

## APPENDIX C.1

# Case Studies—Restrooms

### C.1.1 Process

An important aspect of the research was to conduct several case studies of recent restroom work at a variety of airports to get firsthand from the planning and operations managers their perspectives about the planning, design, and maintenance of airport terminal restrooms. The original proposal listed eight airports known by our team members to have a recent restroom project, including one international location - Schiphol in Amsterdam. Upon further consideration, the research team realized a more systematic investigation was in order to insure a representative mix of case studies.

In the new selection of candidates, the team determined that a sampling was needed of each of the four FAA hub-size classifications – large, medium, small, and non-hub. Two of each seemed reasonable given our budget. We also felt that the locations should be somewhat spread out across the country to avoid a regional skew. The last, but most important criterion was that the airports had recently completed a significant restroom project within the last few years. The project could be new or a renovation, but had to be more than a cosmetic facelift. The timing was important in that the restrooms were not so old to be out of date but be completed for a long enough period that the airport was able to evaluate how well their initiatives worked.

The research team began by charting the US airports that received AIP Grants from the FAA for terminal projects in 2010 and 2012. These were ranked by the 2013 enplanement levels and categorized by hub size (see Exhibit 5-1). Also noted were the year the project was completed; whether it was new, expanded, or renovated; and the scope of work. The 30 airports were located on a map (see Exhibit 5-2) to show their distribution. Through research and communication with contacts at various airports, we narrowed our selection to the following eight airports for the rationale stated:

#### Large Hub

##### **Atlanta Hartsfield-Jackson International Airport (ATL)**

- New international terminal
- Largest airport on list

##### **Dallas/Ft. Worth International Airport (DFW)**

- Major renovation of terminals A, B, C, E
- Has restroom guidelines
- Responded to our airport manager's survey

#### Medium Hub

##### **Sacramento International Airport (SMF)**

- New terminal

##### **John Wayne Airport (SNA)**

- New terminal and restroom renovations

#### Small Hub

##### **Long Beach Airport (LGB)**

- New concourse

##### **Blue Grass Airport (LEX)**

- Restroom renovations
- Responded to survey

#### Non-hub

##### **Jackson Hole Airport (JAC)**

- Terminal expansion including restrooms

##### **Duluth International Airport (DLH)**

- New terminal including restrooms
- Smallest airport on list
- Close proximity to team

The team added two more airports, both large hubs, with special attributes that would round out the study: (LAX) Los Angeles International Airport and (MSP) Minneapolis-St. Paul International Airport. A number of our team members had participated in the master planning and renovation of their restrooms, including numerous initiatives intended to push the “state of the art.” The feedback would be valuable both for the lessons learned and as a comparison to the other airports on our list. In the course designing the MSP restrooms, one of the few available resources our team

found was the Los Angeles World Airport (LAWA) Design and Construction Handbook, which included a comprehensive section on restