equipment with a Direct Digital Control (DDC) system installed and managed by Johnson Controls. This system allows the building to have a night setback for heating, cooling, and ventilation to cut down on energy consumption. The night setback schedule is catered around the weekly flight roster for arriving and departing passenger's comfort.

Utility Systems

Northwestern Energy provides a natural gas and electricity for the building. The building is equipped with a 480Y/277 400 amp electrical service and a standard natural gas service.

Historical utility data

The two tables below represent the building's natural gas and electricity consumption and utility service charges for the past three years. Northwestern Energy charges the facility for the usage of natural gas therms on a monthly basis. Additionally, Northwestern Energy charges the facility for the usage of electricity in kilowatt-hours and the service demand of kilowatts on a monthly basis.

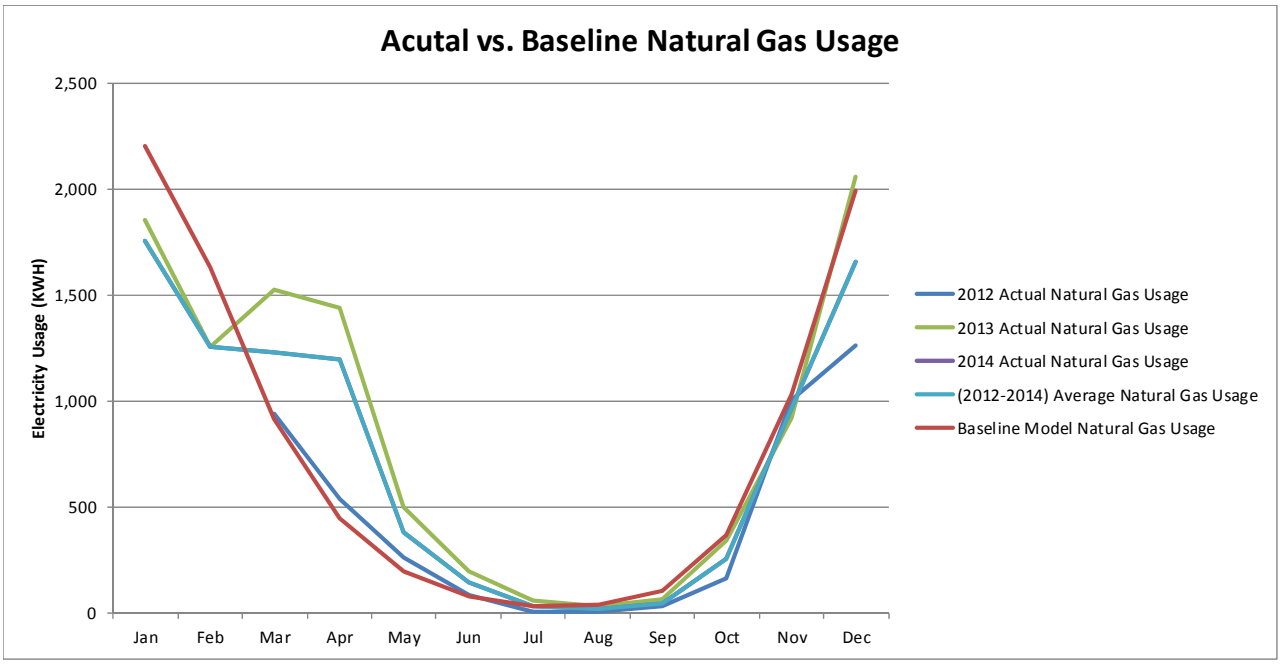
Bert Mooney Historical Natural Gas Usage			
Year	Month	Usage (therms)	Charge ($)
2012	March	939	$ 792.07
2012	April	536	$ 437.16
2012	May	263	$ 221.84
2012	June	81	$ 91.72
2012	July	7	$ 40.91
2012	August	5	$ 39.42
2012	September	30	$ 57.39
2012	October	160	$ 150.28
2012	November	1007	$ 777.39
2012	December	1261	$ 977.54
2013	January	1855	$ 1,439.68
2013	February	1254	$ 984.80
2013	March	1522	$ 1,178.97
2013	April	1438	$ 1,145.07
2013	May	499	$ 429.08
2013	June	198	$ 189.72
2013	July	55	$ 82.36
2013	August	32	$ 64.09
2013	September	N/A	N/A
2013	October	342	$ 288.16
2013	November	919	$ 720.82
2013	December	2055	$ 1,618.19
2014	January	1647	$ 1,357.38
2014	February	4044	$ 3,326.90

Bert Mooney Historical Electricity Usage				
Year	Month	Usage (KWH)	Demand (KW)	Charge ($)
2012	April	35,136	117	$ 3,486.68
2012	May	33,600	113	$ 3,340.13
2012	June	37,440	108	$ 3,524.12
2012	July	33,024	104	$ 3,204.18
2012	August	32,448	96	$ 3,150.37
2012	September	31,488	94	$ 3,093.30
2012	October	28,032	106	$ 2,969.84
2012	November	30,912	104	$ 3,158.96
2012	December	35,904	113	$ 3,616.88
2013	January	38,976	106	$ 3,808.13
2013	February	37,632	109	$ 3,769.91
2013	March	33,408	100	$ 3,366.15
2013	April	31,872	108	$ 3,346.26
2013	May	32,448	98	$ 3,293.76
2013	June	31,104	94	$ 3,182.25
2013	July	30,336	96	$ 3,156.71
2013	August	34,176	108	$ 3,558.79
2013	September	37,632	103.68	$ 3,766.69
2013	October	30,144	103.68	$ 3,226.23
2013	November	34,560	96	$ 3,475.76
2013	December	35,520	103.68	$ 3,585.91
2014	January	39,552	103.68	$ 3,872.73
2014	February	32,640	94.08	$ 3,256.01
2014	March	37,248	117.12	$ 3,790.37
2014	April	35,328	111.36	- -

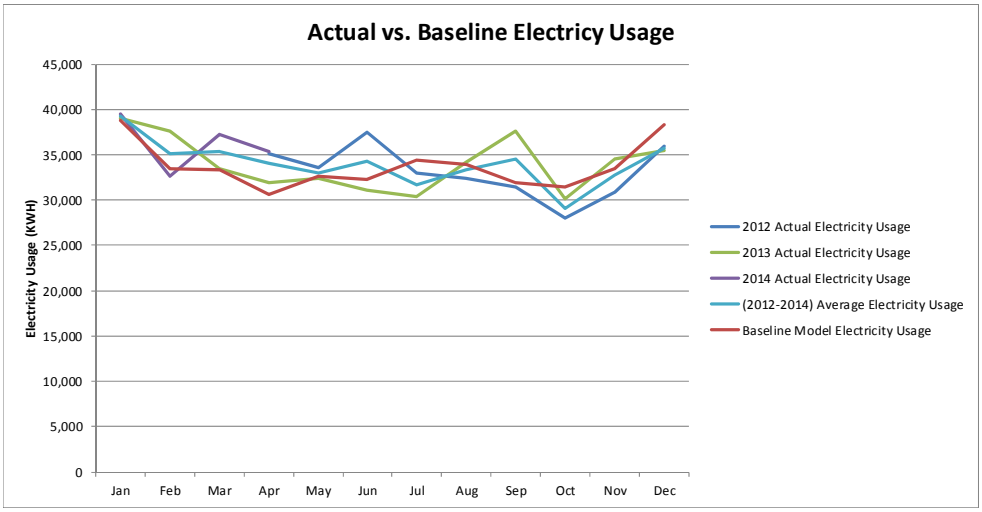
Baseline Energy Use Analysis

Based on information gathered from onsite visits, architectural/engineering plan sets, from Johnson Controls, and utility information; a baseline energy model was generated. The baseline energy model was created using an hour-by-hour simulation software, Carrier's E20-II Hourly Analysis Program (HAP). HAP was used to calculate the energy use of the facilities buildings based on heating, ventilation, air conditioning, and lighting. HAP's energy analysis module performs an hour-by-hour simulation of building loads and equipment operation for all 8,760 hours in a year. This approach provides superior accuracy versus the reduced hour-by-hour method. HAP uses typical meteorological year (TMY) weather and the ASHRAE Transfer Function to calculate dynamic heat flow. These features and usability of HAP allow engineers to modify buildings and HVAC system parameters that reflect existing conditions.

The figure below graphically represents historical natural gas usage compared to the calibrated baseline model. As seen, the baseline model emulates the average natural gas usage of the building based on the last three years of building operation.



The figure below graphically represents historical electricity gas usage compared to the calibrated baseline model. As seen, the baseline model emulates the average electricity usage of the building based on the last three years of building operation.



Savings Opportunities through Energy Conservation

#1 ECM – Boiler Replacement

Description:

This ECM involves replacing the existing hot water heating boiler with two new high efficiency boilers. With today's technology in hot water heating, the new boilers could provide superior efficiency over the existing hot water boiler reducing natural gas consumption and increasing comfort.

The existing hot water boiler is an American Standard model number G-6028 series IB-J3. This boiler has an input of 3,915,000 Btu/hr. with a rated thermal efficiency of 80%. Over time, a boiler of this vintage will begin to loose efficiency. It is assumed that this boiler is operating around 70%.

The existing hot water boiler would be replaced with two smaller high efficiency boilers. These boilers have a fully modulating gas valve with a supply water temperature reset based on outside air temperatures. The existing boiler operates at a constant supply water temperature of 200 degrees Fahrenheit. The new boilers will vary the supply temperature to match the load of the building. On moderate days, the boiler would supply 140-degree heating water and up to 180 degrees Fahrenheit as it got colder outside. By decreasing the operating temperature of the boilers, there is an opportunity to achieve thermal efficiencies of 90%+. At times of the year, this would be a 20% increase in efficiency over the existing boiler.

Energy savings for this ECM were calculated using a modified HAP baseline model. The original baseline model was duplicated; maintaining identical building envelope, lighting, and all HVAC characteristics and components. The new modified baseline model has a new boiler with efficiency's that accurately depict conditions that would be seen with this boiler replacement. The table below is an estimated energy cost savings associated the modified HAP baseline model simulation.

ECM #1 Estimated Energy and Cost Savings														
Baseline	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	38,795	33,418	33,347	30,675	32,621	32,318	34,468	33,967	31,925	31,496	33,501	38,302	404,833	$45,663
Natural Gas Total Usage (therms)	2,204	1,630	915	442	193	79	30	40	105	367	1,033	1,989	9,027	$7,828
ECM #1	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	32,934	29,706	32,802	31,706	41,960	34,003	39,942	37,771	31,220	32,731	31,755	32,904	409,434	$45,054
Natural Gas Total Usage (therms)	1,787	1,331	770	395	182	78	32	42	103	331	864	1,615	7,530	$6,155
													Total Savings	$2,282

Cost Estimate:

The table below shows cost estimates associated with this ECM. Cost estimates were produced with a combination of resources from the MEANS Cost Works program along with pricing from venders and distributers.

ECM #1 - Boiler Replacement Cost Estimate			
Qty.	Description	Materials & Labor	Total
1	Demo Existing Boiler Assembly	$3,800	$3,800
2	Install New Mod. Con. Boilers	$17,800	$35,600
2	Install Boiler Venting	$4,852	$9,704
2	Install Boiler Pumps and Assembly Piping	$20,274	$40,548
2	Install New System Circulator Pumps	$15,025	$30,050
		Total Costs	$119,702

#1 ECM to Baseline Cash Flow Comparison:

The table below shows a cash flow comparison between the ECM and the baseline model. Additionally, the table below displays the simple payback period associated with this ECM. Baseline and ECM operating costs were assumed to have a 3% increase each year associated with escalated fuel rates.

ECM #1 to Baseline Cash Flow Comparison				
ECM Initial Investment		$119,702		
Baseline Operating Cost		$53,491		
ECM Operating Cost		$51,209		
Simple Payback Period		> 20 Years		
Year	Date	Baseline Cash Flow	ECM Cash Flow	Cash Flow Savings
0	Present	$0	$119,702	$ (119,702)
1	2015	$55,096	$172,447	$ (117,352)
2	2016	$111,796	$226,729	$ (114,933)
3	2017	$170,101	$282,547	$ (112,445)
4	2018	$230,011	$339,901	$ (109,889)
5	2019	$291,526	$398,791	$ (107,265)
6	2020	$354,645	$459,218	$ (104,572)
7	2021	$419,369	$521,181	$ (101,811)
8	2022	$485,698	$584,680	$ (98,981)
9	2023	$553,632	$649,715	$ (96,083)
10	2024	$623,170	$716,287	$ (93,117)
11	2025	$694,313	$784,395	$ (90,082)
12	2026	$767,061	$854,039	$ (86,978)
13	2027	$841,413	$925,220	$ (83,806)
14	2028	$917,371	$997,936	$ (80,566)
15	2029	$994,933	$1,072,189	$ (77,257)
16	2030	$1,074,099	$1,147,979	$ (73,879)
17	2031	$1,154,871	$1,225,304	$ (70,434)
18	2032	$1,237,247	$1,304,166	$ (66,919)
19	2033	$1,321,228	$1,384,564	$ (63,337)
20	2034	$1,406,813	$1,466,499	$ (59,685)

#2 ECM – Boiler Replacement and Air Handling/Fan Coil Unit Hot Water Coils

Description:

This ECM involves replacing the existing hot water heating boiler with two new high efficiency boilers (as described in ECM #1) in addition to replacing each air handler and ducted fan coil's hot water coils. By making these improvements, the facility could save significant energy and even more than available from ECM #1.

The existing hot water coils for each air handler and duct fan coil were designed with 200 degree Fahrenheit supply water. By replacing these coils, the air handlers and ducted fan coils could produce the same amount of heat with 140-degree supply water temperatures. As described in ECM #1, higher thermal efficiencies can be achieved with lower boiler water temperatures. The new boiler plant could now have a range of thermal efficiencies of 90% to 95%. At times of the year, there could be a thermal efficiency increase of 25% over the existing system.

Energy savings for this ECM were calculated using a modified HAP baseline model. The original baseline model was duplicated, maintaining identical building envelope, lighting, and all HVAC characteristics and components. The new modified baseline model has a new boiler with efficiency's that accurately depict conditions that would be seen with this boiler replacement. The table below is an estimated energy cost savings associated the modified HAP baseline model simulation.

ECM #2 Estimated Energy and Cost Savings														
Baseline	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	38,795	33,418	33,347	30,675	32,621	32,318	34,468	33,967	31,925	31,496	33,501	38,302	404,833	$45,663
Natural Gas Total Usage (therms)	2,204	1,630	915	442	193	79	30	40	105	367	1,033	1,989	9,027	$7,828
ECM #2	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	29,797	26,796	29,447	28,535	38,907	42,788	48,975	46,736	40,088	29,447	28,480	29,742	419,738	$45,050
Natural Gas Total Usage (therms)	1,577	1,168	666	333	157	69	31	39	90	280	747	1,423	6,580	$5,839
													Total Savings	$2,602

Cost Estimate:

The table below shows cost estimates associated with this ECM. Cost estimates were produced with a combination of resources from the MEANS Cost Works program along with pricing from venders and distributers.

ECM #2 - Boiler Replacement and AHU Coiler Replacement Cost Estimate			
Qty.	Description	Materials & Labor	Total
1	Demo Existing Boiler Assembly	$3,800	$3,800
2	Install New Mod. Con. Boilers	$17,800	$35,600
2	Install Boiler Venting	$4,852	$9,704
2	Install Boiler Pumps and Assembly Piping	$20,274	$40,548
2	Install New System Circulator Pumps	$15,025	$30,050
6	Install New Hydronic Heating Coils and Piping	$3,781	$22,686
		Total Costs	$142,388

#2 ECM to Baseline Cash Flow Comparison:

The table below shows a cash flow comparison between the ECM and the baseline model. Additionally, the table below displays the simple payback period associated with this ECM. Baseline and ECM operating costs were assumed to have a 3% increase each year associated with escalated fuel rates.

ECM #2 to Baseline Cash Flow Comparison				
ECM Initial Investment		$142,388		
Baseline Operating Cost		$53,491		
ECM Operating Cost		$50,889		
Simple Payback Period		> 20 Years		
Year	Date	Baseline Cash Flow	ECM Cash Flow	Cash Flow Savings
0	Present	$0	$142,388	$ (142,388)
1	2015	$55,096	$194,804	$ (139,708)
2	2016	$111,796	$248,746	$ (136,950)
3	2017	$170,101	$304,215	$ (134,114)
4	2018	$230,011	$361,211	$ (131,199)
5	2019	$291,526	$419,733	$ (128,207)
6	2020	$354,645	$479,782	$ (125,137)
7	2021	$419,369	$541,358	$ (121,988)
8	2022	$485,698	$604,460	$ (118,762)
9	2023	$553,632	$669,089	$ (115,457)
10	2024	$623,170	$735,245	$ (112,075)
11	2025	$694,313	$802,927	$ (108,614)
12	2026	$767,061	$872,136	$ (105,075)
13	2027	$841,413	$942,872	$ (101,459)
14	2028	$917,371	$1,015,134	$ (97,764)
15	2029	$994,933	$1,088,923	$ (93,991)
16	2030	$1,074,099	$1,164,239	$ (90,140)
17	2031	$1,154,871	$1,241,082	$ (86,211)
18	2032	$1,237,247	$1,319,451	$ (82,204)
19	2033	$1,321,228	$1,399,346	$ (78,119)
20	2034	$1,406,813	$1,480,769	$ (73,955)

#3 ECM – Replace Chiller

Description:

This ECM involves replacing the existing chiller with a high efficiency chiller.

Energy savings for this ECM were calculated using a modified HAP baseline model. The original baseline model was duplicated, maintaining identical building envelope, lighting, and all HVAC characteristics and components. The new modified baseline model has a new chiller with efficiency's that accurately depict conditions that would be seen with this boiler replacement. The table below is an estimated energy cost savings associated with the modified HAP baseline model simulation.

ECM #3 Estimated Energy and Cost Savings														
Baseline	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	38,795	33,418	33,347	30,675	32,621	32,318	34,468	33,967	31,925	31,496	33,501	38,302	404,833	$45,663
Natural Gas Total Usage (therms)	2,204	1,630	915	442	193	79	30	40	105	367	1,033	1,989	9,027	$7,828
ECM #3	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	30,541	27,459	30,128	29,186	32,849	33,948	36,672	35,454	32,580	30,055	29,181	30,487	378,540	$41,031
Natural Gas Total Usage (therms)	2,204	1,630	915	442	193	79	30	40	105	367	1,033	1,989	9,027	$7,828
													Total Savings	$4,632

Cost Estimate:

The table below shows cost estimates associated with this ECM. Cost estimates were produced with a combination of resources from the MEANS Cost Works program along with pricing from venders and distributers.

ECM #3 - Chiller Replacement Cost Estimate			
Qty.	Description	Materials & Labor	Total
1	Remove Existing Chiller	$2,925	$2,925
1	Remove Existing Cooling Tower	$1,750	$1,750
1	Install New Chiller	$60,900	$60,900
1	Install New Cooling Tower	$31,075	$31,075
2	Install Cooling Tower Pumps	$1,650	$3,300
2	Install New System Circulator Pumps	$15,025	$30,050
		Total Costs	$130,000

#3 ECM to Baseline Cash Flow Comparison:

The table below shows a cash flow comparison between the ECM and the baseline model. Additionally, the table below displays the simple payback period associated with this ECM. Baseline and ECM operating costs were assumed to have a 3% increase each year associated with escalated fuel rates.

ECM #3 to Baseline Cash Flow Comparison				
ECM Initial Investment		$130,000		
Baseline Operating Cost		$53,491		
ECM Operating Cost		$48,859		
Simple Payback Period		> 20 Years		
Year	**Date**	**Baseline Cash Flow**	**ECM Cash Flow**	**Cash Flow Savings**
0	Present	$0	$130,000	$ (130,000)
1	2015	$55,096	$180,325	$ (125,229)
2	2016	$111,796	$232,115	$ (120,319)
3	2017	$170,101	$285,372	$ (115,270)
4	2018	$230,011	$340,094	$ (110,082)
5	2019	$291,526	$396,282	$ (104,756)
6	2020	$354,645	$453,935	$ (99,290)
7	2021	$419,369	$513,055	$ (93,685)
8	2022	$485,698	$573,640	$ (87,941)
9	2023	$553,632	$635,691	$ (82,059)
10	2024	$623,170	$699,207	$ (76,037)
11	2025	$694,313	$764,190	$ (69,877)
12	2026	$767,061	$830,638	$ (63,577)
13	2027	$841,413	$898,552	$ (57,139)
14	2028	$917,371	$967,932	$ (50,561)
15	2029	$994,933	$1,038,777	$ (43,845)
16	2030	$1,074,099	$1,111,089	$ (36,989)
17	2031	$1,154,871	$1,184,866	$ (29,995)
18	2032	$1,237,247	$1,260,109	$ (22,862)
19	2033	$1,321,228	$1,336,817	$ (15,590)
20	2034	$1,406,813	$1,414,992	$ (8,178)

#4 ECM – Replace Hydronic Pumps and Hot/Chilled Water 3-Way Valves

Description:

This ECM involves replacing the existing hot and chilled water pumps with variable speed ECM motor pumps. The existing hot and chilled water pumps are constant volume and pump water to 3-way valves at each air handler and fan coil. Constant volume pumps continuously pump the same volume of water regardless if all or one fan coil/air handler has a demand. By replacing the pumps and valves, the new hot and chilled water ECM motor pumps could change speeds based on the demand reducing required pump energy.

Energy savings for this ECM were calculated using a modified HAP baseline model. The original baseline model was duplicated, maintaining identical building envelope, lighting, and all HVAC characteristics and components. The new modified baseline model includes new pump curves with efficiency's that accurately depict conditions that would be seen with this pump replacement. The table below is an estimated energy cost savings associated the modified HAP baseline model simulation.

ECM #4 Estimated Energy and Cost Savings														
Baseline	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	38,795	33,418	33,347	30,675	32,621	32,318	34,468	33,967	31,925	31,496	33,501	38,302	404,833	$45,663
Natural Gas Total Usage (therms)	2,204	1,630	915	442	193	79	30	40	105	367	1,033	1,989	9,027	$7,828
ECM #4	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	34,855	31,500	35,347	34,256	37,410	29,722	35,345	32,505	26,890	35,818	33,771	34,848	402,267	$44,587
Natural Gas Total Usage (therms)	2,196	1,644	967	509	217	89	34	45	119	434	1,091	1,998	9,343	$8,107
													Total Savings	$797

Cost Estimate:

The table below shows cost estimates associated with this ECM. Cost estimates were produced with a combination of resources from the MEANS Cost Works program along with pricing from venders and distributers.

ECM #4 - Pump and 3-Way Valve Replacement Cost Estimate			
Qty.	Description	Materials & Labor	Total
2	Remove Existing System Circulator Pumps	$385	$770
6	Remove Existing Fan Coil Hydronic Piping and Valving	$65	$387
4	Install New System Circulator Pumps	$15,025	$60,100
2	Install New Vairable Frequency Drives	$2,475	$4,950
6	Install New Hydronic Valves	$1,995	$11,970
		Total Costs	$78,177

#4 ECM to Baseline Cash Flow Comparison:

The table below shows a cash flow comparison between the ECM and the baseline model. Additionally, the table below displays the simple payback period associated with this ECM. Baseline and ECM operating costs were assumed to have a 3% increase each year.

ECM #4 to Baseline Cash Flow Comparison				
ECM Initial Investment		$78,177		
Baseline Operating Cost		$53,491		
ECM Operating Cost		$52,694		
Simple Payback Period		> 20 Years		
Year	**Date**	**Baseline Cash Flow**	**ECM Cash Flow**	**Cash Flow Savings**
0	Present	$0	$78,177	$ (78,177)
1	2015	$55,096	$132,452	$ (77,356)
2	2016	$111,796	$188,307	$ (76,511)
3	2017	$170,101	$245,744	$ (75,643)
4	2018	$230,011	$304,761	$ (74,750)
5	2019	$291,526	$365,359	$ (73,833)
6	2020	$354,645	$427,538	$ (72,893)
7	2021	$419,369	$491,298	$ (71,929)
8	2022	$485,698	$556,639	$ (70,940)
9	2023	$553,632	$623,560	$ (69,928)
10	2024	$623,170	$692,062	$ (68,892)
11	2025	$694,313	$762,145	$ (67,832)
12	2026	$767,061	$833,809	$ (66,748)
13	2027	$841,413	$907,054	$ (65,640)
14	2028	$917,371	$981,879	$ (64,508)
15	2029	$994,933	$1,058,285	$ (63,353)
16	2030	$1,074,099	$1,136,273	$ (62,173)
17	2031	$1,154,871	$1,215,840	$ (60,970)
18	2032	$1,237,247	$1,296,989	$ (59,742)
19	2033	$1,321,228	$1,379,719	$ (58,491)
20	2034	$1,406,813	$1,464,029	$ (57,216)

#5 ECM – Provide Demand Controlled Ventilation

Description:

This ECM involves a modification to the existing DDC controls to provide demand control ventilation. Demand controlled ventilation only provides enough ventilation for the occupants that fill the conditioned spaces. In order to incorporate this change, a CO2 sensor is added to the return ductwork and the associated programing is added to the existing DDC controls. This allows the outside air dampers to modulate the amount of ventilation supplied maintaining an appropriate air quality in the conditioned space.

Energy savings for this ECM were calculated using a modified HAP baseline model. The original baseline model was duplicated, maintaining identical building envelope, lighting, and all HVAC characteristics and components. The new modified baseline model has a new chiller with efficiency's that accurately depict conditions that would be seen with this boiler replacement. The table below is an estimated energy cost savings associated the modified HAP baseline model simulation.

ECM #5 Estimated Energy and Cost Savings														
Baseline	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	38,795	33,418	33,347	30,675	32,621	32,318	34,468	33,967	31,925	31,496	33,501	38,302	404,833	$45,663
Natural Gas Total Usage (therms)	2,204	1,630	915	442	193	79	30	40	105	367	1,033	1,989	9,027	$7,828
ECM #5	Energy Usage													Charge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Electricity Total Usage (KWH)	30,541	27,458	30,127	29,185	40,590	43,722	49,310	47,441	41,245	30,055	29,181	30,488	429,343	$45,921
Natural Gas Total Usage (therms)	1,893	1,386	772	369	183	78	30	40	104	303	846	1,698	7,702	$6,749
													Total Savings	$821

Although demand controlled ventilation decreases the amount of outside air supplied to the facility, it reduces the opportunity for free cooling when outside air temperatures are cooler than inside. As a result, an increase in cooling cost can be seen in the table above. Overall, the advantage of the control strategy saves energy throughout the year making this a beneficial ECM to implement.

Cost Estimate:

The table below shows cost estimates associated with this ECM. Cost estimates were produced with a combination of resources from the MEANS Cost Works program along with pricing from venders and distributers.

ECM #5 - Demand Controlled Ventilation			
Qty.	Description	Materials & Labor	Total
2	Install Duct Mounted CO2 Sensors	$1,800	$3,600
1	Modify DDC Controls	$2,400	$2,400
		Total Costs	$6,000

#5 ECM to Baseline Cash Flow Comparison:

The table below shows a cash flow comparison between the ECM and the baseline model. Additionally, the table below displays the simple payback period associated with this ECM. Baseline and ECM operating costs were assumed to have a 3% increase each year associated with escalated fuel rates.

ECM #5 to Baseline Cash Flow Comparison				
ECM Initial Investment		$6,000		
Baseline Operating Cost		$53,491		
ECM Operating Cost		$52,670		
Simple Payback Period		7 Years		
Year	**Date**	**Baseline Cash Flow**	**ECM Cash Flow**	**Cash Flow Savings**
0	Present	$0	$6,000	$ (6,000)
1	2015	$55,096	$60,250	$ (5,154)
2	2016	$111,796	$116,080	$ (4,284)
3	2017	$170,101	$173,491	$ (3,389)
4	2018	$230,011	$232,481	$ (2,470)
5	2019	$291,526	$293,052	$ (1,526)
6	2020	$354,645	$355,202	$ (557)
7	2021	$419,369	$418,933	$ 437
8	2022	$485,698	$484,244	$ 1,455
9	2023	$553,632	$551,135	$ 2,497
10	2024	$623,170	$619,606	$ 3,565
11	2025	$694,313	$689,657	$ 4,657
12	2026	$767,061	$761,288	$ 5,773
13	2027	$841,413	$834,499	$ 6,914
14	2028	$917,371	$909,291	$ 8,080
15	2029	$994,933	$985,662	$ 9,271
16	2030	$1,074,099	$1,063,614	$ 10,486
17	2031	$1,154,871	$1,143,145	$ 11,725
18	2032	$1,237,247	$1,224,257	$ 12,990
19	2033	$1,321,228	$1,306,949	$ 14,279
20	2034	$1,406,813	$1,391,221	$ 15,592

#6 ECM – Replace Runway and Taxiway Lights

Description:

This ECM involves replacing the existing runway and taxiway lights with more efficient LED fixtures. The current runway and taxiway lights with the combined transformer demand 40W per fixture. Replacement LED fixtures with the combined transformer demand only 19.6W, a 20.4W savings over the existing fixtures. However, the replacement fixtures require a heated lens to keep it free of snow in the winter months causing the demand to increase to 40W per replacement fixture.

Energy savings for this ECM were calculated using several spreadsheets. The first spreadsheet calculates the load of the replacement fixture based on outside air temperatures. As stated above, the replacement fixtures require a 20.4W lens heater when the ambient air temperatures drop below 40 ° F.

Replacement Light Fixture Load Base on Outside Air Temperatures				
Month	Average High Temperature (F)	Average Low Temperature (F)	Average Temperature (F)	Replacement Light Fixture Load (W)
January	38	6	22	40
February	43	12	28	40
March	56	25	40	19.6
April	66	35	50	19.6
May	75	44	59	19.6
June	82	51	66	19.6
July	86	55	70	19.6
August	86	55	70	19.6
September	80	49	64	19.6
October	69	38	53	19.6
November	56	24	40	19.6
December	43	11	27	40
			Average Light Fixture Load (W)	24.7

The table below calculates the savings associated with the lighting replacement based on the annual hours of lighting.

Runway / Taxiway Lighting Replacement Calculations									
Location	Description	Quantity	Existing Load per Fixture	Average Replacement Load per Fixture (W)	Estimated Annual Hours of Operation	Demand		Usage	
						Load Savings (KW)	Demand Charge Savings ($)	Usage Savings (KWH)	Usage Charge Savings ($)
Runway 15-33	Signs	16	432	- -	350	- -	- -	- -	- -
	RW Lights	86	65	24.7	350	3.47	$32.11	1,213	$88.03
	Threshold	16	65	24.7	350	0.64	$5.97	226	$16.38
Runway 11-29	Signs	23	287	- -	350	- -	- -	- -	- -
	RW Lights	51	54	24.7	350	1.49	$13.84	523	$37.95
	TW Lights	100	36	24.7	350	1.13	$10.47	396	$28.70
	Threshold	12	88	24.7	350	0.76	$7.04	266	$19.29
TW A	Signs	9	497	- -	350	- -	- -	- -	- -
	TW Lights	124	36	24.7	350	1.40	$12.98	490	$35.59
TW C	Signs	10	446	- -	350	- -	- -	- -	- -
	TW Lights	147	36	24.7	350	1.66	$15.39	581	$42.19
					Totals	10.56	$97.80	3,695	$268.14
					Total Savings	$365.93			

Cost Estimate:

The table below shows cost estimates associated with this ECM. Cost estimates were produced with a combination of resources from the MEANS Cost Works program along with pricing from venders and distributers.

ECM #6 - Runway/Taxiway Lighting Replacement			
Qty.	Description	Materials & Labor	Total
594	Remove Existing Taxiway/Runway Lights	$30	$17,820
594	Install New Taxiway/Runway Lights	$310	$184,140
		Total Costs	$201,960

#6 ECM to Baseline Cash Flow Comparison:

The table below shows a cash flow comparison between the ECM and the baseline model. Additionally, the table below displays the simple payback period associated with this ECM. Baseline and ECM operating costs were assumed to have a 3% increase each year.

ECM #6 to Baseline Cash Flow Comparison				
ECM Initial Investment		$201,960		
Baseline Operating Cost		$53,491		
ECM Operating Cost		$53,125		
Simple Payback Period		>20 Years		
Year	**Date**	**Baseline Cash Flow**	**ECM Cash Flow**	**Cash Flow Savings**
0	Present	$0	$201,960	$ (201,960)
1	2015	$55,096	$256,679	$ (201,583)
2	2016	$111,796	$312,991	$ (201,195)
3	2017	$170,101	$370,898	$ (200,796)
4	2018	$230,011	$430,398	$ (200,387)
5	2019	$291,526	$491,492	$ (199,966)
6	2020	$354,645	$554,179	$ (199,534)
7	2021	$419,369	$618,461	$ (199,091)
8	2022	$485,698	$684,336	$ (198,637)
9	2023	$553,632	$751,804	$ (198,173)
10	2024	$623,170	$820,867	$ (197,697)
11	2025	$694,313	$891,523	$ (197,210)
12	2026	$767,061	$963,774	$ (196,713)
13	2027	$841,413	$1,037,617	$ (196,204)
14	2028	$917,371	$1,113,055	$ (195,684)
15	2029	$994,933	$1,190,086	$ (195,154)
16	2030	$1,074,099	$1,268,711	$ (194,612)
17	2031	$1,154,871	$1,348,930	$ (194,060)
18	2032	$1,237,247	$1,430,743	$ (193,496)
19	2033	$1,321,228	$1,514,149	$ (192,922)
20	2034	$1,406,813	$1,599,149	$ (192,336)

Energy Conservation Measure Breakdown Summary

The table below is a breakdown of each energy conservation measure compared to the baseline model. The explanation of each ECM is written in the previous section, Savings Opportunities through Energy Conservation Measures.

Energy Conservation Measure Breakdown Summary							
ECM #	Description	Annual Electricity Usage (KWH)	Annual Natural Gas Usage (therms)	Total Annual Energy Charges ($)	Annual Savings ($)	Cummulative First Cost ($)	Simple Payback (years)
	Baseline Model Data:						
1	Boiler Replacement	409,343	7,530	$51,209	$2,282	$119,702	> 20 Years
2	Boiler Replacement and AHU Coil Replacement	419,738	6,580	$50,889	$2,602	$142,388	> 20 Years
3	Replace Chiller	378,540	9,027	$48,859	$4,632	$130,000	> 20 Years
4	Replace Hydronic Pumps and 3-way Valves	402,267	9,343	$52,694	$797	$78,177	> 20 Years
5	Demand Controlled Ventilation	429,343	7,702	$52,670	$821	$6,000	7 Years
6	Taxiway/Runway Lighting Replacement						

Recommended Action Plan

Based on the results from above, we recommend that none of the studied energy conservation measures be implemented at this time. Plans for this facility include a new terminal expansion. At the time of renovation, we recommend that all existing systems within the existing airport building be converted to systems consistent with the new expansion. The following section evaluates four systems for the proposed Airport Terminal Expansion.

Airport Terminal Expansion Mechanical System Evaluation

This section of the report is intended to provide a preliminary comparison of Heating, Ventilation, and Air Conditioning (HVAC) systems for the new airport terminal. The system comparison is based on a preferred terminal alternative floor plan in the Bert Mooney Airport 2010 Master Plan Update. The assumed goals of the HVAC system are to be meet and exceed the energy efficiency requirements of LEED, be cost effective, and provide good occupant comfort performance.

In this report, four systems were compared to one another and to an ASHRAE 90.1 Baseline System. The following systems were **evaluated for the new airport terminal**.

- **Single Duct Variable Air Volume System** - Chilled Water Cooling, High-Efficiency Condensing Boiler Hot Water Heating, VAV Box, and Variable Speed Fans
- **Four Pipe Fan Coil** – Chilled Water Cooling, High-Efficiency Condensing Boiler Hot Water Heating
- **Water Source Heat Pumps** – Conventional Configuration Using a Cooling Tower for Heat Rejection (cooling) and High-Efficiency Condensing Boilers (Heating)
- **Geothermal Heat Pumps** – Closed Loop System for heat rejection and heat absorption from the earth
- **ASHRAE Baseline (System 5)** – Packaged Rooftop Variable Air Volume (VA) with Reheat, The system includes direct expansion and fossil fuel (Natural Gas) fired Boiler at code minimum efficiencies.

Criteria for the evaluation of the mechanical systems were divided into four categories, Performance, Initial Cost, Energy Efficiency (Annual Operating Cost), and Operation/Maintenance.

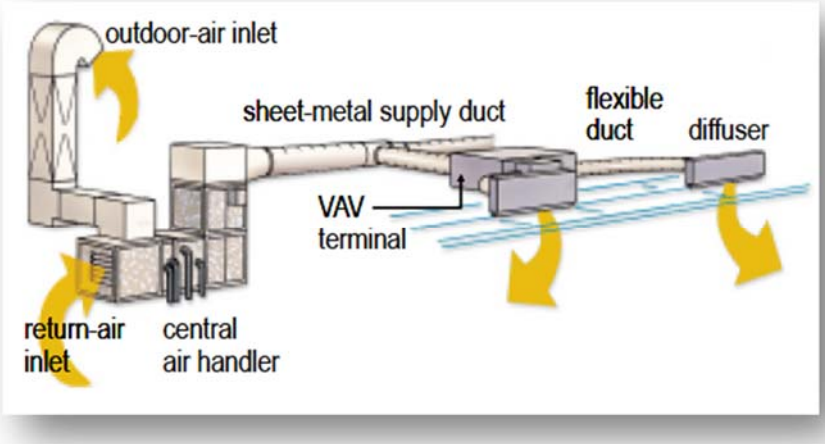
- **Performance**
    - Flexibility of control (more thermostat zones)
    - Occupant comfort
- **Initial Cost**
    - Construction cost
- **Energy efficiency**
    - Annual Operating Cost
- **Operating/Maintenance**
    - Reliability
    - Ease of maintenance
    - Frequency of maintenance

The importance or “priority” of these selection criteria points has not been established. These criteria have simply been identified to assist the building Owner (Bert Mooney Airport) in the system selection process. It is suggested that the Owner review each category and determine a relative importance for each. For example, if “occupant comfort” or “flexibility of control” is critical, then the “Performance” category should be weighted higher than the other categories. A System Comparison Matrix in a following section of this report summarizes the four HVAC system alternatives.

MECHANICAL SYSTEM DESCRIPTIONS

SINGLE DUCT VARIABLE AIR VOLUME SYSTEM

This multiple-zone system uses a central supply fan to provide a variable volume of conditioned air to zone terminals called VAV boxes. Each VAV box contains a damper to vary the volume of air in conjunction with a reheat coil to vary the temperature of the air. Zone thermostats control the terminal dampers to regulate the flow of air into the zones to maintain comfort conditions. When the zone temperature falls below the cooling set point, the terminal damper closes to its specified minimum position. When the zone temperature continues to fall to the heating set point, a modulating hot water valve opens at the reheat coil to provide heat to maintain zone comfort conditions. When the zone temperature rises above the set point of the thermostat, the modulating valve is closed and the terminal damper opens to allow a greater amount of cool air to enter the space.



The volume of air supplied to the VAV boxes is determined by using a pressure sensor located about two-thirds the way down the longest duct. If the VAV boxes are closing, the pressure in the duct will rise and a variable frequency drive will slow the fan wheel down to decrease the amount of air entering the ductwork. If the VAV boxes are opening, the pressure in the duct will fall and the variable frequency drive will speed up the fan wheel to increase the amount of air entering the ductwork.

Generally, the temperature of the air in the supply ductwork is around 55F. This air is supplied to all of the individual VAV boxes. If the space needs heating or cooling, the VAV box and heating coil operate as described above.

This system can utilize fresh air for cooling. When the outside air is below 55F outside air can be used to cool the building without using the chiller at all. When the outside air is between 55F and about 75F, the outside air dampers are wide open and the chiller operates. Once the outside air temperature goes above 75F, (the highest room temperature set point) there is no cooling effect to the outside air and the outside air dampers close to a minimum position. The type of system is generally called “economizer cooling” or “free cooling.”

This system uses a central hot water boiler to heat water that is then pumped to coils at each VAV box. For cooling, water is pumped through an air-cooled chiller located in a mechanical room or outside of the building. This chilled water is used at the main air-handling unit to cool the air distributed throughout the building to 55F.

The proposed boilers would be appropriately sized, premium-efficiency, condensing gas units capable of full modulation with a 5 to 1 turndown ratio or higher. The new boilers would be capable of achieving a maximum operating efficiency of 96%.

Variable Air Volume System Pros and Cons

System Pros

- Only the necessary amount of primary air is used, conserving primary fan power.

- Diversity is applied to supply air volume, reducing duct and fan sizes.
- Air economizers can be added easily to the design to minimize mechanical cooling during cooler weather.
- Air handling unit can maintain minimum outside air amounts, avoiding the need for dedicated ventilation equipment.
- Multiple VAV boxes and varying airflow allows for great control.
- Simultaneous heating and cooling can occur.

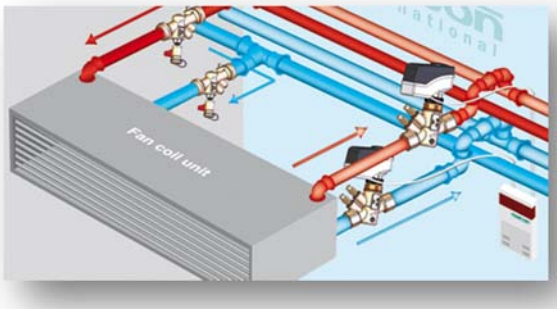
System Cons

- Outdoor air quantities entering the building may vary, with the increase and decrease in airflow.
- Difficult to maintain the correct amount of outdoor air in each zone
- Requires sophisticated controls
- Large duct shafts are needed
- Large Mechanical Space needed.

FAN COIL UNIT

Fan coils have a fan and one coil (two-pipe) or two coils (four-pipe) in single zone units distributed throughout the building. These units would be located either in mechanical rooms or above lay-in ceilings and would be installed throughout the building to minimize ducting. An individual fan coil would represent a single zone of comfort control. Multiple spaces or areas of similar use would be grouped together and served by a single fan coil.

Four-pipe fan coil systems allow some zones to be heated while other zones are being cooled. Separately piped coils provide heating or cooling as directed by the control system and room thermostat. Heating is provided, by the centrally located, boiler hot water heating plant. An air-cooled chiller located outside of the building provides cooling.



The proposed boilers would be appropriately sized, premium-efficiency, condensing gas units capable of full modulation with a 5 to 1 turndown ratio or higher. The new boilers would be capable of achieving a maximum operating efficiency of 96%.

The Fan coil systems will utilize a dedicated ventilation system to supply each zone with ventilation air. The dedicated ventilation system can be ducted to each fan coil unit where it will be mixed with return air, and then conditioned (heated or cooled), before it is delivered to the space. Additionally, the ventilation air can be conditioned at the dedicated ventilation unit and ducted directly to the space. Another option for dedicated ventilation is the use of a heat recovery ventilation unit (HRV). The HRV's could be utilized to recover heat from exhaust air and transfer that heat to the ventilation air for the building.

The four-pipe fan coils have a separate heating hot water and chilled water-cooling loop piped to each fan coil. These loops will utilize two-way control valve and variable frequency drives (VFDs) to provide a variable flow system. A variable flow system will provide pump power savings, by pumping only the required flow needed a given times.

Fan Coil System Pros and Cons

System Pros

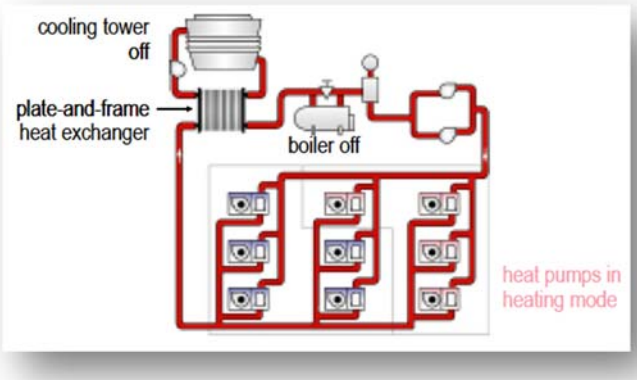
- Energy efficient since there is very little fan work.
- Ventilation air can enter directly to the zone.
- Decentralized approach allows one unit to be serviced without affecting any other zone.
- Easy to add energy recovery to the ventilation system
- Offer individual zone control (single office or grouped office depending on configuration)
- Simultaneous heating and cooling
- Chiller plant is sized based on block load, not connected load.
- Easy to control

System Cons

- Units could be located in occupied spaces. Service may interrupt the occupants.
- Fans directly in the space may cause sound concerns.
- A dedicated ventilation system is usually required.
- An increase in construction cost associated with additional piping and pumping equipment.
- Chiller Plant located outside.

WATER SOURCE HEAT PUMP

This is a unitary, single-zone system where a constant amount of conditioned air is provided by a unit in the space. Ventilation is provided through each unit separately. The Heat Pump will provide heating or cooling to a space as directed by the control system and room thermostat. These units would be located either in mechanical rooms or above lay-in ceilings and would be installed throughout the building to minimize ducting. An individual heat pump would represent a single zone of comfort control. Multiple spaces or areas of similar use would be grouped together and served by a single heat pump.



Both the heating side and the cooling side incorporate refrigeration technology to either heat or cool the air stream. A “closed” building circulation loop would supply water to each heat pump. Each Water source heat pump can either draw or reject heat to the primary loop depending on whether the independent zone is calling for heating or cooling. In the peak of summer or winter it is common for all (or most) of the heat pumps to be calling for the same demand (heating or cooling). In moderate seasons, different zones often call for mixed demands. Examples include: [1] building interior zones calling for cooling due to the internal loads generated by people, lights and equipment while zones exposed to the cold exterior walls/windows may call for heating; [2] a sun-lit south exposed zone may call for cooling while a shaded north zone may call for heating. In these seasons of mixed demand, the heat pump loop operates at its most efficient. Energy is circulated from zones demanding heat to zones rejecting heat.

The Water Source Heat Pump systems will utilize a dedicated ventilation system to supply each zone with ventilation air. The dedicated ventilation system can be ducted to each fan coil unit where it will be mixed with return air and then

conditioned (heated or cooled) before it is delivered to the space. Additionally the ventilation air can be conditioned at the dedicated ventilation unit and ducted directly to the space. Another option for dedicated ventilation is the use of a heat recovery ventilation unit (HRV). The HRV's could be utilized to recover heat from exhaust air and transfer that heat to the ventilation air for the building.

The primary loop temperature is typically maintained between 70°F to 90°F. During cooling season when the Water Source Heat Pump loops approaches 90°F, a closed circuit cooler will be utilized to reject heat from the primary loop and building. During heating season as the loop approaches 70°F a boiler is used to heat the loop. The proposed boilers would be appropriately sized, premium-efficiency, condensing gas units capable of full modulation with a 5 to 1 turndown ratio or higher. The new boilers would be capable of achieving a maximum operating efficiency of 96%.

Water source heat pumps require around 2.4 gpm per ton of capacity. The sum of all of the water source heat pumps is the system flow rate. The system will utilize variable frequency drives (VFDs) to provide a variable flow system. A variable flow system will provide pump power savings, by pumping only the required flow need a given times.

Water Source Heat Pump System Pros and Cons

System Pros

- Very energy efficient since there is very little fan work and the heat in the building is moved from where there is too much to where it is needed.
- Ventilation air can be introduced directly to the zone.
- Easy to add energy recovery to the ventilation system
- Decentralized approach allows one unit to be serviced without affecting any other zone.
- Offer individual zone control (single office or grouped office depending on configuration)

System Cons

- Units could be located in occupied space. Service may interrupt the occupants.
- Sound concerns with fans and compressors directly in or adjacent to the space.
- A dedicated ventilation system is required.
- No diversity applied to capacity. The WSHP capacity is based on connected load, not block load.
- The maintenance costs can be higher than most of the other systems studied in this report.
- Cooling Tower (closed circuit cooler) located outside.

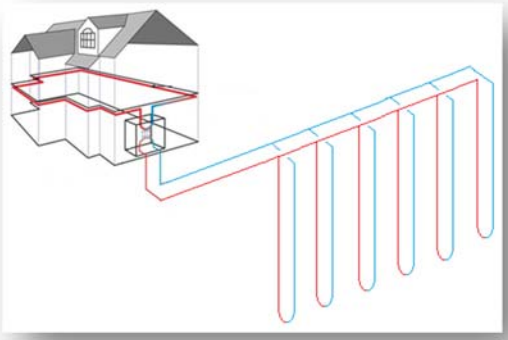
Geothermal Heat Pump

A geothermal heat pump is similar to the water source heat pump system. Like a water source system, the heat pump system is a unitary, single-zone system where a constant amount of conditioned air is provided by a unit in the space. Ventilation is provided through each unit separately. The Heat Pump will provide heating or cooling to a space as directed by the control system and room thermostat. These units would be located either in mechanical rooms or above lay-in ceilings and would be installed throughout the building to minimize ducting. An individual heat pump would represent a single zone of comfort control. Multiple spaces or areas of similar use would be grouped together and served by a single heat pump.

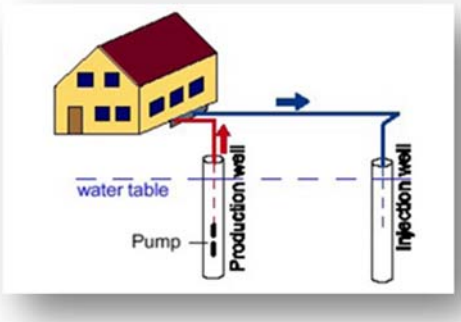
Rather than employ a boiler and cooling tower to add and reject heat from the geothermal heat pump utilizes the earth as the medium from which heat is extracted or rejected. Water is pumped through a heat exchanger in the heat pump.

Heat is extracted, and then the water is then returned to the ground, either through discharge through a closed loop system. Because ground temperatures do not vary as dramatically as outside air temperatures, the heat available for transfer, as well the unit's operating efficiency remains relatively constant. At depths of 15 feet or more below ground, the soil maintains a year-round temperature of about 43F to 52F in this region. Therefore, in the summer, it is cooler than the outside air, and in the winter, its warmer making it an ideal energy source. Although initial installation costs may be higher, annual operating costs are much lower than all other types of heating system. The savings also carries over to summer where cooling cost can be 30-50% less than the cost of cooing with and average air conditioning system.

There are two loops being considered for this project. A vertical closed loop system was used during the energy modeling and energy efficiency comparison. The other option that should be reviewed during project design is an open loop system. The vertical closed loop and open loop options are described below.



Vertical systems are often used for large commercial buildings and schools because the land area required for horizontal loops would be prohibitive. Vertical loops are also used where the soil is too shallow for trenching, and they minimize the disturbance to existing landscaping. For a vertical system, holes (approximately four to six inches in diameter) are drilled about 20 feet apart and 200 to 400 feet deep. Into these holes go two pipes that are connected at the bottom with a U-bend to form a loop. The vertical loops are connected with horizontal pipe (i.e., manifold), placed in trenches, and connected to the heat pump in the building.



An open loop system uses a well or surface water body such as a pond or lake as the heat exchange fluid that circulates directly through the ground source heat pump system. Once the water has circulated through the system, it returns to the ground through the well, a recharge well. Discharge to surface water may be considered but triggers additional permitting considerations. The open-loop surface water option is only practical where there is an adequate supply of relatively clean water, and all regulations regarding a surface or groundwater discharge are met.

INITIAL COST

The initial cost of the HVAC system evaluated for the future Bert Mooney Terminal expansion is important to take into consideration. The schematic plan of the new terminal expansion makes evaluating the initial cost difficult. While assumptions about the buildings construction can be made while evaluating the energy performance of a system, it is difficult to produce an initial cost that would provide reliability in its numbers. To evaluate the initial cost of the HVAC system a cost per square foot number has been developed to give a comparison between systems. When the Bert Mooney Terminal expansion moves forward and the building plans begin to take shape, a more detailed cost estimate should be developed for a more accurate evaluation of the systems costs and accessories. Refer to the Mechanical System Comparison Table for the HVAC cost per square foot estimates.

ENERGY

An energy model was generated based on the preferred terminal alternative floor plan in the Bert Mooney Airport 2010 Master Plan Update. Because the plans are in a schematic stage and the construction details have not been designed, assumptions were made on the envelope construction, fenestration area and performance, door area and construction, elevations, roof slopes, etc. These assumptions were based on current construction practices and current building code minimum standards.

As mentioned above the baseline system was created based on ASHRAE 90.1 guidelines. For a building of this size and in the Butte temperature zone, the baseline system is a Rooftop Variable Air Volume (VA) with Reheat. The system includes direct expansion cooling and fossil fuel (Natural Gas) fired Boiler. The efficiencies for baseline equipment were input per the ASHRAE guidelines. LEED requires the design team to demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating as defined by ASHREA 90.1. The tables on the following page show the proposed building as compared to the different systems evaluated. The Mechanical Systems Annual Energy Cost Table shows the annual cost by component and percent difference as compared to the ASHRAE baseline. The Mechanical Systems Annual Energy Consumption shows the Electrical and Natural Gas consumption and percent difference as compared to the ASHRAE System baseline.

Mechanical Systems Annual Energy Cost Table					
Component	ALT1 - VAV Baseline	ALT2 - VAV AHU - Condensing Boiler	ALT3 - Fan Coil - 4 Pipe	ALT4 - Boiler/Tower Heat Pump	ALT5- Geothermal Heat Pump
	($)	($)	($)	($)	($)
Air System Fans	9,358	5,987	4,495	4,526	4,541
Cooling	3,771	2,077	5,133	6,630	5,390
Heating	18,752	12,066	5,844	6,384	5,125
Pumps	4,592	3,763	7,003	3,592	3,607
Heat Rejection Fans	0	0	258	158	0
HVAC Sub-Total	36,472	23,893	22,733	21,291	18,663
Lights	23,688	23,470	23,212	23,374	23,449
Electric Equipment	13,402	13,296	13,200	13,303	13,358
Misc. Electric	0	0	0	0	0
Misc. Fuel Use	0	0	0	0	0
Non-HVAC Sub-Total	37,090	36,766	36,412	36,676	36,807
Grand Total	73,562	60,659	59,144	57,967	55,470
Energy Savings % - Cost	--	18%	20%	21%	25%

Mechanical Systems Annual Energy Consumption Table					
Component	ALT1 - VAV Baseline	ALT2 - VAV AHU - Condensing Boiler	ALT3 - Fan Coil - 4 Pipe	ALT4 - Boiler/Tower Heat Pump	ALT5 - Geothermal Heat Pump
HVAC Components					
Electric (kWh)	186,966	126,287	182,850	202,843	200,123
Natural Gas (Therms)	22,456	14,237	6,587	2,408	0
Non-HVAC Components					
Electric (kWh)	395,049	395,049	395,049	395,049	395,049
Totals					
Electric (kWh)	582,015	521,336	577,899	597,892	595,173
Natural Gas (Therms)	22,456	14,237	6,587	2,408	0
Energy Savings % - Electrical	--	10%	1%	-3%	-2%
Energy Savings % - Natural Gas	--	37%	71%	89%	100%

OPERATIONS AND MAINTENANCE

Maintenance costs are primarily a measure of labor activity. The layout and configuration of the system can significantly affect the amount of time and effort required for maintenance. The following factors were sited from the HVAC Applications 2011 ASHRAE Handbook. Each factor contributes to maintenance costs and should be considered in the evaluation.

- Quantity and type of equipment - Each piece of equipment requires a basic amount of maintenance and time, regardless of its size or capacity. A greater number of similar pieces of equipment are generally more expensive to maintain than larger but fewer units.
- Equipment location and access - The ability to maintain equipment in a repeatable and cost-effective manner is significantly affected by the equipment's location and accessibility. Equipment that is difficult to access increases the amount of time required to maintain it. Equipment maintenance requiring erection of ladders or lifts increases maintenance costs while likely reducing the quantity and quality of maintenance performed. Equipment location may also dictate an unusual working condition that could require more service personnel than normal.
- System Run Time - The number of hours of operation for a HVAC system affects maintenance costs. Many maintenance tasks are dictated by equipment run time. The greater the run time, the more often these tasks need to be performed.
- Critical systems - High-reliability systems require more maintenance to ensure uninterrupted system operation. Critical system maintenance is also usually performed with stringent shutdown and failsafe procedures that tend to increase the amount of time required to service equipment. Maintenance on critical systems may sometimes incur labor premiums because of unusual shutdown requirements.
- System complexity - systems that are more complex tend to involve more equipment and sophisticated controls. Highly sophisticated systems may require highly skilled service personnel, who tend to be more costly.
- Local conditions - The physical location of the facility may require additional maintenance. Equipment in dusty or dirty areas or exposed to seasonal conditions may require more frequent or more difficult cleaning of equipment and filters. Additional maintenance tasks may be needed.

- Geographical location - Maintenance costs for remote locations must consider the cost of getting to and from the locations. Labor costs for the number of anticipated trips and their duration for either in-house or outsourced service personnel to travel to and from the site must be added to the maintenance cost to properly estimate the total maintenance cost.
- Equipment age - The effect of age on equipment repair costs varies significantly by type of HVAC equipment. Technologies in equipment design and application have changed significantly, affecting maintenance costs.
- Available infrastructure - Maintenance costs are affected by the availability of an infrastructure that can maintain equipment, components, and systems. Available infrastructure varies on a national, regional, and local basis and is an important consideration in the HVAC system selection process.

▪ Source: 2011 HVAC Applications ASHRAE Handbook

SYSTEM COMPARISON MATRIX

As previously stated, the importance or "priority" of these selection criteria points has not been established. The Performance, Energy (Operating Cost), Initial Cost, Operation & Maintenance have not been prioritized. The matrix below summarizes the ranking of each category as if each category was comparable equally. It is recommended that an importance "weighting factor" be applied to each category. The owner should establish these priorities. With priorities defined the matrix could be converted to a numerical ranking (1-4, 4 being the best) and the values calculated. The values in the table below represent the ranking of each system relative to the three others in each category.

Mechanical System Comparison Table					
System Name	Performance*	Energy (EUI)**	Energy Saving (%)***	Initial Cost ($/SF)	O & M*
Variable Air Volume	★★★★	**63.74**	**18%**	**$25 - $30 / SF**	★★
4-Pipe Fan Coils	★★★	52.18	20%	$25 - $30 / SF	★★
Water Source Heat Pumps	★★	**45.24**	**21%**	**$22 - $27 / SF**	★★★
Geothermal Heat Pumps	★★	40.28	25%	$28 - $36 / SF	★★★★
* Performance and O&M's are compared on a star rating system ranging from 1 to 4 stars, 4 stars being the best					
**EUI - annual energy use intensity which displays kBTU/sf to operate the proposed system					
***Energy Savings Represents the Energy Savings as compared to the Baseline Model					

The Energy Use Intensity (EUI) reported in the comparison table is a measure of buildings energy use per square foot per year. It is calculated by dividing the total energy consumed by the building in one year by the total gross floor area of the building.

SUMMARY

In consideration of the four options mentioned above, each presents its systems pros and cons. The system comparison matrix represents advantages in one area but a lower ranking as compared to the other systems in other areas. To make a system evaluation, you must clearly define the scope of the future expansion with requirements, project goals, expectations, and budgets. As the Terminal Expansion Project progresses, the analysis can be refined to provide precise numbers based on the building's design rather than educated assumptions based on code minimums. It is feasible to consider a hybrid of the systems based on usage of the space. For example, provide VAV to office areas where individual control is preferred. Constant volume fan coils or heat pumps could serve the hold and/or baggage area where space is large and individual control is not required. Lastly, utilize a geothermal water-to-water heat pump to provide the heating water and chilled water to the air handler, heat pumps, or fan coils. In summary, each of the evaluated systems will provide good performance and energy efficiency, the key is to define the priorities and then reevaluate.

APPENDIX I – Recycling Sites in Butte-Silver Bow

RECYCLING IN BUTTE

Company	Location	Plastic #1-7	Aluminum cans	Paper/Cardboard	Plastic bags	Steel/tin cans	Other
A & S Metals	2100 Meadowlark Ln. (406-494-1661)	X	X	X		X	
A & S Metals	NCAT 3040 Continental Dr.	X	X	X		X	
A & S Metals	Civic Center (Parking lot on N. side of bldg.)	X	X	X		X	
A & S Metals	Dewey Blvd Post Office (corner of Marilyn & Hobson Ave)	X	X	X		X	
A & S Metals	Corner of Platinum &	X	X	X		X	
Albertsons	1301 Harrison Ave (406-723-7944)				X		
A.W.A.R.E. Inc.	640 S. Arizona St. (406-723-	X	X	X	X		
Copper City Wireless	1619 Grand Ave (406-723-1133)						Cell phones & batteries
Dancing Rainbow Natural Grocery	9 S. Montana St. (406-723-				X		Cardboard egg cartons
H & H Trading	804 S. Arizona St. (406-782-		X				Copper, brass
Pacific Steel & Recycling	1301 Gaylord St. (406-782-0402)		X	X Cardboard/Newspapers		X	Batteries, autos, all metals,
RadioShack	3100 Harrison Plaza Mall (406-494-3951						Small batteries
Recycle Butte	Curbside(406-490-7230) Bi-weekly discounts	X	X	X	X	X	
Rosin Brothers Inc.	2010 Silver Bow Blvd (406-782-2341)					X	Copper, brass, steel, tin, iron
Safeway	310 W. Front St. (406-723-				X		
Safeway	2500 Massachusetts Ave (406-494-7046)				X		
Walmart	3901 Harrison Ave (406-494-1420)	X	X	X	X		
Post Office	701 Dewey Blvd			X (Mail)			

Recycle Butte: Curbside recycling. Please call (406) 490-7230. www.recyclebutte.com

Federal Aviation Administration

Recycling, Reuse and Waste Reduction at Airports

A Synthesis Document

Prepared by the Office of Airports
Federal Aviation Administration
April 24, 2013

TC13-0043

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- Oakland International Airport (OAK)
- Philadelphia International Airport (PHL)
- Phoenix Sky Harbor International Airport (PHX)
- Portland International Airport (PDX)
- Salt Lake City International Airport (SLC)
- San Diego International Airport (SAN)
- San Francisco International Airport (SFO)
- Seattle-Tacoma International Airport (SEA)
- Yeager Airport (CRW)

I. INTRODUCTION

Sustainability

1. **Brundtland definition - meeting the needs of the present without compromising the ability of future generations to meet their own needs.**
2. **ACI definition (developed by the airports) – a holistic approach to managing an airport so as to ensure the integrity of the economic viability, operational efficiency, natural resource conservation and social responsibility (EONS) of the airport.**

Over the past several years, the Federal Aviation Administration (FAA) has been encouraging airport sponsors to incorporate sustainability in airport planning, design, and operations. Sustainability has been defined to include the principles of economic growth, environmental stewardship, and social responsibility.[1] Current FAA programs that support sustainability include Airport Noise Compatibility Planning, the Voluntary Airport Low Emission Program, Environmental Management Systems, and most recently Airport Sustainability Planning. In our continuing efforts to assist airport sponsors in incorporating sustainability into airport planning, design, and operations, the FAA has decided to provide specific guidance to airports in two key focus areas: programs to encourage recycling, reduction and reuse of materials, and programs to encourage airports to reduce their energy consumption

The FAA has compiled this synthesis document, or "one-stop-shop," for airport sponsors to use as a resource when contemplating an airport recycling, reduction, and waste reuse program to further their waste minimization initiatives. Specifically, this guidance is designed to provide recommendations on what things to consider and steps to establishing a recycling program at an airport to divert municipal solid waste (MSW) from the landfill. Although recycling of MSW is the focus of this document, other non-MSW waste streams are discussed which may require special considerations with respect to regulatory compliance. There is a special emphasis on construction and demolition waste since this is a big component by weight and volume of waste generated on an airport.

The document includes lessons-learned and case studies from airports around the country that not only address best practices in recycling, but also in the areas of reuse and waste reduction via "green" procurement programs. Although recycling of MSW is the focus of this document, other non-MSW waste streams are discussed for completeness since they may be a significant portion of the waste generated at an airport and may require special considerations with respect to compliance. And finally, the document provides a list of resources for the user since the market for recyclables is ever changing and these resources can be used to keep the user up to date with the most current information available.

A. Types of Waste Encountered at an Airport

Federal, state, and local agencies regulate different types of waste based on what the waste contains. In general waste from airports can be divided into seven types of waste: (1) municipal solid waste (MSW); (2) construction and demolition waste (C&D); (3) green waste; (4) food

[1] http://www.epa.gov/oecaerth/cleanup/revitalization/er3/benefits.html

waste; (5) waste from aircraft flights (deplaned waste); (6) lavatory waste; (7) spill cleanup and remediation waste; and (8) hazardous materials. Each is described below.

1. *Municipal Solid Waste* (MSW) consists of everyday items that are used and then discarded, such as product packaging, furniture, clothing, bottles, food scraps, and newspapers.

2. *Construction and Demolition Waste* (C&D) is generally categorized as MSW. However, as it can be a major component of airport waste, it has been separated into its own category in this document. C&D waste is any non-hazardous solid waste from land clearing, excavation, and/or the construction, demolition, renovation or repair of structures, roads, and utilities. C&D waste commonly includes concrete, wood, metals, drywall, carpet, plastic, pipe, land clearing debris, cardboard, and salvaged building components. In some instances, C&D waste may be subject to special requirements (e.g., tar impregnated roofing materials, asbestos containing building materials, etc.).

3. *Green Waste* is categorized as MSW and is also referred to as yard waste. Green waste consists of tree, shrub and grass clippings, leaves, weeds, small branches, seeds, pods and similar debris generated by landscape maintenance activities.

4. *Food Waste* is food that is not consumed or is the waste generated and discarded during food preparation activities. Food wastes are also considered part of the MSW waste stream.

5. *Deplaned Waste* is a specific type of MSW that is removed from passenger aircraft. These materials include bottles and cans, newspaper and mixed paper, plastic cups and service ware, food waste, food soiled paper, and paper towels. Waste that comes off the airplanes after flights can represent 20% of an airport's total municipal solid waste stream. The composition is roughly 30% each of paper waste, compostable food material, and non-recyclable materials, with the balance consisting of cups and beverage containers.

In the U.S., waste from international flights, except Canada, needs to be processed separately as the waste can potentially introduce plant pests and diseases. International waste is governed by the United States Department of Agriculture and must follow the handling procedures found in the Manual for Agricultural Clearance.

There are three approved methods for managing international waste: incineration to ash, sterilization, or grinding and discharge into an approved sewage system. Often, third party ground handling companies or flight kitchen operations manage this waste. Listed in the Manual for Agricultural Clearance are approved airports that can handle and dispose of international waste. Airports that are not on the list must deliver their waste to the nearest approved facility. For example, international flights that arrive at John Wayne Airport (SNA) transport their waste to Los Angeles International Airport (LAX) for treatment in autoclaves where sterilization is performed per USDA rules. The waste is then turned over to a waste hauler for disposal at a landfill. Many airports are prohibited from incinerating waste due to air quality regulations.

6. *Lavatory Waste* falls under the category of special waste and is generated when the lavatory tanks of the airplanes are emptied via hose and pumped into a lavatory service vehicle,

which can be either a self-powered truck or a lavatory cart pulled by a tug. After the aircraft's lavatory tanks are emptied, they are refilled with a mixture of water and a disinfecting concentrate, commonly called "blue juice." The lavatory waste removed from the aircraft is transported to a triturator facility, generally located airside, near airline operations, for pretreatment prior to discharge to the sanitary sewage system and publicly owned treatment works (POTW).

Lavatory waste, which contains chemicals ("blue juice") and potential enteric pathogens, can present risks to the environment and human health if not handled properly. Therefore, caution must be taken to ensure that releases of lavatory waste do not occur during the transfer process, which can result from either equipment failure (leaking values or hoses, etc.) or operator error.

7. *Spill cleanup and remediation wastes* are another type of special waste. These materials are generated during cleanup of spills and/or the remediation of contamination from various types of sites on an airport (e.g. storage tanks, oil and gas production, vehicular leaks, spills from maintenance activities, etc.). Care must be taken to ensure that these types of waste materials are not co-mingled with other waste streams and that storage and disposal procedures comply with applicable regulatory requirements.

8. *Hazardous Waste* must be handled in accordance with stringent federal regulations. Wastes designated as "hazardous" are covered by regulations outlining legal handling, treatment or disposal. Hazardous wastes are either specifically "listed" in the regulation (40 CFR 261.31-.33), or are ignitable, corrosive, toxic or reactive (as defined in 40 CFR 261.21 - .24). For details, see the Resource Conservation and Recovery Act ("RCRA") and its amendments and the regulations 40 CFR Subtitle C, Parts 260–270.

Hazardous Waste Case Study
St. Paul International Airport (MSP)

Hazardous wastes most often seen in the aviation industry include:

- **solvents**
- **caustic parts washes**
- **heavy metal paint waste and paint chips**
- **wastewater sludges from metal etching and electroplating**
- **unused epoxies and monomers**
- **waste fuels (including sump fuel or tank sludges) and other ignitables**
- **unusable water conditioning chemicals**
- **illegal dumping of containerized chemicals**
- **contaminated sludge in GA aircraft wash rack oil/water separators**
- **nickel cadmium (ni-cad) batteries**
- **waste pesticides**

The EPA developed less stringent regulations for certain hazardous waste, known as *universal wastes*, set forth in 40 CFR part 273, the Universal Waste Rule. If handled in a responsible method prior to legal recycling, these wastes are less heavily regulated. This rule provides a set of streamlined regulations to reduce the regulatory burden by allowing longer time for the

storage of the wastes, reduced record-keeping requirements and consolidation off-site without a permit.

Universal wastes are:

- ✓ Generated in a wide variety of settings other than the industrial settings usually associated with hazardous wastes;
- ✓ Generated by a vast community (typically greater than 1,000 sources);
- ✓ May be present in significant volumes in non-hazardous waste management systems unless measures are made to separate out these recyclable wastes.

Federal and state regulations govern the collection and management of these widely generated wastes, thus facilitating environmentally sound collection and proper recycling or treatment since economical recycling options exist for most of these wastes. These regulations also encourage the development of municipal and commercial programs to reduce the quantity of these types of wastes going to landfills. States can modify the universal waste rule and add additional universal waste(s) in individual state regulations, so the exact regulations for the applicable state should be consulted.

Universal Wastes include:

- **Batteries;**
- **Aerosol cans;**
- **Pesticides;**
- **Mercury-containing devices (such as mercury thermostats);**
- **Mercury-containing lighting (such as fluorescent bulbs); and**
- **Electronic devices and components (such as computers and monitors).**

B. Sources and Pathways of Airport Waste

For the millions of passengers who travel by air, airports are simply places where they get a boarding pass, go through security, grab a drink or a meal, queue and board the plane, and then take off down the runway. Even those who work at an airport may not see the full scope of activity buzzing around the complex facility. Each airport activity has its own set of actors, resource requirements and waste stream. Any plan to implement a recycling program at an airport must consider all of the activities and waste streams at the facility, even if the program is phased in gradually one or two activities at a time. The major activities should be analyzed in the context of their location, the context of what tasks are being performed, and what wastes are being generated. Below is a breakdown of the principal activities at each location as well as a description of the waste that is generated.

Terminals: The terminal is the heart of an airport complex and normally has the biggest concentration of people, which can translate into the biggest concentration of waste. The terminal houses not only the ticket counters and gates, but also restaurants, shops and restrooms that are frequented by passengers and employees of airlines and the airport. In addition, many terminals are large enough to have office space and break rooms for airline and airport personnel. As of the varied operations, the types of waste produced at a terminal are also varied, and include food, paper, plastic (in many forms), aluminum cans, restaurant grease and oil, universal wastes (electronics, light bulbs, batteries) green waste (from lawn care), general trash and deplaned waste from aircraft.

Airfields: The airfield features the runways and taxiways that allow aircraft to take off, land and go to and from the terminal. With such limited and transient activities, the character of waste produced at airfields is also limited and consists mostly of rubber from aircraft tires (runway rubber) and green waste.

Aircraft maintenance hangars: In the hangars, aircraft are subjected to the repairs and maintenance that are necessary for the safety and smooth operation of such large, complex pieces of machinery. In addition, airlines have aircraft ground service equipment (GSE) that need to be serviced as well. Servicing equipment results in a number of predictable types of waste, such as oil, grease, certain hazardous chemicals, universal waste (batteries, electronics, light bulbs), wastewater, plastic and vehicle waste such as tires and fluids (brake, transmission, etc.). These hangars also typically have office space where office waste is generated (see offices description below).

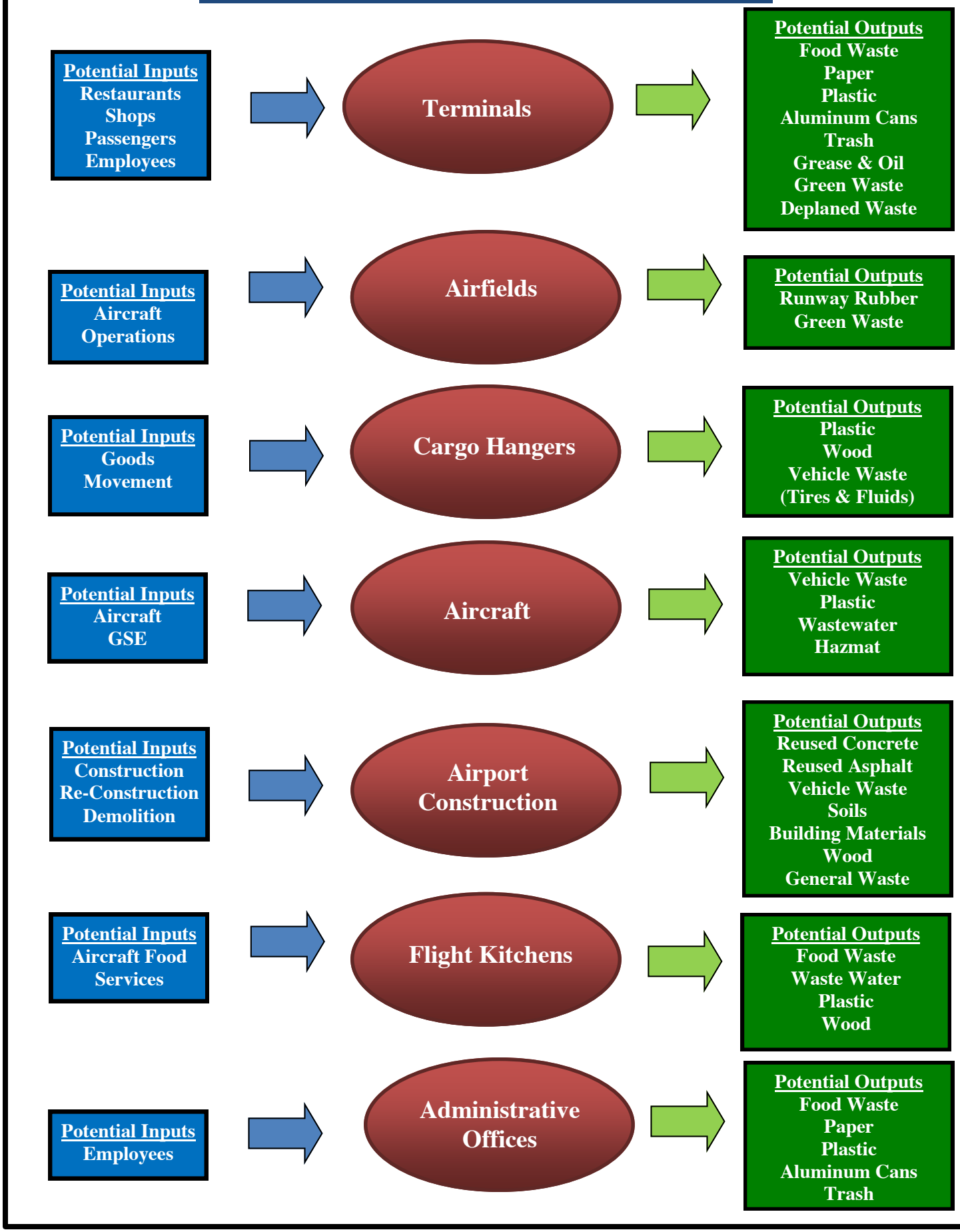
Cargo hangars: At all but the smallest airports, cargo being transported by air is loaded and offloaded and temporarily stored in hangars, and those hangars have equipment to move large heavy pallets. Waste from the cargo hangar will include tires, fluids from equipment, universal wastes (light bulbs, electronics, and batteries), wooden pallets and plastic packing material.

Flight kitchens: The food that is served on passenger airplanes has to be prepared, packaged, staged, and loaded onto the aircraft. During these phases, several types of waste may be produced, such as food, wastewater, plastic (of various types) and wooden pallets.

Offices: All airports have office space for airline and airport employees, as well as government representatives, and large airports may have multi-story office buildings. These offices yield waste streams typical of all office operations: paper, toner cartridges, universal wastes (batteries, light bulbs, and electronics), plastic, aluminum cans, food and general trash.

Airport construction projects: Whether they are large or small, all airports have construction needs from time to time, which can involve demolition, renovation or new construction. The waste products from construction are different from the normal day-to-day waste streams and thus require special attention, as will be discussed later in this paper. Types of waste that can arise from construction activities are concrete, asphalt, building materials, wood, soil, construction equipment waste and regular trash.

Any Town Airport Waste Streams



II. ESTABLISHING AN AIRPORT MUNICIPAL SOLID WASTE RECYCLING PROGRAM

Although airports throughout the United States have made efforts in recent years to increase recycling and minimize MSW, much work remains to be done. Undoubtedly, there are formidable challenges involved in setting up effective waste minimization and recycling programs at airports, but significant improvements can be made through a comprehensive analysis of the current systems in place, a frank assessment of constraints, and development of a clear plan of action.

Until recently, most airport recycling programs have focused primarily on maximizing the amount of recyclable materials removed from the waste stream. While this is important from both environmental and economic perspectives, a broader view is also necessary. Rather than focusing exclusively on extracting recyclables out of the waste stream, large organizations are now finding ways to minimize the overall waste stream up and down the value chain, thus influencing material management for better environmental and economic results. Similarly, a successfully executed airport recycling/waste minimization program has the potential to positively impact airport tenants, customers and the community at large.

The EPA provides a best practices overview regarding establishment of a recycling/waste minimization program at an airport as well as an overview of wastes typically generated at airports.[2]

A. How to Establish an Effective Airport Recycling/Waste Minimization

A successful long-term airport recycling program is the result of careful planning, precise execution, and continual testing and improvement. Using examples from the experiences of airports around the country, along with input from the Environmental Protection Agency (EPA), ten primary steps have been identified to design and implement an effective airport recycling/waste minimization program. While the problem of effective recycling/waste minimization at airports is universal, each airport faces a unique set of problems depending on its individual region, unique geography and society. Therefore, while some general practices are applicable to all airports, some solutions discussed may only apply to a particular airport or region.

10 Steps to Design and Implement an Effective Airport Recycling/ Waste Minimization Program

1. Commitment from Management
2. Program Leadership
3. Waste Identification
4. Waste Collection and Hauler
5. Waste Management Plan Development
6. Education and Outreach
7. Monitor and Refine
8. Performance Monitoring
9. Promote Success
10. Continuous Improvements

1. Commitment from Management

In order for a recycling program to be successful, management has to support the program. Management will need to understand the benefits of implementing a recycling program. Management will also need to be updated with successes to ensure their continued support.

[2] http://www.epa.gov/osw/conserve/rrr/rogo/documents/airports.htm

2. Program Leadership

A recycling coordinator should be designated who will be responsible for overseeing the recycling program. The coordinator will work with individuals from every sector of the airport to design and implement the program. They will also help to encourage participation and train and educate tenants, concessions and the public. In addition, the coordinator would be responsible for monitoring the recycling program and reporting to management.

3. Waste Identification

Waste Audit Case Study:

- **Los Angeles International Airport (LAX)**
- **Portland International Airport (PDX)**
- **St. Paul International Airport (MSP)**

Prior to developing a recycling/waste minimization plan, it is imperative to understand what waste is generated by which stakeholders, how much is collected, and where collection takes place at the airport. Examining both qualitative and quantitative data is essential and provides a baseline necessary for measuring future progress. Proper waste assessments should be based on the size of the airport, specific knowledge of airport operations, and include a detailed analysis of the waste stream, the program goals, and available resources, both at the airport and local recycling capabilities. The waste audit can also provide a baseline for future comparisons and for identifying new recycling opportunities.

Primary approaches to understanding the generation and flow of waste at an airport is a waste audit and include:

- Examination of Records
  - Waste hauling and disposal records and contracts
  - Supply and equipment invoices
  - Other waste management costs (commodity rebates, container costs, etc.)
- Facility Walk-Through
  - Qualitative waste information through observation of staff and customers and first-hand observation of waste handling practices to understand waste handling practices and how waste flows through an airport
  - Understanding waste pickup and hauling practices and how waste flows through an airport
- Waste Audits
  - Collection and analysis of the types of waste produced at the airport

Waste Assessments should include:

- Identification of what can and cannot be recycled in the region.
- Locations in the airport that generate waste.
- Types of wastes generated in each area, such as paper, scrap metal, plastic, etc.
- Identification of which materials that can be reduced, reused, and recycled
- Quantity of waste generated by each area of the airport (airlines, administrative offices, enplaned and deplaned passengers, concessions, etc.).
- Commodity rates for recyclable materials.
- Expenses for processing recyclables
- Costs for hauling, disposal and labor of landfill bound waste.

The most comprehensive and resource intensive way to assess waste stream composition, opportunities for waste reduction, and capture of recyclables is through a waste audit or material sort. To be successful, a waste audit must be a well-organized process that explicitly measures the quantity and types of

wastes generated. It provides a "point in time" snapshot of the waste stream of an organization and a reference point that provides information about current waste practices and how they can be improved. At an airport, a variety of waste, generators, receptacles and collection systems may be evaluated to assess specific waste streams.

4. Waste Collection and Hauler

Once you understand what is in your waste stream, it is important to gauge the potential markets for the materials that could be potentially recovered from it. One of the frustrating things about recycling is that the markets for secondary materials fluctuate, particularly for waste paper and cardboard. Proximity to glass recycling facilities can effect whether there is even a market for recovered glass. This market variability makes it difficult to establish recycling standards that are appropriate nationwide. However, there are a few materials that generally have some value in all markets, such as aluminum cans. Local waste haulers will know which materials can be cost-effectively recycled in your area.

Waste collection and choosing a waste hauler will be dependent on your area and what works best at the individual airport.

a. MSW Waste Collection

There are different options for collection systems depending on the local recycled materials market and the unique needs of each airport. Each system has advantages and disadvantages. Markets, material commodity values, local and regional frameworks, and types/availability of haulers should be examined before the system is created.

- *Separate stream recycling* requires airport travelers and tenants to place different materials in separate bins. The most common version of separate stream recycling is one bin for containers (plastics bottles, aluminum cans, and glass bottles) and another bin for paper. This ensures that material collection maintains a high level of quality, improving market returns for most materials.
- *Commingled recycling* allows airport travelers and tenants to place all recyclable materials in a single bin. The material is sorted later, usually at the materials recovery facility. This method can lead to lower quality material, particularly for paper and may not be available in some regions.
- *Post-collection separation of ALL materials*, known as "Mixed Waste Processing", allows airport travelers and tenants to dispose of recyclables and trash in the same receptacle. All material is sorted later. This process is labor-intensive and removes responsibility from individual generators.

Multiple studies have shown that public area waste collection at airports best achieves desired results of proper sorting and minimal contamination in recycling and waste streams when collection containers are paired in a "buddy system" containing paired recycling and landfill waste bins. Top-facing images and restrictive lids help to educate busy travelers to properly segregate and place materials and reduce contamination. Given the right visual cues and a simple, paired waste/recycling approach, public area collection can successfully contribute to an effective waste minimization program.

Different areas within the airport facility can have different collection strategies. The decision about what type of collection system is best for a facility or for specific areas requires an understanding of passenger and employee behavior and the value of the recyclables if co-mingled or separated. The waste identification process described above can help inform decisions about the best collection method.

In addition, compactors can be of value for reducing the amount of floor or ramp space needed for waste and recyclable collection. Again, the facility constraints and layout, value of the commodities, and nature of the waste generated from the collection area are instrumental input for making informed decisions about whether compactors make sense or not. For new additions to a concourse or terminal building or for new construction, it is imperative that the discussion about whether to include compactors or not should take place during the initial planning discussions.

b. Waste Hauler

Choosing the appropriate hauler and Material Recovery Facility (MRF) is an important component of an airport waste minimization and recycling program. There may be multiple options depending on the geographical location, and contracts and services may be bundled or separate.

Generally, two main systems of waste hauling contracts are available at airports; however a combination of the following systems may be appropriate for larger airports. Individual waste hauling contracts for each tenant represent a decentralized system, while airports that choose to handle all waste together represent use of a centralized system. When circumstances allow, many airports opt for a centralized waste management system, as it simplifies the collection process and allows for added efficiencies. A centralized system requires only one site for bins or collection, and this central collection area may be used for all tenants. Size considerations and volume of collection may warrant the use of decentralized system of waste collection; however, efficiencies may be gained by establishing a "hub and spoke" approach to a decentralized collection (multiple centralized collections) that could mimic many of the benefits of a single centralized collection.

In addition to the two main systems, there is an emerging strategy of Resource Management Contracting which compensates waste contractors for development of the collection system and performance in achieving the waste reduction goals rather than the volume of waste disposal (EPA reference).

There is no "right" choice for a hauler. An optimal hauler will be chosen depending on the specific needs of each individual airport. Generally, the hauler chosen should present the right balance of cost with the service necessary to achieve the recycling/waste minimization goals of the program. There are various levels of service that can be provided, and haulers may vary based on cost, customer service, environmental impact, and many other factors. It is important to point out that municipal governments may have contracts or policies in place that dictate specific requirements not addressed herein. The airport sponsor should check with the local solid waste division within his/her respective county to inquire about any local requirements.

5. Waste Management Plan Development

In developing the waste management plan, consider who the essential stakeholders are, characteristics of waste at your airport, and waste reduction strategies that could be implemented. This document outlines some common challenges when implementing a recycling program (see below).

a. Who are the essential stakeholders?

There are a number of essential stakeholder groups to consider when creating an airport recycling program. The implementation of a successful program should directly address each of the following groups, taking into account the individual needs and challenges of each when developing the program.

Essential Stakeholders

- Passengers passing through public areas, parking lots, garages, curbside pickup and drop off areas, restrooms, holding areas, and food courts
- Tenants such as businesses, airlines, and concessions (including taxi, hotel, rental cars, flight kitchens, and other industries that operate at the airport)
- Airline employees (including ground crew, cabin cleaning crew, catering);
- Employees of airport authorities, government offices, business agencies, etc.
- Maintenance operations and support facilities
- Contractors of the airport and its tenants, including aircraft cleaning and service, janitorial services, waste haulers, and construction contractors
- City or County solid waste management.

b. Waste Reduction Strategies

Waste reduction minimizes waste that would otherwise wind up in a landfill or disposed of in some other fashion that is environmentally undesirable. Reduction of a waste or a waste stream can come in different forms including waste redirection, repurposing, reuse, separation, or other means to lessen the volume of the waste stream or amount of waste. Reduction can best be accomplished when the total composition of an airports waste stream is analyzed in its entirety. Anything that moves material away from the landfill or some other disposal option is a positive move towards reduction.

i. Municipal Solid Waste General

Methods to reduce waste generated by the airport rely on contractual requirements. Examples include

- Requiring the vendor to package waxes, cleaners and other airport custodial products in refillable containers that can be accepted back by the manufacturer for reuse;
- Contract requirement for acceptance by the manufacturer of the airport's specification paints of any paint waste, which can be mixed into new paint batches;
- Contractual requirement to reduce packaging of products bought in bulk by the airport; and

- Requirements that concessions use compostable plates, plastic ware, and other high use items.

Airports undertake a number of measures for reduction of waste. To reduce the weight of trash, travelers at San Francisco International Airport (SFO) are asked to empty their water bottles in a receptacle prior to passing through the Transportation Security Administration (TSA) check points where liquid in drinking water bottles is prohibited. The collected water is then directed down a sink drain instead of being added to the other regular trash reducing the weight of the trash. When the weight of trash is reduced, it is less costly to dispose of. That also translates into less energy used to dispose of water weight in the trash waste stream. For example, some airports have constructed pre-security liquid collection vessels so that fluids from portable drinking containers can be emptied prior to disposing or recycling the bottle. This type of system helps to maintain the integrity of the recyclables and reduces the weight of the trash.

Liquid Waste Case Studies:

- **Oakland International Airport (OAK)**
- **Portland International Airport (PDX)**
- **San Francisco International Airport (SFO)**

Food and Restaurant Case Studies:

- **Denver International Airport (DIA)**
- **John Wayne Airport (SNA)**
- **Minneapolis Airport (MSP)**
- **Philadelphia International Airport (PHL)**
- **San Francisco International Airport (SFO)**

Some airports are using trash compactors to reduce the volume of the waste. Yet others are using composting for green waste and food waste. Compositing uses aerobic decomposition to degrade organic material. The compost product can then be used as a soil amendment.

Small-scale compositing operations can take place on site, though regulatory requirements vary from one jurisdiction to another for this activity. Commonly, green waste destined for further processing is hauled to a compost facility that can handle large quantities of this material, producing a more consistent compost product, while complying with all local and state regulatory and permitting requirements.

Pallet Case Study:

San Diego International Airport (SAN)

Shipping pallets, most commonly wooden but can be made of metal or plastic, arrive at the airport from deliveries of goods from vendors serving both the airport and airport tenants. Contractual arrangement with vendors to allow return and reuse of the pallets with new shipments should be identified and promoted.

Due to the numerous deliveries at any airport, cardboard has become a typical recycled item. Bailers and bins are placed in locations around terminal loading docks and in facilities yards to deal with this voluminous waste stream. Bailed, cardboard boxes have a relatively high resell market value and often are the "low hanging fruit" in an airport's recycling scheme.

General MSW Case Studies:

- **Denver International Airport (DIA)**
- **John Wayne Airport (SNA)**
- **Minneapolis Airport**
- **Oakland International Airport (OAK)**
- **San Francisco International Airport (SFO)**
- **Yeager Airport (CRW)**

ii. Green Waste

Green Waste Case Study:
San Diego International Airport (SAN)

Depending on the local climate and physical environment, there are various options available at airports to reduce the amount of green waste generated, which include the following best management practices:

Landscape Design and Plant Selection. A well-planned landscape design can help prevent or reduce the amount green waste produced or and amount of resources expended for its maintenance. Each region of the country has different resource conditions, such as the amount of annual rainfall, soil type, temperature ranges and available sunlight, all of which need to be taken into consideration when planning landscape design and plant selection. Finding the right balance of plant types and efficient irrigation systems can provide both the optimal aesthetics and resource conservation goals of the airport.

- *Xeriscaping*. The practice of xeriscaping applies to landscaping that uses slow-growing, drought-tolerant plants, which conserve water and reduce the amount plant trimmings, and ultimately waste generation. In many instances, this involves the selection of indigenous, native plant species, which are already accustom to the regional climate and environment. In addition, xeriscaping generally requires far less fertilizer, herbicide and pesticide use than traditional landscaping methods and therefore is more environmentally sustainable.
- *Grasscycling*. The practice of grasscycling simply means leaving the grass clippings on the lawn after mowing. The grass clippings quickly decompose, allowing valuable nutrients and moisture to return back to the soil. Grasscycling saves time and money by reducing the mowing time (since bagging and discard of clippings is eliminated) and the amount of fertilizer, herbicides, pesticides and water needed to maintain a healthy turf. Consequently, it is also good for the environment by minimizing the amount of potential pollutant discharges going to the storm drain system and beyond.
- *Mulching*. The process of mulching involves physically breaking up the landscaping trimming using a chipper, grinder or other mechanical means. The resultant "mulch" can then be applied as a protective cover over bare areas of soil to retain moisture, provide insulation from cold weather, reduce erosion, provide nutrients, and suppress weed growth and seed germination. The mulching of landscaping waste can take place on site for direct application or it can be hauled off to a local mulching or composting facility for processing.

- *Alternative Daily Landfill Cover*. Another application of green waste is in its use as alternative daily cover at municipal solid waste landfills, where permitted. Using green waste as daily cover, in lieu of soil cover, saves valuable landfill space and may count towards waste diversion goals in many jurisdictions. Generally, the green waste is hauled directly to the landfill, where it is shredded, stored and applied as daily cover material.

iii. Deplaned Waste

Deplaned Waste Case Study
Portland International Airport (PDX)

On average, 20% of a commercial service airport's municipal solid waste is from deplaned waste.[3] Analysis has shown that 40% of this total could be readily recycled.[4] For example, by weight #1 PET plastic bottles represent about 1% of deplaned waste, and aluminum cans roughly 3%, with mixed paper being the largest fraction that is easily recyclable.[5] Other deplaned material destined for disposal includes things that could be handled through better management, such as large quantities of used travel kits, head phones, partial rolls of toilet paper, and clean, unused paper products. Food waste and soiled paper are easily compostable; however, easy access to composting facilities is not widespread across the U.S. yet.

There are a number of airline participants that would need to be involved in comprehensively addressing deplaned waste, including purchasing, inflight catering, flight attendant services, and cabin cleaning. There is great variability among airlines in their approach to recycling deplaned waste, and significant room for improvement. Airports can play an important role in working with their airline tenants in providing adequate facilities for recycling deplaned waste. There are numerous documented instances of source-separated recyclable material being thrown in the trash due to poor communication and inadequate facilities.

As mentioned in the introduction, there is a portion of deplaned waste known as international waste that has to be processed separately. However, even some of these wastes could be recycled. The best opportunities for recycling international waste are with cans, bottles, newspaper/magazines that have not come into contact with food, or plastic containers that haven't held milk or dairy products and have been stored separately from the other international waste. These items can be included in an airport's recycling stream without being incinerated, sterilized, or ground up. Bins are often provided for by an airport where recyclable materials can be collected, or the recyclables are rounded up for redemption by the airlines at their designated station.

Airline purchasing departments should carefully choose the products that go on board to make waste management easier. Rather than a disposable travel kit on every seat for international flights, for example, providing those kits on request would reduce waste. Some airlines already have locations where discarded newspapers and magazines can be used by other passengers; this type of reuse should be encouraged.

[3] Airports such as PDX have reported up to 40% of the airport's waste as deplaned waste (PDX, June 2011)
[4] *Id*.
[5] Based on PDX audits conducted in January and June 2008.

One of the challenges to reducing deplaned waste by recycling materials is that there is not a national program established for all airports to process deplaned waste the same way. Due to the complexity and variability of recycling and waste collection in the United States, it is challenging to implement a "one size fits all" approach to recycling for airports and airlines. The materials mix that Materials Recovery Facilities will accept varies substantially not only nationally and regionally, but often within a single community, making a streamlined collection process a major challenge. Increasing landfill diversion rates from deplaned waste collection will remain difficult until standards of collection and regulation are adopted.

If there was a national standard airlines that serve multiple markets would be able to establish uniform procedures knowing that facilities will be available to manage their deplaned recyclables. In addition, airports would be able to increase their overall recycling rates knowing that there will be consistency in how material will be coming off planes. If there was a national standard, materials could be comingled in collection bags, and easily separated at a sorting facility. On board collection could consist of two bags, one for these recyclable materials, and one for everything else. It is recommended that clear plastic bags be used for both the recoverable material and that to be disposed, so that materials can be easily identified. The clear two bag system could be used by both flight attendants and cleaning crews.

6. Education and Outreach

Initial communication before implementation of the program, continuing education, and ongoing facilitation with each of these groups and awareness of the different role each plays in the airport program will be pivotal for success. Many airport tenants, contractors (such as janitorial service companies) and concessionaires have significant employee turnover. Therefore, recurring training is required to ensure that the airport staff is well versed in the program specifics. In addition, some of the staff may not use English as a primary language, therefore the training materials and signage should be addressed appropriately.

Training Case Studies:

- **Denver International Airport (DIA)**
- **Oakland International Airport (OAK)**
- **San Francisco International Airport (SFO)**

Whenever possible, it is helpful to share with the public and stakeholders data and metrics about the positive impact that the program is having on the environment. Waste reduction decreases transportation emissions and saves energy by using fewer resources. Producing new products from recovered materials lessens the need for mining or harvesting virgin materials. The EPA's Waste Reduction Model (WARM) allows organizations to estimate the greenhouse gas and energy savings from recycling, composting and source reduction.

7. Monitor and Refine

Throughout the implementation of the recycling program, there should be continuous monitoring and refinements to the recycling program to ensure that recycling is encouraged.

8. Performance Monitoring

Ideally, specific program goals should be set prior to initiating collection. In many cases, targets will be created in part by local government and state mandates. For example, certain jurisdictions may require the airport to recycle a certain percentage of its waste to help achieve this particular goal. In other cases, targets will be primarily internal. There is increasing pressure to increase waste diversion rates in many regions of the country, and some areas are setting mandatory minimums. These local or state goals can be starting points for many programs. Conversely, there may be little political or economic incentive in a region, but an operation with the size and impact of an airport may help push and develop markets for recycled commodities to create momentum in the regional marketplace.

The performance monitoring measures will help to communicate the successes of the recycling initiative at the airport. Quantifying how much waste is being recycled and compare this to baseline waste audit information can be helpful to show management and the public how the program is helping to reduce waste.

9. Promote Success

Promoting the success of the recycling program will ensure that the public, tenants, and management continue to support the initiative.

10. Continuous Improvements

The airport recycling coordinator should evaluate the program over time and consider new initiatives to help reduce waste and promote recycling or reusing materials.

B. Challenges for Setting up a Recycling and Waste Reduction Plans at Airports

Implementing and maintaining a successful recycling/waste minimization program at any organization can be challenging. Given the size, complexity, and pace of an airport environment, these challenges are greatly exacerbated. There are a number of common obstacles that impede the development and ongoing progress of a successful program.

- *Dealing with multiple entities:* There are multiple stakeholder groups that impact and are affected by recycling and waste collection in an airport environment. This creates a complex system with many opportunities for unintended consequences. Therefore, an appropriate recycling strategy should consider all groups that participate, and how they interact with one another, in order to create an optimal strategy for the success of the program.
- *Fractured/disjointed management chain:* Due to high employee turnover among concessions and tenant staff, it is difficult to get consistent compliance and proper waste sorting and disposal. Constant feedback, education, and ongoing technical assistance are pivotal for success.
- *Incentives structure:* In areas where the airport authorities are responsible for tenant and airline waste management, incentives structures that encourage waste minimization must be considered. Additionally, in regions where landfill disposal fees are low, strategies need to be developed to encourage waste minimization.

- *Space needs:* To make proper waste minimization and collection a priority, convenient and ample space must be provided at the terminal. With cost and space as pivotal factors, waste collection is often an afterthought, forcing less-than-ideal conditions for collection and the need for improvisation.
- *Airfield security:* Security measures complicate access for the waste hauler to airport areas such as ramps and loading docks.
- *Maintenance:* Maintaining an appropriate number of staff to keep waste areas clean and free from discarded materials is critical. If left unchecked, waste areas will quickly become a "dumping ground" for materials and wastes beyond the scope of the program.
- *Language or cultural barriers:* Multiple languages and cultures can present communication challenges, especially in the development stages of a program or a particular initiative. It is especially important to be sensitive to cultural and language issues as plans are established and the waste recycling system is implemented.
- *Human nature:* A successful waste collection area must be designed with human psychology in mind. Simple paths towards different waste collection are important, and collection containers should feature clear, consistent language and presentation.
- *Lease language:* Lack of specific recommendations for materials procurement, employee training, guidelines, expectations and recommendation for airport tenant compliance with waste program protocols can provide significant challenges to successfully executing an airport waste program.

III. CONSTRUCTION AND DEMOLITION WASTE (CWM) PROGRAM

This section discusses the reuse and recycling of construction materials, including benefits, costs, goal setting, types of construction and demolition (C&D) debris, CWM Plans, best practices, implementation considerations, tracking and reporting, markets for recycled materials, lessons learned, and resources.

A. Objectives of a CWM Program

A CWM program is dependent upon development of goals, sustainability guidance, and use of more specific implementing mechanisms through use of standards, specifications, project tracking checklists, and standardized reporting formats.

Two Primary Objectives of a CWM Program

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

C&D debris can be defined as the non-hazardous solid waste stream than results from land clearing, excavation, and/or the construction, demolition, renovation, and repair of structures, roads, and utilities. C&D debris commonly includes concrete, asphalt, wood, metals, drywall, carpet, plastic, pipe, rocks, earthwork, land-clearing debris, cardboard, and salvaged building components. C&D debris makes up roughly 25 percent of all solid waste discarded in the U.S.[6]

Some airports have developed CWM programs to encourage recycling and reuse of non-hazardous wastes and materials generated during construction, demolition, renovation, maintenance, and repairs.

An efficient construction waste program may provide the following benefits:

- Economic – Provides cost savings from reduced material hauling, disposal fees, and fuel costs, and avoiding purchasing new materials. Job site recycling creates employment and economic activity that benefits local economies.
- Environmental – Reduces the amount of materials sent to landfills and the environmental impacts of extracting or producing new materials. The reuse of materials on-site reduces off-site hauling, and decreases transportation air emissions and fuel burn.
- Operational – Streamlines the quantification and organization of materials on-site, reducing impacts to airport operations. Less time and labor may be needed for hauling, installation and maintenance.
- Social – Reduces traffic in the surrounding community through reduced off-site hauling.

[6] Lennon, Mark, The Institution Recycling Network, *Guide to Construction and Demolition Recycling*, page 2, April 2005, www.mass.gov/dep/recycle/reduce/cdrguide.pdf (accessed May 14, 2012).

B. Involving Contractors and Other Stakeholders

Procurement Case Studies:

- **Chicago O'Hare International Airport (ORD)**
- **San Francisco International Airport (SFO)**
- **Salt Lake City International Airport (SLC))**

A successful CWM program means starting early; incorporate a CWM program from the start to guarantee success. Include recycling requirements in all contracts, subcontracts, and purchase orders. All applicable goals, guidance, and required standards and specifications to be applied need to be addressed prior to contracting and acknowledged during the procurement stage. This includes addressing CWM requirements during pre-proposal or submittal conferences, providing requirements in advance, in RFQs/RFPs, and other materials. Confirmation of any applicable "green building standards" or airport sustainability guidance manuals should be clearly made. Pre-bid meetings to clarify expectations, requirements, and performance criteria are also a valuable tool for the airport and contractor to emphasize managing resources in economically and environmentally responsible ways (e.g., waste reduction, reuse and recycling).

Be upfront to ensure contracts highlight repurposing, reusing materials/salvaging, and how use of recycling materials is defined. Contracts should establish clear minimums (goals) and applicable standards and specifications. Contracts can require preparation of a CWM Plan, establishment of a CWM coordinator/manager, and tracking and reporting requirements. Resource Management contracts, which typically include pre-bid meetings to clarify expectations, requirements, performance criteria, etc., can also be a valuable tool for the airport/contractor to emphasize and/or reward managing resources in economically and environmentally responsible ways (e.g., prevention, reuse, and recycling).

Continual training helps ensure understanding and compliance with established goals and requirements. Conduct periodic training workshops to explain goals, requirements, and tracking and reporting requirements. Reward and recognize contractors and employees for meeting and exceeding goals and related achievements. A variety of incentive programs can be considered to monetize complying with and exceeding established CWM recycling goals. The incentives can be monetized to financially reward contractors through reduced costs, incentive payments, or bonuses. Non-financial incentives include award and recognition programs that recognize savings, achievement of goals, and overall performance.

C. Establish Construction and Demolition Diversion Goals

To achieve the economic, environmental, operational, and social benefits of implementing a CWM program, establish upfront minimum goals for recycling and reusing and/or salvaging non-hazardous C&D debris. To facilitate this process, the airport/contractor should adopt a CWM Plan to maximize the diversion of materials from disposal and expedite recycling and reuse of materials in projects.

Goals can be established formally through environmental or sustainability management plans and other sustainability related programs, implementation of standards and specifications, and contractual requirements, perhaps in parallel with other state or local requirements. Goals can also be achieved indirectly through cost-savings considerations. For example, re-use of materials can lower acquisition and disposal costs, and environmental initiatives can reduce fuel usage and

air emissions. Today, airports such as San Diego and Chicago are achieving a high percentage of material recycling and recovery, approximating a 98% recovery rate.

Diversion should include the salvage of materials on-site or the donation of materials to charitable organizations.[7] Each airport and/or contractor should determine the market for recycling or reusing materials in its area, and the available haulers and recyclers to handle the materials. The particular location and project could influence the airport's diversion rate goal. For example, relocating airfield security fencing may have a higher diversion rate goal compared to construction of a taxiway.

D. Developing a Construction Waste Management (CWM) Plan

Implementation of a CWM program is a start-to-finish process, beginning long before project start with development of goals, standards and specifications to implement those goals, reflection during the procurement process and contracting, training, and incentives through cost savings, awards and recognitions. A CWM program is dependent upon development of 'Sustainability Design and Construction' guidance, along with implementing mechanisms through use of standards and specifications and project tracking checklists.

At a minimum, a CWM Plan should identify the anticipated types and quantities of materials to be diverted from disposal and the required process for on-site and off-site sorting or comingling of materials.

CWM Program should consider the following construction and demolition debris for recycling or reuse:

- **Earth, Soil, Dirt**
- **Concrete Reclaimed Asphalt Pavement**
- **Bricks/Masonry (cinder blocks, mortar, etc.)**
- **Rock, Stone, Gravel**
- **Ferrous Metal (iron, steel, etc.)**
- **Nonferrous Metal (aluminum, copper, etc.)**
- **Roofing Shingles and other Roof Materials**
- **Cardboard, Paper, Packaging**
- **Sand**
- **Wood**
- **Gypsum Drywall**
- **Plastics**
- **Plaster**
- **Paint**
- **Plumbing Fixtures and Piping**
- **Carpet and Pad**
- **Non-Asbestos Insulation**
- **Glass**
- **Land-Clearing Debris**

Included within the CWM Plan is consideration of a "balanced earthwork management plan" that outlines procedures and best practices to maintain and utilize excavated soil and land-clearing debris on-site and/or for other nearby projects. As such, the airport and contractor(s) need to

[7] U.S. Green Building Council, "MR [Materials and Resources] Credit 2: Construction Waste Management," LEED® 2009 Reference Guide for New Construction and Major Renovations," updated October 2010.

evaluate cut-and-fill needs early on to maximize the potential benefits of matching available soil and material resources with project needs.

A CWM Plan typically consists of the following information:[8]

1. **General**: An overall strategy for managing the project's C&D debris. Describe the general intent of the project with regard to the diversion of C&D waste from the landfill or incinerator and the recovery of materials where applicable.

2. **Regulatory**: Reference all applicable laws, municipal codes, regional plans, city or airport sustainability manuals, construction specifications, and any other appropriate standards and specifications. The contractor must comply with waste transport, disposal, stormwater, and other regulations of state, local, and/or federal authorities having jurisdiction. The CWM Plan should clearly indicate that the contractor is responsible for providing waste handling, containers, storage areas, signage, transportation, and other items to facilitate implementation of the CWM Plan for the duration of the contract.

3. **Waste Identification:** The anticipated types and quantities by weight of demolition, site-clearing, and construction waste generated by the project, including the assumptions for the estimates. Calculations should be done by weight (conversion may be necessary) and must be consistent throughout. The CWM Plan should include:
    - Completing a 'Materials Handling Estimate Worksheet' for all applicable project waste streams.
    - Identifying where recyclable materials storage and collection points will be.
    - Identifying a plan to communicate recycling goals with employees and subcontractors.

4. **Waste Reduction Work Plan**: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total weight of each type of waste, final disposition for each waste type, and handling and transportation procedures.

    a. *Salvaged Materials* – For each type of material that is salvaged or recycled, describe the type of material, source, estimated quantity, and receiving entity. Include names, addresses, and telephone numbers for the receiving individuals and/or organizations.

    b. *Disposed Materials* – Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

    c. *Handling and Transportation Procedures* – Describe the method for separating recyclable waste, including sizes of containers, container labeling, and the designated location where material separation will occur. CWM operations should be conducted in a manner to minimally impact airport and public roadways, streets, sidewalks, and adjacent facilities. A site should be designated for the classification of materials to be salvaged,

[8] Chicago Department of Aviation, *Sustainable Airport Manual*, Version 2.1, Section 5.0 Materials & Resources, 5.3 Construction Waste Management, October 31, 2011.

recycled, reused, sold, donated, or disposed. Waste materials should not be allowed to accumulate on-site. The C&D debris should be removed and transported in a manner that prevents spillage and all truck beds should be covered at all times during transport en route to the ultimate destination.

The airport and/or contractor(s) should continually track and report on quantities and types of materials generated, reused, and disposed of off-site, on compliance with sustainability goals and objectives, and on application of best practices to evaluate compliance with the CWM Plan and recognize completion of best practices. Metrics may include developing "Sustainability Design and Construction" guidance, along with more specific implementing mechanisms through use of standards and specifications, project tracking checklists and standardized reporting forms. Results can be reported in quantities achieved, resulting benefits, subsequent uses of materials, and results relative to goals. Additionally, programs and/or contractors can be further recognized by applying a rating and ranking program and an award recognition program.

Other Considerations

Depending on the number and size of projects, the airport may consider developing a sustainability design and construction review team comprised of project planners, construction management, and contractors to facilitate project reviews, reporting and tracking. Project reporting can be achieved through standardized checklists and forms that are submitted electronically. Holding training workshops for contractors can be a valuable tool for reviewing CWM tracking and reporting requirements.

The airport/contractors should further reduce the use of finite raw materials and long-cycle renewable materials by replacing them with high-recycled content, rapidly renewable materials and Forest Stewardship Council (FSC) certified wood products. Goals and percent requirements should be clearly established and communicated, and projects that include high-recycled content materials should be recognized and rewarded. "Closing the loop" by purchasing products made with materials recovered from recycling creates a market for materials recovered/recycled from projects. Programs can establish minimums, or higher content ratios to further facilitate 'buying recycled.' Typical construction related products with high-recycled content include:

- Steel Rebar (default 25% recycled content)
- Copper wire (assumed to contain 65% recycled content by default)
- Other metals
- Wood based products (pallets, forms, etc.)
- Carpet
- Windows, doors, framing
- Plastic products
- Building materials

5. Tracking, Reporting, Invoicing – CWM Submittals: Submit documentation demonstrating how the CWM Plan goals were met, which may include the following:

- Provide a design estimate of materials anticipated to be used, recycled, salvaged, and/or disposed of using the CWM form.
- Develop a full CWM Plan prior to start of construction, which includes a pre-construction estimate of construction material types and quantities to be recycled and/or disposed of during the project.
- Submit monthly CWM forms provided by the Contractor during construction.
- Complete material Handling Worksheets, which may include recycling receipts and weight tickets for all materials provided by the recycling facility to the airport/project manager.
- Provide a final construction waste total provided by the contractor prior to final payment.

Consider also assigning a CWM coordinator to be a single point of contact responsible for implementation, monitoring, and reporting of CWM activities. The contractor should be held responsible for training workers, subcontractors, and suppliers on proper CWM procedures. The CWM Plan must be distributed to all subcontractors and suppliers when contract work begins.[9]

Construction and Waste Case Studies

- **Chicago O'Hare International Airport (ORD)**
- **Denver International Airport (DIA)**
- **John F. Kennedy International Airport (JFK)**
- **Phoenix International Airport (PHX)**
- **Oakland International Airport (OAK)**
- **Salt Lake City International Airport (SLC)**
- **San Diego International Airport (SAN)**
- **Yeager Airport (CRW)**

[9] Chicago Department of Aviation, Specification 01524-9, *Construction Waste Management*, O'Hare Modernization Program Master Specifications, Revision 5, Issued July 30, 2010.

IV. CASE STUDIES, LESSONS LEARNED, CHALLENGES AND BEST PRACTICES

Case studies provide the opportunity to learn first-hand through an airport's existing program or experience. The case studies included in this Appendix present a sample of the various types of waste recycling, reuse, and reduction programs already in place at many airports. Many have seen substantial success and even cost savings in their implementation. Some have been in place for a number of years; some are just getting underway. These initiatives are happening at airports of all sizes and types, although the scale of their implementation may differ. For each case study presented, you are encouraged to view additional materials available on the case study airports website, or by contacting one of our committee members for more information.

This appendix includes 27 representative case study examples created through our Committee members and as an outgrowth of an industry-wide call for case studies facilitated by our industry partners including the American Association for Airport Executives (AAAE); Airports Council International-North America (ACI-NA); and the Airports Consultants Council (ACC).

A. Boston Logan International Airport (BOS), Boston, Massachusetts

Warm Mix Asphalt on Runway 4R/22L

Aggregate Industries Northeast Region recently placed 25,952 tons of warm mix asphalt on Runway 4R/22L at Boston's Logan International Airport, the first airport in the nation to use the environmentally friendly asphalt on a runway repaving project,. The priority was to reduce greenhouse emissions and energy during construction. According to BOS, warm mix uses 20 percent less energy to make, produces 20 percent fewer greenhouse emissions when applied, and allows a higher percentage of recycled asphalt pavement in the final product.

For more information on BOS' waste management programs, visit www.massport.com/environment/environmental_reporting/Pages/EnvironmentalReporting.asp

Contact: Stewart Dalzell, Deputy Director Environmental & Planning Dept., Boston Logan International Airport, SDalzell@massport.com

B. Chicago O'Hare International Airport (ORD), Chicago, Illinois

Construction Waste Management Program

Chicago is completing the multi-phased O'Hare Modernization Program (OMP) that includes the construction and commissioning of four new runways and the extension of two others at ORD. Due to the large nature of the OMP, opportunities exist for on-site material recycling, especially for the aggregate and paving materials.

Construction waste generated as part of the OMP is used on other OMP-related projects or hauled to nearby debris sorting facilities to maximize the recovery of materials. Over 600,000 tons of materials have been recycled, including concrete and asphalt, bricks, scrap metal, light

bulbs, and landscaping waste. Over 98% of OMP C&D debris has been recycled and prevented from entering area landfills.

Through March 2012, the OMP has managed approximately 20 million cubic yards of soil on-site, saving more than $140 million either by incorporating it as part of new projects or stockpiling it for future use. As highlighted in the following table, the OMP's balanced earthwork plan, material recycling and reuse, have helped the Chicago Department of Aviation (CDA) achieve the triple bottom line.

Benefits OMP Balanced Earthwork Management Plan through March 2012

Quantities To Date (Through March 2012)	Description
Over 20 million	Cubic Yards of Soil Moved (enough to fill the Willis Tower 10 times)
Over 7 million	Cubic Yards of Excess Soil Kept On-site
Over 630,000	Haul Trips Saved
Over 1.1 million	Hours of Roadway Travel Saved
Over 47 million	Vehicle Miles Traveled (VMT) Saved
Over 7.2 million	Gallons of Diesel Fuel Saved
Over $140 million	Dollars Saved
Approximately 73,000	Tons of CO2 Saved

Source: Chicago Department of Aviation

1. *O'Hare International Airport: Guiding Construction Waste Management with the Sustainable Airport Manual And Detailed Specifications*

Focused Case Study

To ensure that sustainable initiatives were implemented during the build-out and modernization of ORD, the CDA introduced the Sustainable Design Manual (SDM) in 2003 at the start of the OMP, which was subsequently expanded into the Sustainable Airport Manual (SAM). The SDM/SAM positioned Chicago as the first in the nation to develop sustainable guidelines for design and construction at airports, establishing the model for green airport development. The SAM includes a project rating and certification system, and recognizes designers and contractors for sustainability accomplishments. The SAM has evolved to now encompass airport planning, design, construction, operations and maintenance, and concessions and tenants.

The Design/Construction chapter of SAM continues to guide the incorporation of sustainability into design and construction of civil-airside, civil-landside, occupied buildings, and unoccupied buildings/structures in an airport environment. Over 60 projects at Chicago's airports (O'Hare and Midway International Airports) have been reviewed by the SAM Green Airplane Rating System. As part of SAM, the CDA also developed a number of implementing specifications, including Specification 01524 Construction Waste Management which requires contractors to submit a CWM Plan, design estimate, monthly CWM forms, and a final construction total. For more

information, refer to the CDA's Sustainable Airport Manual, Version 2.1 (www.airportsgoinggreen.org).

For more information on ORD's programs, download the CDA's 2011 Sustainability Report at http://ohare.com/Environment/sustainabilityreport.aspx.

Contact: Chicago Department of Aviation, Amy Malick, Deputy Commissioner Sustainability, amy.malick@cityofchicago.org

C. Denver International Airport (DEN), Denver, Colorado

Waste Recycling and Waste Management Program

DEN continues to expand existing programs and explore new initiatives toward reaching the airport's strategic plan goal of becoming a zero-waste facility by 2020. In 2001, 0.64 pounds of waste per passenger was sent to the landfill. DEN has reduced this to 0.42 pounds per passenger in 2011 with a diversion rate of 12.5 percent. In 2011, DEN collected 1,571 tons of recyclable material (removing it from the municipal solid waste stream), including 59.7 tons of wood pallets, 767 tons of cardboard, and 75 tons of organic material. In addition, DEN recycled the following commodities, primarily from airport maintenance activities: more than 1,300 batteries; 26,012 pounds of electronics; 21,000 fluorescent lamps; 293 tons of scrap metal; 84,718 tons of concrete to recycle staging areas and 21,512 tons recycled in place; 11,549 tons of asphalt to recycle staging areas; 101,173 pounds of restaurant yellow grease; 1,750 gallons of antifreeze; 1,093 tires; 21,912 gallons of used oil; and 466 gallons of solvent.

Two additional programs DEN is pursuing include:

Composting – With the support of food concessionaires and janitorial staff who collect used paper towels from office restrooms, in 2011 DEN diverted more than 5 tons of organic material per month from the landfill. It is hauled to a commercial composting facility operated by A-1 Organics, where it is transformed into high-grade compost for residential and agricultural purposes.

Plastics Bailer – In May 2011, DEN was awarded an RREO (Recycling Resources Economic Opportunity) grant from the State of Colorado to purchase a plastic-film bailer. According to waste composition studies, between 80 and 100 tons of plastic film/wrap are thrown away each year by DEN and its tenants. DEN began using the bailer in January 2012 and expects to substantially reduce the amount of the plastic wrapping material going to the landfill.

1. *Denver International Airport; Pena Boulevard Construction Waste Management*

Focused Case Study

The DEN project team implemented a program that crushed, recycled, and reused roadway concrete in place along a stretch of Peña Boulevard reconstruction. This process saved the time, expense, and environmental impact of transporting old pavement and new base materials. This process saved 1,250 gallons of diesel fuel and avoided 1.5 tons of CO2 emissions and, most importantly, paved the way for broader applications of sustainable roadway improvement projects at DEN.

2. *Denver International Airport; Conducting A Waste Assessment (Waste Audit)*

Focused Case Study

In its 2009 Strategic Plan, Denver International Airport (DEN) set a goal for itself of becoming a Zero Waste facility by 2020. In 2010, DEN – utilizing Waste Management Inc.'s "Green Squad" - conducted a waste audit to analyze DEN's current waste streams, to identify how far DEN is from reaching 100% landfill diversion today, and to provide recommendations and solutions that will enable DEN to move closer to its Zero Waste goal. DEN conducted an assessment of waste generated from the following areas: Airport Office Building (AOB)/Main Terminal; Concourses A, B and C; East & West Overflow Parking; Air Cargo; Maintenance. The audit sampled 20 loads (totaling 5,395.5 lbs.) sorted into 31 material types. Weights obtained from the sorts were used to evaluate the effectiveness of DEN's current recycling programs, identify areas for improving both the current and future recycling programs, and for identifying potential savings opportunities associated with waste diversion strategies. Based on sample results, the assessment illustrated that DEN had an opportunity to decrease the amount of waste sent to landfill by over 62%, and, under current market conditions, the opportunity to save over $200,000 annually through avoided disposal costs and recycling rebate revenues.

The audit identified that up to 3,229.5 tons of recyclables (29.8% of the solid waste stream) on annual basis were sent to landfill instead of being diverted to the existing single-stream recycling program; as well as 24.1 tons (.2%) of recyclable e-waste; and 95.5 tons (.9%) of construction & demolition (C&D) materials. In addition, the audit suggested that DEN has the potential to divert up to 3,136.7 tons (28.9%) of its organics by expanding its current composting program to include pre-consumer and post-consumer waste throughout the entire airport. Finally, DEN could potentially divert an additional 170.9 tons (2.4%) annually by implementing new diversion programs. Resulting recommendations included: Improve educational awareness about DEN's zero waste goal and waste diversion throughout the entire airport; improve collection strategies to encourage more diversion; expand the current composting program to include pre and post-consumer organic material throughout the entire airport; and, implement new programs to divert additional materials.

For more information on DIA's waste management programs, see DIA's 2011 Annual Report, Managing the Environment and visit www.business.flydenver.com/environmental.

Contact: Aimee Fenlon, Environmental Public Health Program Administrator, City and County of Denver, Department of Aviation, Aimee.Fenlon@flydenver.com; or

Jerry Williams, Jerry.Williams@flydenver.com

D. Hartsfield-Jackson Atlanta International Airport (ATL), Atlanta, Georgia

Construction Waste Management Conveyor and Recycling

Hartsfield-Jackson International Airport in Atlanta is probably one of the larger airfield pavement recyclers, and has developed innovative programs to handle and process demolition waste for reuse in airport construction projects. ATL projects have incorporated in excess of 675,000 tons of recycled Portland cement concrete in projects involving reconstruction of Runways 9R-27L, Runway 8R-26L, as well as Taxiways "M" and "E." Additionally, the Airport utilized an overland belt conveyor system that transported 93 percent of the 21.5 million cubic yards of fill necessary for a new runway's construction, resulting in reduced truck trips, emission elimination, and diversion of construction material waste from landfills.

For more information on ATL's waste management programs, visit: www.atlanta-airport.com/airport/Environmental/MaterialsRecovery.aspx

Contact: Michael Chenye, Hartsfield-Jackson Atlanta International Airport, Michael.Cheyne@atlanta-airport.com

E. John F. Kennedy International Airport (JFK), Port Authority of New York and New Jersey (PANYNJ)

Construction Debris Recycling

Since January 2009, all PANYNJ contracts require the construction contractor to submit a Construction Debris Recycling Plan. The plan requires the contractor to provide documentation that 75 percent (by weight) of all steel, asphalt, concrete, and clean soil is recycled on a project-by-project basis. This goal has been met since the contract specification was introduced.

Example Project: Taxiway reconstruction/onsite material recycling. In preparation for the arrival of the A380 airplane, the centerline of one of the main taxiways at JFK needed to be shifted 16 feet for a total length of approximately 4 miles. A detailed study was conducted to evaluate the potential reuse of existing asphalt, lime cement fly ash pavements, and sandy subgrade soil. It was determined that the existing pavements could be reused onsite as a base

course for the new pavement. The pavement was removed, crushed, treated with Portland cement, and remixed onsite. A rigorous testing program was followed to ensure all specification requirements were met. This eliminated the need for approximately 25,000 cubic yards of virgin material, saved approximately $2 million in construction costs, and reduced truck traffic for aggregate delivery.

For more information on JFK's programs, see www.panynj.gov/about/airport-initiatives.html

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Arlyn Purcell, Supervisor Environmental Programs, apurcell@panynj.gov),

F. John Wayne Airport (JWA), Orange County, California

Recycling Programs

JWA is owned and operated by County of Orange, California. JWA began source-separated recycling in December 2008 at the Eddie Martin building and at the loading dock below the Terminal. Recycling carts and a 3 yard recycling bin were placed in the Eddie Martin building and a 40 yard recycling dumpster was placed in the loading dock. To facilitate use of the new recycling bins, JWA developed a pictorial recycling flyer so staff would know what goes where. Larger versions of the flyer were posted at each recycling bin. Bottle and can recycling was initiated with one major terminal vendor. Coffee ground collection and composting was initiated in 2010. JWA expanded its recycling to the public areas of the terminal after a terminal expansion project was completed in late 2011.

In 2009, the recycling rate for materials collected was 54%, a 12% increase over 2008. C&D tonnage from the terminal expansion project was recycled by private contractors. The total 2009 diversion rate including C&D was 85%, which increased to 87% in 2010. The recycling rate for materials collected also increased to 55%, a 1% increase over 2009. JWA continues to be committed to reducing its environmental footprint in an efficient, cost-conscious manner.

1. *John Wayne Airport - Coffee Ground Composting Program*

Focused Composting Case Study

In 2010, JWA initiated coffee grounds collection in partnership with its franchised waste hauler, Rainbow Environmental Services (Rainbow). Vendors selling coffee place their used coffee grounds in a separate recycling bin provided by Rainbow. Rainbow collects the grounds and transports them back to their facility in Huntington Beach where the grounds are proportionately mixed with processed green material. Once mixed in with the green material, the coffee grounds are transported to a certified composting facility where they are processed into compost. Since the inception of the program in 2010, JWA has diverted over 150 tons of coffee grounds, converting a former source of waste into a valuable resource.

For more information on JWA's program, see www.ocair.com/communityrelations/environmental.aspx.

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G. Los Angeles International Airport (LAX)/Los Angeles World Airports (LAWA), Los Angeles, California

Waste Characterization, Recycling and Waste Management Program

LAX has conducted several waste characterization studies and concluded that each passenger generates 0.9 pounds of trash and each air cargo ton handled at LAX generates 4 pounds of trash. Using this method, LAX's total waste generation in 2009 was 30,590 tons. In 2009, LAWA recycled 19,670 tons and diverted 631 tons to other uses, for an overall diversion rate of 66.4%.

In order to divert recyclable items from the waste stream, LAWA implemented a wide array of free recycling programs for its tenants and LAWA employees, some of the materials accepted in LAX's recycling program are cardboard, wood pallets, plastic, beverage containers, mixed paper, and metals. Construction and demolition materials, including carpet, green waste, mixed batteries, and other e-waste is recycled through LAWA's own in-house program. Grass clippings and tree branches are sent to the city's joint processing center to be composted.

LAWA asks that tenants report any recycling done outside the program. Below is a sample of select materials recycled in 2009 by tenants and LAWA at LAX.

RECYCLED MATERIAL	TONS
Mixed Paper	5581
Glass	18
Metals	440
Mixed Green Waste	341
Wood Panellets	1146

LAWA also designates materials for reuse or donation. Wooden pallets, cardboard, office paper, and scrap metal are reused if at all possible. Donations of packaged and prepared food from airline caterers are sent to local food banks in order to support the local community and avoid excess waste.

Some new projects are being developed at LAX include the following:

- Installing new advertising "amenity units" incorporating recycling collection into the advertising concession program. These units provide several openings for mixed paper/newspaper, cans, plastics and trash.
- LAWA plans to begin recycling coffee grounds and filters into compost from the multiple tenants and office spaces that dispose of coffee wastes on a daily basis.

- A feasibility study is being explored to expand the current cooking oil and grease recycling to an airport-wide collection program. In 2005, 30,350 lbs. of oil and grease were recycled by tenants.
- LAWA is considering a mandatory recycling clause in all airport concession contracts. Currently the program is voluntary, although LAX provides incentives for tenants to participate.

1. Los Angeles International Airport: Recycled Content Plastic Trash Bags

Focused Case Study

A California recycling law passed in 1989 required all cities and municipalities to divert at least 50% of their waste stream from landfills by recycling, reuse, source reduction and composting by the year 2000. To meet this recycling goal, LAWA developed a comprehensive, facility-wide recycling program for all airport users. Source reduction is one element of the program that helps toward the recycling goal. With more than 60 million passengers traveling through its terminals each year, LAX purchased 218.2 tons of plastic trash liners (small, medium, and large sizes) in 2010. That's more than 430,000 pounds of trash bags alone, without even counting the weight of the trash! To reduce the airport's impact, LAX purchases trash bags that contain 10% to 20% post-consumer recycled polyethylene, helping to reduce landfill waste by 20 to 40 tons per year. LAX has reached a waste diversion rate of 67.2% and is on track for the 70% target by 2015.

For more information on this LAWA's sustainability programs, see www.lawa.org/welcome_LAWA.aspx?id=1916.

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H. Minneapolis-St. Paul International Airport (MSP), Minneapolis, Minnesota

Recycling and Composting Programs

The Metropolitan Airports Commission (MAC) is committed to reducing and recycling waste at Minneapolis-St. Paul International Airport (MSP). The MAC has identified the following reasons to support recycling: to conserve resources by reducing demand for raw materials; to reduce dependence on landfills; to avoid solid waste disposal costs ($47/ton); to avoid solid waste taxes and fees (31.5% locally); to reduce environmental liability; and to lead by example.

The MAC recycles: paper, cardboard, metal, glass and plastic bottles, batteries, food/organic waste, grease, wood pallets, tires, construction materials, tree/yard waste, paint, automotive oil, used oil filters, antifreeze, solvents, deicing fluid, light bulbs and printer cartridges. In addition,

used oil is re-refined, used absorbents are burned for energy recovery, and oil-based paint waste and gasoline and diesel fuel wastes are fuel blended for energy recovery.

In 2011 the MAC diverted and recycled: 70 tons of scrap metals; 171 tons of pallets; 245 tons of baled cardboard; and 637 tons of co-mingled recyclables. In addition, the MAC recycled 154 tons of regulated waste materials including: 91.1 tons of used cooking oil; 1.5 tons of parts cleaners and solvents; 15.2 tons of tires; 25 tons of used oil; 7.9 tons of fluorescent and HID lamps; 10 tons of batteries; 1.6 tons of light ballasts and transformers; 0.8 tons of antifreeze; and 1.4 tons of paint.

In 2011, 91.1 tons of used cooking oil/grease from terminal restaurants was recycled. The used cooking oil is processed offsite and converted into biodiesel.

In 2010, the MAC implemented a pilot program for back-of-house organic waste diversion in airport terminal restaurants. Through this program MSP concessionaires worked to keep 120 tons of food waste out of the solid waste stream in 2011. MAC Field Maintenance generates large volumes of yard waste (brush, grass, and tree trimmings) in the course of maintaining landscaped areas. In 2011, 6.64 tons of material was collected. Food waste and yard waste are sent to a local composting facility where, after a few months, it becomes a valuable soil amendment product. Finished compost is mixed with topsoil and used by landscape contractors and public works entities, and MAC Maintenance uses it for landscaping at MSP.

Year-round mechanical sweeping of hundreds of acres of pavement at MSP generates a mixed load of sand and debris. Classified as an industrial waste, this material is segregated based on composition and is run through a screener; the clean sand is able to be reused on site, eliminating hundreds of tons of material from landfill disposal.

For more information on MSP's sustainability and waste management programs, see www.mspairport.com/about-msp/sustainability.aspx

1. *Minneapolis-St. Paul International Airport, Hazardous Waste Management Recycling*

Focused Case Study

Hazardous wastes are defined as materials that "…pose a substantial, present or potential hazard to human health or the environment". Such wastes are typically associated with vehicle and equipment shops or facility maintenance, including painting. Hazardous waste generators are required to be licensed and pay fees based on the amount of waste generated and the management method for different wastes. Waste reduction efforts at MSP include process changes, equipment upgrades, employee training, product substitution and researching alternate disposal methodology. Reducing the amount of hazardous waste produced by MSP operations provides economic and environmental benefits. Benefits of waste reduction include: reduced disposal costs; reduced fees and taxes - based on waste volume; reduced administrative costs for training, paperwork; and reduced environmental liability. In 2011, MSP recycled 154 tons of additional materials

including: 91.1 tons used cooking oil; 1.5 tons parts cleaners and solvents; 15.2 tons tires; 25 tons used oil; 7.9 tons fluorescent and HID lamps; 10 tons batteries; 1.6 tons light ballasts and transformers; 0.8 tons antifreeze; and 1.4 tons paint. What hazardous-type wastes are generated and how are they managed?

- Used oil is re-refined
- Batteries are recycled
- Parts washing solvent is recycled and reused on site
- Antifreeze is recycled and reused on site
- Used absorbents are burned for energy recovery
- Used oil filters are recycled
- Fluorescent and HID lamps are recycled
- Ballasts and transformers are recycled
- Mercury containing items are recycled
- Water based pain waste is recycled into concrete
- Oil based pain waste is fuel blended for energy recovery
- Gas and diesel fuel wastes are fuel blended for energy recovery.

For more information on MSP's sustainability and waste management programs, see www.mspairport.com/about-msp/sustainability.aspx

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I. Oakland International Airport (OAK), Oakland, California

Waste Reduction and Recycling Programs

OAK's waste reduction and recycling program covers general aviation activities and office areas on the north field, as well as two commercial passenger terminals, concessionaires, airlines and office areas on the south field. Materials collected include food waste, newspaper, cardboard, magazines, office paper, plastic, glass, aluminum and other metals. In fiscal year 2011-2012, 152 tons of kitchen scraps were composted from OAK concessionaires and 496 tons of recyclable materials were prevented from entering area landfills – a diversion rate of 38%.

OAK works closely with its airline partners to match existing corporate recycling programs with on-the-ground recycling facilities. OAK staff conducts year-round training sessions with tenants, concessionaires and custodial staff to continually improve program successes. In 2008, OAK was the first airport in the country to install two chute rooms inside the passenger terminal to facilitate recycling. In January 2011, 3 liquid collection stations were installed at the head of security lanes to reduce the weight of the waste and recycling receptacles, leading to fewer staff injuries, savings of staff time and disposal cost-savings. A Big Belly solar trash/recycling compactor pilot project was completed last year and a new pilot project to compost paper towels from restroom areas is under development.

OAK hosted a special weeklong AOA (Airport Operations Area) Spring Cleaning Event in April 2012 to promote the OAK's commitment to cleanliness, airfield safety and foreign object debris (FOD) awareness while educating tenants on OAK's Recycling Program and commitment to sustainability. Participants included 11 commercial airlines, four air cargo operators, two ground-handlers, four concessionaires, 169 general aviation tenants, three full-service FBOs, the TSA, and the FAA. A total of 20.4 tons of material was collected, 17.6 tons of which (86%) were recycled.

OAK's award winning Materials Management Program (Program) recycles concrete, asphalt and soil from construction projects, resulting in less traffic, fewer emissions and less landfill waste. Since 2003, the Program has saved over $7.5 million in waste disposal costs and $1.3 million in material import costs. The Program has taken more than 425,000 tons of demolition materials, reclaimed 270,000 tons of reusable materials, saved 4,000 metric tons of greenhouse gases and removed 150,000 pounds of vehicle emissions from the air.

For more information on OAK's recycling programs, see www.oaklandairport.com/noise/environmental_recycle.shtml.

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J. Philadelphia International Airport (PHL), Philadelphia, Pennsylvania

Organic Waste Recycling Program

In 2011, PHL initiated an Organic Waste Pilot Program, partially funded by United States Environmental Protection Agency and launched by the Airport to determine the feasibility of implementing an airport-wide composting program. The Organics Pilot Program installed receptacles at participating restaurants to evaluate the practicality, productivity, and cost-effectiveness of a composting program at PHL. The results were encouraging: 6,041 pounds of waste were collected, which averages out to about 431.5 pounds per day. The compostable waste material was appropriately labeled and sent to the Wilmington Organics Recycling Center (WORC) in Wilmington, Delaware, to complete the composting process.

The Organics Pilot Program highlights the relative ease with which PHL employees responded to the training sessions and became acclimated to the addition of the receptacles. Based on reports from the staff, the relocation of this waste did not "interfere significantly with existing business practices." The Pilot program's success prompted PHL to consider expanding the program throughout the terminals. The implementation of this program, in combination with recycling programs already in place, ensures that 73% of restaurant waste is diverted from landfills.

For more information on PHL's programs, see www.phl.org/AboutPHL/Environmentalinitiatives.

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K. Phoenix Sky Harbor International Airport (PHX), Phoenix, Arizona

Construction Waste Management Program

Description: Taxiway C serves Runway 8-26, the longest and most heavily used runway at PHX. PHX's Taxiway C Infill Project added a 2,200-foot segment at the west end of Taxiway C. The design team was required to comply with the PHX Design and Construction Services Green Guide, a performance based standard with life cycle and life cycle cost analysis tools for addressing design and construction impacts where LEED® is not applicable, such as for pavements and non-building construction.

All components of the designed pavement materials and structural cross-sections were analyzed, including the existing unsuitable soils and asphalt pavement which had been planned for removal and disposal. It was determined that the underlying soils could be mixed with cement to provide a suitable soil-cement subgrade for the project and the existing asphalt paving could be milled and recycled as new base material, which saved $200,000.

Use of the design decision support tool "Pavement Life-Cycle Assessment Tool for Environmental and Economic Effects" (PaLATE), an Excel-based tool developed for the assessment of the environmental and economic effects of pavements, allowed a detailed study of 12 separate concrete mix designs with varying amounts of cement and fly ash to determine the most long-term cost effective, long-lasting, and environmentally friendly paving material.

Specific construction quantities for the project were loaded into the PaLATE program and an estimated use of environmental resources and air emissions for each design was produced. Travel distance factors were included so that a comparison of energy consumption between recycled pavement and subgrade hauled from off-site could be made. The comparison of the designs showed that significant savings in environmental resources could be identified.

Other sustainability project decisions were made using the PHX Design and Construction Green Guide such as:

- Developing a vehicle and construction equipment anti-idling plan
- Utilizing EPA-rated higher tier low-emission construction vehicles
- Evaluating and mitigating project energy use
- Maximizing on-site salvage and reuse of materials and resources
- Detailed construction scheduling and sequencing plan to reduce emissions, including use of a compressed workweek
- Prevention of roadway damage during construction and reducing construction traffic

The Taxiway C Infill project had a construction cost of $10.36 million and the Aviation Department estimates the innovative design resulted in a total cost savings of $1.36 million.

For more information on this PHX program: Phoenix Sky Harbor International Airport and Huitt-Zoliars, "'Green' is the New White for Concrete Pavements – Phoenix Sky Harbor International Airport," http://skyharbor.com/community/environmentalPrograms.html.

1. *Phoenix International Airport Runway Friction Rubber Removal Recycling*

Focused Case Study

Like many airports, PHX uses a heated high pressure water blasting method for friction improvement on runways and other aircraft movement areas. The vacuumed waste is run through a set of filters within the truck to reuse the water, but at completion of the process, there is a water and rubber mixture from emptying the truck filters.

In the PHX Facilities yard, a Baker Tank has been plumbed to the sanitary sewer where this waste can be decanted. The water portion of the mix is permitted to be discharged to the sanitary sewer and the rubber solids from this process go to a local recycler for use in the development of rubberized asphalt. The City of Phoenix has used rubberized asphalt for roads since the early 1960's and rubber recycling is a mature local market.

These wastes go through analytical testing to screen that it is not hazardous waste (especially, metals) and for sewer discharge approval of the decanted wastewater. PHX's costs for this recycling process are approximately $300 per month, including analytical testing and handling.

For more information on this PHX program: Phoenix Sky Harbor International Airport and Huitt-Zoliars, "'Green' is the New White for Concrete Pavements – Phoenix Sky Harbor International Airport," http://skyharbor.com/community/environmentalPrograms.html.

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L. Portland International Airport (PDX), Portland, Oregon

24-Hour Waste Characterization Study

In 2010, a 24-hour waste characterization study was conducted at PDX. The purpose of this study was to gain a better understanding of the source areas where waste and recycling at PDX is being generated and to enable the PDX Waste Minimization Team to learn how best to target their efforts. The largest source area is airline waste (deplaned waste) which consists of waste generated onboard the aircraft. Public area waste is the second largest source area and consists of waste generated in the public areas of the PDX terminal. This includes waste from parking garages, pre and post security area, restrooms and food courts. Concessions waste is the third largest source area and it consists of all waste generated by concessions and retail tenants operating at PDX. This includes back of house waste as well as waste generated by customers in tenant controlled seating areas. The fourth largest source area is administrative waste. This consists of waste that is generated by the offices located at PDX and airline ticket counter waste.

The study provided detailed data on the recycling rates of each source area as well as individual tenants at PDX. For the study, the central collection area was monitored for a 24-hour period,

beginning at 12:00 midnight. Waste loads were intercepted before employees placed it into the designated receptacle.

Airline waste contributed approximately 44% of the materials collected. This is the largest contributing source area of the PDX waste stream. The airline waste recycling rate could be improved by:

- Keeping ice and liquid from the landfill bound waste load.
- Continue to provide specialized recycling support to individual airline tenants.
- Facilitate communication between airlines and their ground service provider to increase the rate of capture of materials accepted into the commingle recycling system.

Public area waste contributed approximately 35%, making it the second largest contributing source area. One of the most frequently observed materials found in public area landfill bound waste and commingled recycling are single use beverage cups; more than 6,000 cups of coffee are sold in the Port terminal each day. Currently, the PDX Waste Minimization Team is working with concessions tenants to explore the options for getting cups out of the landfill bound waste stream. The landfill bound waste stream could be decreased by:

- Expanding public area food composting.
- Encouraging concessions tenants to switch to durable or compostable serviceware instead of the current single use serviceware.
- Continue to work with coffee tenants, regional MRF's and paper mills to explore the options for recycling hot beverage cups
- Continue public education and outreach about the Port's recycling system.
- Explore other more sustainable options for reducing the quantity of paper towels by switching to durable towels or hand dryers in public area restrooms.

Concessions waste contributes approximately 18% of the PDX waste stream making it the third largest contributing source area. In many cases bags designated as trash contained predominantly food waste and other compostable materials. Recommendations for improved recycling among concessions tenants:

- Continue providing education about composting to decrease the amount of food waste present in the landfill bound load.
- Promote targeted outreach to the largest waste generators with the lowest recycling rates
- Continue to support and to provide incentives to those tenants with higher recycling rates.
- Implement a peer-based reporting system, in which each tenant could measure their recycling efforts alongside those of other tenants.
- Facilitate the switch to 100% durable and compostable serviceware inside the terminal.

Administrative waste made up 3% of the waste stream. The amount of administrative waste present in the waste stream on any given day may vary. Recommendations included:

- Target outreach and support to all ticket counters to provide education about the Port's recycling system.
- Provide assistance to other sources of administrative waste such as the Lost and Found office and TSA.
- Educate administrative waste generators about waste minimization practices such as double-sided printing, use of durable coffee cups, not printing emails unless necessary, etc.

The studied offered the following recommendations that apply to all source area generators:

- Incentivize tenants to minimize waste generation and comply with City of Portland and Port of Portland mandates. One possible option would be to implement a system to charge for garbage disposal while offering free recycling.
- Continue to coordinate among tenants, waste haulers, material processors, and compost facilities to negotiate better and more diverse recycling and waste minimization programs and practices.
- Continue to support those parties who are actively trying to improve their recycling habits.
- Provide outreach to large generators of waste that have comparatively lower recycling rates than their peers.

1. Portland International Airport; Liquid Collection Station Program

Focused Case Study

In 2009, Portland International Airport (PDX) created, developed and installed beverage collection stations to reduce the amount of liquid in the PDX waste stream. This program was established in response to a study which estimated that 90 tons of liquid waste is generated annually at security checkpoints. With federal regulations restricting beverages allowed through airport security, the stations serve as an innovative response to a persistent challenge. Based on measurements taken by janitorial staff that service the stations at both security checkpoints ABC and DE, PDX travelers divert between 5,000 and 8,000 pounds of liquid each month from the waste stream. Similar stations have now been installed at other airports across the country, and the Port of Portland has supplied graphics at no charge to other airports.

Program benefits include:

- Providing an opportunity for proper disposal of recyclable beverage containers
- Preventing the contamination of recyclables by reducing the amount of soiled paper
- Promoting the reuse of beverage containers
- Fostering a safer work environment for janitorial staff by reducing heavy lifting.

2. *Portland International Airport: Deplaned Waste Studies*

Focused Case Studies

In 2008, Portland International Airport (PDX) conducted a study to examine deplaned waste recycling opportunities. PDX examined a flight carrying 112 passengers between Orlando, FL and Portland, OR. Estimated total weight of cabin waste (garbage + recycling): 35.9 lbs. In total, it was seen that 63% of all possible recyclable materials were captured. These following types of materials were recycled: 1.0 lbs. plastic bottles; 0.3 lbs. aluminum cans; 6.6 lbs. of paper. However, it was noted there was substantial room for improvement with the following types of recyclable materials were left in the garbage: 2.3 lbs. plastic bottles; 0.3 lbs. aluminum cans; 2.1 lbs. of paper. Based on the waste composition, it was determined that flight attendants had the opportunity to recycle 35% of this aircraft's cabin waste: paper (24%), aluminum cans (2%), and plastic bottles (9%). They ended up recycling 22% (See data table below for types of materials and exact weights.)

Waste Material	Total Weight (lbs.)	Amount Recycled
Paper	8.7	6.6 lbs. captured
Aluminum Cans	.6	0.3 lbs. captured
Plastic Bottles	3.3	1.0 lbs. captured
Compostable Food/Fibers	4.6	n/a
Non-Recyclable Containers	18.7	n/a
Total Recyclables (paper, cans, and plastic bottles)	12.6	7.9 lbs. captured (63% of possible)
Total Garbage (food waste, liquid, non-recyclables)	23.3	n/a

In a similar exercise, PDX also studied at a flight carrying 129 passengers from JFK to PDX and found that flight attendants had the opportunity to recycle 52% of the aircraft's cabin waste: paper, and that they recycled 38% (26 lbs. of materials recycled out of a total possible 35 lbs. of recyclable materials). Although there was room for improvement with some recyclable materials left in the garbage, 73% of all possible recyclable materials were captured including: 5.25 lbs. plastic bottles; 5.3 lbs. aluminum cans; and 15 lbs. paper.

For more information on PDX's waste management programs, visit www.portofportland.com/env_home.aspx.

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M. Seattle-Tacoma International Airport (SEA), Seattle, Washington

Food Court Recycling

The Port of Seattle introduced new collection bins to the public food court area as part of SEA's continuing efforts to reduce landfill-bound waste. Accompanying tabletop decals encourage food court diners to think about where they toss their trash. A recent waste study concluded that 44% of airport waste is compostable, and public areas generate nearly half of all airport waste.

Since the bins were installed, more than 50 tons of food scraps and other compostable material were collected and diverted from landfills. The food scrap composting program aims to test the feasibility of extending airport food waste composting collection programs to passengers. Collected compostable material is sent to a local composting facility that converts the food scraps and fibers into nutrient rich soil amendments for use in gardens and landscaping. Recyclables are also collected and sent to recycling facilities.

For more information on SEA's program, see www.portseattle.org/Environmental/Pages.

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N. Salt Lake City International Airport (SLC), Salt Lake City, Utah

Reducing Waste by Reducing Waste Liners

In 2010, it was determined that a change was needed in SLC's waste bin liner program. The incorrect liners sizes and multiple bags were being used, creating inefficiencies in the trash disposal program. Salt Lake City Department of Airports (SLCDA) incorporated a program where the liners were "right sized" to the specific capacity of the waste bins utilized at SLC thus reducing plastic liner waste and cost. Further waste reductions were accomplished by using color-coding to increase staff awareness of available recycling bins and types, by coding the liners with the type of use, and by utilizing a lower mil of plastic.

The waste bin liners were manufactured and delivered in a rolled product form that allowed for less intense energy during manufacturing (compared to flat pack), and the ability to stock more per case, resulting in reduced packaging. SLC maintained its relationship with the existing waste liner manufacturer who contracted with a local supplier to allow for 'direct and drop' shipments without necessary repackaging. This local relationship will help reduce the impact to the environment and SLC's carbon footprint by reducing deliveries, new supply orders, fuel consumption, and labor costs. Between 2010 and 2011, SLC saved over 500,000 cubic yards of plastic waste liner and an estimated $30,000 by "right sizing" and minimizing the liner thickness.

For more information on SLC's programs, see www.slcairport.com/environment.asp.

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O. San Diego International Airport (SAN), San Diego, California

Green Build Construction Waste Management Program

In late 2009, SAN began construction on the largest project in the history of the airport. The "Green Build" is a $1 billion dollar airport facilities expansion project designed to meet SAN's current and future demand for travel while improving customer service and serving as an economic stimulus for the San Diego region. Highlights of the project include 10 new aircraft gates, more comfortable passenger waiting areas, enhanced curbside check-in, more security lanes, expanded concessions, and a dual-level roadway to relieve curb-front traffic congestion by separating arriving and departing passengers. At the peak of construction, the project is anticipated to create approximately 1,000 construction-related jobs. Sustainability and environmental sensitivity are the hallmarks of Green Build. The airport is making every effort to recycle and reuse construction waste on-site. The project is designed to achieve LEED® Silver certification from the US Green Building Council and is expected to be completed in 2013.

In 2011, Green Build generated approximately 5,500 tons of waste. Approximately 94 percent (5,150 tons) of that waste was diverted from landfills. Where possible, C&D waste from the project, such as concrete, has been recycled and reused on-site. Diverting 5,150 tons of waste from land disposal saved the airport over half a million dollars in 2011 (recycling savings = 5,150 tons X $98/ton tipping fee if not recycled = $504,700).

1. San Diego International Airport: Green Waste Reduction And Xeriscape Program

Focused Case Study

SAN maintains its 12.5 acres of landscaping with a combination of drought-tolerant California-native grasses, shrubs, trees, and palms that also generate smaller amount of plant litter and debris. The native plants can be maintained with smaller amounts of fertilizers, pesticides, and herbicides than exotic plants. When grasses are used for landscaping, SAN uses Hybrid Bermuda grass, which requires one-third less water than normal fescue-type lawns and less maintenance. Any clippings that are generated during maintenance are left on the turf as an organic fertilizer, reducing the amount of green waste generated. All of the green waste collected from landscape maintenance activities is recycled into mulch or compost. The mulch is processed on site and used for ground cover and erosion control. The remainder of green waste is hauled off site, along with coffee grinds and pre-consumer kitchen waste, to a municipal composting facility. In 2011, SAN diverted 20 tons of green waste from disposal using these methods.

2. San Diego International Airport: Wood Pallet Processing

Focused Case Study

Broken or unclaimed wooden pallets are collected by SAN's waste hauler and transported to a municipal composting facility for processing. The pallets are converted to wood chips for resale to customers at $18.00 per yard. These wood chips can be used as proactive ground cover or decoration. For more information visit: www.sandiego.gov/environmental-services/miramar/greenery/woodchips.shtml.

The best management practices for pallets include the following elements:

- ***Reuse.*** Vendors delivering goods on a routine basis to the airport and their tenants can take and reuse the pallets.

- ***Recycle.*** Wood pallet recycling is a general term for the sorting, refurbishing, dismantling and remanufacturing of pallets for sale, as well as the grinding of wood pallets for feedstock for other wood-based products, such as fiberboard. Pallet recycling is a multi-billion dollar business in the U.S.

- ***Mulching/Composting.*** When wooden pallets reach the end of their useful life, they can also serve as feedstock for processing as mulch or compost.

For more information SAN's programs, see www.sandiego.gov/environmental-services/recycling/cd/cdbenefits.shtml and www.san.org/sdcraa/airport_initiatives/green_build/default.aspx.

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P. San Francisco International Airport (SFO)

SFO Solid Waste Management Program

SFO progressively increased the rate of recycling of solid waste from 51% in 2002 to 75% by the end of FY 2011. SFO is continuing to enhance the source separation operations with the aim of achieving the City's recycling goals of 85% by 2017 and Zero Waste (90% or more) by 2020. SFO estimates that solid waste recycling at the airport offset GHG emissions by over 2,600 tons in 2011. SFO's recycling rate of 75% does not include recycling of construction and demolition waste, which consistently exceeds 90% on major airport construction projects. SFO's solid waste management program includes waste reduction, source separation, and composting. Recent waste reduction achievements at SFO include the following:

- Included a clause in all food concessionaires lease agreements at Terminal 2 requiring the concessionaires to provide biodegradable food-ware
- Initiated an annual waste characterization study to better understand the composition of solid waste streams and evaluate progress in the recycling operations;
- Reduced water bottle waste by providing drains in pre-security checkpoint areas and water bottle refill hydration stations in post security areas.
- Installed electric hand dryers in restrooms to minimize the use of paper towels
- Improved off-site source separation of mixed waste and increased composting of biodegradable waste;
- Partnered with contractors to achieve over 90% construction waste recycling on major projects; and
- Monitored custodial staff and tenants to ensure proper segregation of waste at collection points and at temporary waste storage facilities.

In 2011, about 9,309 tons of solid waste was generated at SFO, of which 6,961 tons or 75% was recycled. SFO's recycled solid waste is composed primarily of food/compostable materials (39%), cardboard (14%), and paper (14%).

SFO credits the success in implementing these programs to the partnership and effective communication between internal and external stakeholder groups at the airport. All of the solid waste programs implemented by SFO are low cost or no cost actions, developed to promote recycling and waste reduction. At SFO, the costs of sending solid waste to a landfill or to a composting facility are equivalent. On-site sorting of recyclable materials is an added monetary benefit to the airport. All source separated materials are hauled off at no cost to SFO and SFO receives a payment from the waste hauler for some materials such as aluminum cans, mixed metals, glass, etc.

1. *San Francisco International Airport: Food Waste Composting Program*

Focused Case Study

The solid waste recycling rate at SFO has increased rapidly since 2007, due to improve on- and off-site sorting of waste, as well as the success of SFO's comprehensive composting program. SFO has been able to successfully transform a 2006 pilot food waste separation program into an ongoing large-scale composting program. In 2011, about 9,309 tons of solid waste was generated at SFO (slightly down from 2010's level of 9,928 tons), of which 6,961 tons or 75% was recycled. SFO's recycled solid waste is composed primarily of food/compostable materials (39%), cardboard (14%), and paper (14%). Currently, food waste along with biodegradable materials, landscaping trimmings, and wastewater treatment sludge is transported to off-site composting facilities. SFO also requires the use of biodegradable tableware, plates, containers, etc. by food vendors in all new leases and lease renewals. This measure enables the composting of 100% of the waste generated at SFO's food concessionaires. In 2010, SFO composted 3,623 tons of food and biodegradable waste, or 37% of SFO's total annual waste, increasing to 39% of total in 2011. The success of SFO's composting program has significantly contributed to the increase in the airport's overall solid waste recycling rate.

For more information on SFO's programs, see www.flysfo.com/web/page/about/T2/sustainability/.

Contact: Sam Mehta, Environmental Services Manager, Sam.Mehta@flysfo.com

Q. Yeager Airport (CRW), Central West Virginia Regional Airport Authority, Charleston, West Virginia

CRW's Recycling Program

In 2009, Yeager Airport, in cooperation with the Kanawha County Solid Waste Authority, started recycling cardboard and paper. The cardboard and paper are collected on a daily basis by the buildings personnel and are picked up weekly by the Solid Waste Authority. Since 2009,

Yeager Airport has recycled over 50 tons of cardboard and paper products. This has resulted in substantial savings in landfill tipping fees. The Kanawha County Solid Waste Authority has also created another income source by bundling the cardboard and paper products and selling them on the market to help support the county-wide recycling program.

In 2010 and 2011, Yeager Airport converted one of the airport's runways into a taxiway. During this construction, almost 200 tons of concrete and blacktop material was recycled into perimeter patrol roads and access roads around the airport. This helped the airport save on construction costs by the contractor not having to haul the material off site and to find a disposal area for the material.

For more information on CRW's programs, see www.yeagerairport.com.

Contact: Terry Sayre, Assistant Airport Director, t_sayre@yeagerairport.com

Airport and Program	General Municipal Solid Waste	Food Waste	Restaurant Grease Waste	Green Waste	Pallet Recycling	Deplaned waste	Construction and Demolition Waste	Rubber Waste	Source Reduction	Liquid Waste	Hazardous Waste	Waste Auditing	Innovative Approaches /New Technologies	Stakeholder Communication/Training	Procurement
Boston Logan International Airport (BOS), Boston, MA															
Warm Mix Asphalt							x		x						
Chicago O'Hare International Airport (ORD), Chicago, Illinois															
Construction Waste Management Program							x		x				x	x	x
Guiding Construction Waste Management with the Sustainable Airport Manual (SAM) and Detailed Specifications							x							x	x
Denver International Airport (DEN), Denver, Colorado															
Waste Recycling and Waste Management Program	x	x											x		
Pena Boulevard Construction Waste Management							x		x						
Conducting a Waste Assessment (Waste Audit)	x											x			
Hartsfield-Jackson International Airport (ATL), Atlanta, GA															
Construction Waste Management Conveyor and Recycling							x		x						
John F. Kennedy International Airport (JFK), Port Authority of New York and New Jersey (PANYNJ)															
Construction Debris Recycling							x		x						
John Wayne Airport (JWA), Orange County, California															

Airport and Program	General Municipal Solid Waste	Food Waste	Restaurant Grease Waste	Green Waste	Pallet Recycling	Deplaned waste	Construction and Demolition Waste	Rubber Waste	Source Reduction	Liquid Waste	Hazardous Waste	Waste Auditing	Innovative Approaches /New Technologies	Stakeholder Communication/Training	Procurement
Recycling Programs	x						x								
Coffee Ground Composting Program		x													
Los Angeles International Airport (LAX)/Los Angeles World Airports (LAWA), Los Angeles, California															
Waste Characterization, Recycling and Waste Management Program	x			x								x			
Recycled Content Plastic Trash Bags	x								x						x
Minneapolis-St. Paul International Airport (MSP), Minneapolis, Minnesota															
Recycling, Reuse, and Composting Programs	x	x	x												
Hazardous Waste Management Recycling											x				
Oakland International Airport (OAK), Oakland, California															
Waste Reduction and Recycling Programs	x						x			x			x	x	
Philadelphia International Airport (PHL), Philadelphia, Pennsylvania															
Organic Waste Recycling Program	x	x					x							x	
Phoenix Sky Harbor International Airport (PHX), Phoenix, Arizona															
Construction Waste Management Program							x		x				x		
Runway Friction Rubber Removal Recycling								x							
Portland International Airport (PDX), Portland, Oregon															
Waste Characterization Study	x											x			
Liquid Collection Stations										x			x		
Deplaned Waste						x									
Seattle-Tacoma International Airport (SEA), Seattle, Washington															
Food Court Recycling	x	x												x	
Salt Lake City International Airport (SLC), Salt Lake City, Utah															
Reducing Waste by Reducing Waste Liners									x						x
San Diego International Airport (SAN), San Diego, California															
Green Build Construction Waste Management Program							x		x						
Green Waste Reduction and Xeriscape Program				x			x								
Wood Pallet Processing	x				x										
San Francisco International Airport (SFO)															
SFO Solid Waste Management Program	x	x					x			x			x	x	x
Food Waste Composting Program	x	x													
Yeager Airport (CRW), Charleston, West Virginia															
CRW's Recycling Program	x						x								

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U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: **ACTION:** Guidance on Airport Recycling, Reuse, and Waste Reductions Plans

Date: September 30, 2014

From: Frank SanMartin
Manager, Airports Financial Assistance Division, APP-500

Danielle J. Rinsler, AICP
Acting Manager, Airport Planning and Environmental Division, APP-400

Reply to Attn. of: Patrick Magnotta
202-267-9609

To: Regional Airports Division Managers

The purpose of this memorandum is to provide guidance on preparing airport recycling, reuse, and waste reduction plans as an element of a master plan or master plan update, within a sustainability planning document, or as a stand-alone document.

This is an initial version of the guidance. It may be updated based on stakeholder input. Direct any comments to the above point of contact.

1. Legislative Background

The *FAA Modernization and Reform Act of 2012* (FMRA), which amended Title 49, United States Code (U.S.C.), included a number of changes to the Airport Improvement Program (AIP). Two of these changes are related to recycling, reuse, and waste reduction at airports.

a. Section 132 (b) of the FMRA expanded the definition of airport planning to include "developing a plan for recycling and minimizing the generation of airport solid waste, consistent with applicable State and local recycling laws, including the cost of a waste audit."

b. Section 133 of the FMRA added a provision requiring airports that have or plan to prepare a master plan, and that receive AIP funding for an eligible project, to ensure that the new or updated master plan addresses issues relating to solid waste recycling at the airport. This includes:

(1) The feasibility of solid waste recycling at the airport;

(2) Minimizing the generation of solid waste at the airport;

(3) Operation and maintenance requirements;

(4) Review of waste management contracts; and

(5) The potential for cost savings or the generation of revenue.

For the purposes of this guidance, "recycling" refers to any program, practice, or opportunity to reduce the amount of waste disposed in a landfill. This includes reuse and waste reduction as well as the recycling of materials.

2. Applicability

This guidance is immediately applicable to all Federally-obligated airports that are preparing or updating an airport master plan, sustainability master plan (a master plan that includes analysis of airport sustainability initiatives), or stand-alone airport recycling, reuse, and waste reduction plan.

Preparing an airport recycling, reuse, and waste reduction plan in accordance with the format and content contained in this guidance will meet the requirements of Section 133 of the FMRA. The format and content described herein may also be used as a basis for the recycling section of an airport sustainability plan, a planning document that focuses on airport sustainability initiatives.[1] Section 7 includes additional information on the deliverables for each of these document types.

3. References

a. 49 U.S.C. § 47102(5) and 47106(a): These provisions outline the legislative requirements for airport recycling, reuse, and waste reduction plans as an element of an airport master plan.

b. FAA Order 5100.38D, AIP Handbook: Published on September 30, 2014, FAA Order 5100.38D outlines AIP grant eligibility for airport recycling, reuse, and waste reduction plans, including the cost of a waste audit.

c. *FAA Synthesis Document: Recycling, Reuse, and Waste Reduction Plans at Airports*: The Office of Airports (ARP) prepared this synthesis document in collaboration with a team of industry partners. Published on April 24, 2013, it is a resource for airport sponsors that are developing or broadening their recycling programs. The synthesis document compiles airport recycling and waste minimization best practices. Lessons learned and case studies from 16 airports are included.

d. Advisory Circular (AC) 150/5200-34A, Construction or Establishment of Landfills near Public Airports and AC 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports: Siting criteria for waste disposal operations on or near airports are identified in these ACs. Any waste disposal operations in an airport recycling, reuse, and waste reduction plan for a federally-obligated airport must be sited in accordance with these documents.

e. Other Resources: Sources for additional information include the Airport Cooperative Research Program, U.S. Environmental Protection Agency, and airport websites. ARP personnel, airport sponsors, and others in the airport industry are encouraged to evaluate the

[1] For the purposes of AIP grant administration, an airport sustainability plan (formerly called a sustainability management plan) is the sustainability element of an airport master plan.

latest information on recycling from a variety of sources. ARP will incorporate this information into future orders, ACs, and guidance as appropriate.

4. Types of Solid Waste Generated at Airports

Airports generate various types of solid waste. This guidance addresses the recycling, reuse, and reduction of municipal solid waste (MSW) and other materials that can be legally disposed of in a 42 U.S.C. §§ 6941-6949a landfill or equivalent state-permitted facility.

Any reference to MSW for recycling, reduction, or reuse in this guidance includes construction and demolition (C&D) debris, organic compostable material such as food and yard waste, and deplaned waste. Definitions of these terms are provided below. Airports can recycle, reuse, or minimize many of the materials described below.

This guidance does not address other types of solid waste such as hazardous waste, universal waste (i.e., batteries, fluorescent bulbs, electronics, etc.), or industrial waste. These materials are often subject to Federal, state, and local laws with specific disposal and recycling requirements. The guidance applies to the following:

a. *Municipal Solid Waste (MSW)* consists of everyday items that are used and discarded. Recyclable MSW at airports includes, but is not limited to, aluminum and steel, glass bottles and containers, plastic bottles and containers, packaging, bags, paper products, and cardboard.

b. *Construction and Demolition (C&D) Debris* is generally categorized as MSW. C&D debris is any non-hazardous solid waste that results from land clearing, excavation, or construction, demolition, renovation, or repair of structures, roads, and utilities.

C&D debris includes, but is not limited to, concrete, wood, metals, soil, bricks and masonry material, asphalt, rock, stone, gravel, sand, roofing materials, drywall, carpet, plastic, pipe, rocks, earthwork, land-clearing debris, cardboard, and salvaged building components.

In some instances, C&D debris requires special handling and may be subject to special requirements. Examples include tar-impregnated roofing materials and asbestos-containing building materials. Materials that may be subject to special requirements are not addressed in this guidance.

c. *Compostables* are also categorized as MSW. They are sometimes referred to as green waste and food waste. Green waste consists of tree, shrub, and grass clippings, leaves, weeds, small branches, seeds, pods, and similar debris generated by landscape maintenance activities. Food waste is food that is not consumed, or generated during food preparation activities and discarded.

d. *Deplaned Waste* is MSW that is removed from passenger aircraft. These materials include bottles and cans, newspaper and mixed paper, plastic cups and utensils, food waste, food-soiled paper, magazines, unconsumed or surplus food, and paper towels.

With the exception of Canada, waste from international flights must be processed separately, as this waste can introduce plant pests and diseases. The United States Department of Agriculture regulates international waste. It must be handled in accordance with procedures in the Manual for Agricultural Clearance. Therefore, waste from international flights is not discussed in this guidance.

5. Factors Influencing the Scope and Nature of Airport Recycling Programs

Many airports currently implement solid waste recycling programs. However, program scope varies considerably. This variability may occur due to the size and location of different airports, the amount of waste being produced, and external factors that affect the scope of recycling programs. Variables include, but are not limited to:

a. Local markets for recyclable commodities;

b. Cost for transport and processing recyclables;

c. Local recycling infrastructure;

d. Willingness of an airport and its tenants to implement recycling programs;

e. The nature of an airport's waste stream;

f. Competition between recycling and landfilling firms; and

g. Airport layout and logistics.

6. Contents of an Airport Recycling, Reuse, and Waste Reduction Plan

The content and scope of an airport recycling, reuse, and waste reduction plan will vary depending on the unique conditions at each airport. For airports that already have recycling programs, certain tasks (such as a new waste audit) may not need to be completed.

Document scope is governed by the extent and accuracy of available information. This includes information on the airport's current recycling program, the types and amounts of airport waste, and factors that influence the scope of the program. Plans for small, low activity airports may also be less detailed.

Though certain tasks may not need to be completed to prepare a plan, review and documentation of each of the five (5) elements listed in the FMRA is required in airport master plans and master plan updates (including sustainability master plans) (see also 49 U.S.C. § 47106(a)(6)).

The following subparagraphs describe the sections that should be included in an airport recycling, reuse, and waste reduction plan.

a. Facility Description and Background: This section should:

(1) Include background information about the airport. This includes, but is not limited to, airport location, hub or general aviation classification, governance, operational statistics, and layout. Airport recycling and waste collection areas can be depicted on maps and/or figures. Operational information such as number of based aircraft, number and type of aircraft operations, carriers that serve the airport, and enplaned passengers should be included as well.

(2) Describe the scope of the existing recycling program. This can be delineated between:

(a) Facilities over which the airport has direct control of waste management (i.e., public space, office space, concourses, and the airfield);

(b) Areas over which the airport has no direct control, but may have influence (i.e., tenant facilities and deplaned waste); and

(c) Areas over which the airport has no direct control or influence. These areas can be excluded from the plan. This section should identify the areas and include justification for the decision to exclude. A waste audit, described in next subsection, may be needed to complete this portion of the plan.

(3) Describe the airport's current waste management program and how it fits into the local municipality's waste management program (ordinances, requirements, permits, etc.).

The following should be included for airports with active recycling programs:

(4) Drivers for implementing/maintaining a recycling program.

(5) A description and inventory of infrastructure in place, both on and off- airport, that supports airport recycling. This includes the location of equipment and facilities used to collect, store, process, and transport waste, and compactors, recycling bins, composting bins, waste sorting facilities, and scales. Off-airport infrastructure includes accessible off-site recycling facilities, existing arrangements with hauling companies for recycling, availability of commodity markets for metals, paper, cardboard, organic material, wood, and other MSW. As stated, maps/figures can be used to depict these areas.

(6) A description of the airport's current solid waste recycling, reuse, and waste reduction efforts, including instances when tenants recycle materials. This description should include:

(a) The date recycling was initiated for various materials;

(b) Recycled or reused material, along with the quantities of various materials being diverted from the landfill. If the information is available, this should be expressed by annual volume or weight, material type, and the percentage of total generated waste; and

(c) Waste minimization efforts.

(7) A description of program performance. This should include:

(a) Any recycling, reuse, and waste reduction goals or targets;

(b) Performance indicators (e.g. tons of waste per passenger, percentage of total waste diverted from the landfill by waste type or area, etc.);

(c) Description of any community outreach/stakeholder involvement during development or review of the recycling program;

(d) Methods of reporting program performance; and

(e) Any challenges or barriers to implementation.

If the recycling plan is an element of an airport master plan, master plan update, or sustainability planning document, some information in this section may be included in other chapters of the document. In these instances, the recycling, reuse, and waste reduction plan need only reference the applicable chapters.

b. Waste Audit: Results of a waste audit should be documented in this section. A waste audit is conducted to identify and document the source, composition, and baseline quantity of MSW waste streams generated at an airport. It should include all areas under direct control of the sponsor, and when applicable, areas over which the sponsor has influence. The baseline information can be used to identify recycling, reuse, and waste reduction opportunities and priorities, and gauge program effectiveness over time. Include:

(1) The annual quantity and composition of generated MSW and C&D debris;

(2) The sources and activities that generate waste; and

(3) The generators (owners and facilities/areas) of various waste streams.

c. Review of Recycling Feasibility: This section should:

(1) Describe the technical and economic factors that currently affect the airport's ability to recycle. This includes analysis of the local market for recyclable commodities, logistical considerations (e.g., haulers, space for compactors, etc.), contractual issues (i.e., janitorial, airline consortiums, etc.), requirements on how waste is handled, haulers and landfill requirements, costs, and other factors.

(2) Reference and describe any Federal, state, or local guidelines or policies that aid or hinder recycling efforts.

(3) Identify any other incentives for implementing/maintaining a recycling program.

(4) Identify logistical constraints. This includes space for containers in certain areas, facility layouts, and access to secure areas.

d. Operation and Maintenance (O&M) Requirements: This section should describe waste handling, and the parties responsible for each area and waste stream. Include the department/section/organization responsible for implementation of each aspect of the airport's recycling program, and their roles and responsibilities. This includes data collection/reporting/tracking, collection procedures, transport to containers, procurement of containers and service(s) providers, contract management, maintenance of waste and recycling equipment, etc. O&M requirements should be articulated for each waste stream (MSW to landfills, recyclables, organic materials, and C&D debris).

e. Review of Waste Management Contracts: This section should:

(1) Describe current contracting for waste management at the airport. The purpose of this description is to identify opportunities for improving program scope and efficiency, as well as identifying constraints. Review and documentation of all contracts involving the collection, hauling, disposal, and recycling of MSW, and handling of C&D debris, should be completed.

(2) Describe how existing contracts encourage or impede the purchase/use of environmentally-preferred products (e.g., products with high recycled content, minimal packaging, capabilities for duplexing documents, environmentally-friendly cleaning products, etc.). This task can be accomplished by reviewing contracts that include responsibilities for implementing recycling program elements (e.g., janitorial contracts, tenant leases, contract specifications for construction [including tenant construction]). The nature and scope of each contract, procedure, and policy should be articulated.

(3) Identify tenant leases and service contracts with corresponding expiration, extension, and/or renewal dates. This information can signal the airport's next opportunity to add recycling, reuse, and waste reduction objectives to existing leases and contracts.

(4) Describe how waste handling and recycling is funded.

This information, when combined with the roles and responsibilities of each entity involved in the program in the preceding section, should provide a comprehensive understanding of how the recycling program functions.

f. Potential for Cost Savings or Revenue Generation: This section presents recycling program recommendations developed following review of the preceding work, and compare the cost of landfilling waste with recycling, composting, or reuse. This is accomplished through financial analysis of the overall waste management program, the current airport recycling program, and potential recommendations that will enhance and broaden the program.

The purpose of this analysis is to help airport sponsors evaluate the cost of the current program and determine if proposed enhancements should be implemented. There is a perception that recycling costs more than landfilling. This is not true in every case. The economics are dependent on the available infrastructure to support recycling, availability and proximity to commodity markets, market demand for certain materials, and the types of waste being generated at the airport.

The financial analysis should evaluate all program components. This includes, but is not limited to capital costs for containers, tipping fees, hauling cost, market/recycling rebates, and labor. The comparison of initial costs and cost reductions from robust recycling practices can result in overall savings.

The initial cost of the current program and recommended enhancements can be expressed within the annual O&M costs over some period of the life of the program. The time period an airport contemplates depends on several factors. This includes the availability of reliable financial data or a master plan's implementation period. If cost savings are realized from recycling practices, maximizing resale of commodities, and other activities, they can be expressed as annual O&M cost reductions during the same period of time.

By compiling and analyzing the information in the preceding subsections, the airport will have sufficient data to make informed solid waste management decisions over time. If recycling is not technically or economically feasible at this time, this information will help an airport determine when increased recycling might be feasible.

g. Plan to Minimize Solid Waste Generation: This section documents the final recycling, reuse, and waste reduction program recommendation(s). It is based on the information obtained in the waste audit, analysis of recycling feasibility, and financial analysis to determine the effectiveness of the current program (if one is currently in place) and identify opportunities for improvement. It should:

(1) At a minimum, document the airport's program to recycle paper (newspaper and magazines), plastic bottles and aluminum cans, and plastic cups. If external factors prevent this minimum level of recycling, the rationale should be articulated.

(2) Present the airport's plan for a comprehensive approach to reduce the amount of waste being disposed of in landfills. Objectives and targets should be established.

(3) Other factors to consider include updated arrangements/contracts/leases between the airport and tenants, new development specifications (to include containers and space for material collection, sorting, and recycling), and new purchasing policies/requirements. These should be documented and, when applicable, linked to objectives and targets.

(4) If aspects of the plan require capital improvements, these should be referenced in the plan and included in the Airport Capital Improvement Plan, as appropriate.

(5) Describe any plan recommendations that may conflict with existing plans and programs. Examples include an airport's stormwater pollution prevention plan. When applicable, identify the procedures or best management practices (such as reducing the potential for stormwater violations through operational and maintenance practices) that will address these conflicts.

(6) Include a discussion about how recycling will be contemplated and implemented as part of new development projects. When articulating these goals, the information and timeframe needed to meet the goals should be included.

(7) Discuss how the airport will track and report on the recommendations, and how this will be reviewed in order to come up with ideas to improve performance. Effective tracking and periodic review will ensure a cycle of continuous improvement is established.

(8) If known, include a description of what, if any, program enhancements will be considered in the future. This can be a later point in the planning period or during the next planning period.

(9) Earlier sections may have identified constraints to improving recycling performance that are outside of the airport's control. For example, there may be no current market for cardboard or other commodities in the area. This section should describe conditions that will trigger re-evaluation.

(10) Describe planned efforts for education and outreach to employees, tenants, and the travelling public on recycling.

7. Deliverables

a. For airport recycling, reuse, and waste reduction plans prepared in accordance with Section 133 of the FMRA, FAA must review and accept draft and final versions of the plan. In these cases, the plan may be a section or appendix in an airport master plan or master plan update. FAA review will coincide with review of the master plan.

b. Recycling, reuse, and waste reduction is typically a sustainability category in sustainability master plans.[2] When completing a sustainability master plan, the recycling, reuse, and waste reduction plan can be included with the other sustainability categories (i.e., emissions reduction, energy efficiency, etc.).

(1) Sustainability master plans typically include a baseline analysis of identified sustainability categories, a list of initiatives for each category, and a plan for tracking and implementing initiatives. Any recycling initiatives identified in a recycling plan should be included in that list.

(2) For airports that are preparing a stand-alone airport sustainability plan, the scope of the recycling plan may be narrower due to funding constraints, and the need to analyze multiple sustainability categories in a single document. In these cases, airports may focus on certain aspects of the recycling plan (waste audit, review of contracts, etc.) to develop a more focused set of objectives. Airports should strive to address the five (5) elements of a recycling plan in the FMRA whenever possible, as this will aid development of meaningful sustainability initiatives.

[2] For additional information on airport sustainability planning, consult FAA's Airport Sustainability Webpage and the AIP Handbook (FAA Order 5100.38D).

8. Updates to this Guidance

As noted earlier, the FAA will continue to update this guidance based on additional stakeholder input. In addition, this guidance will eventually be incorporated into a forthcoming update to AC I50/5070-6B, Airport Master Plans, which will supersede this guidance at that time.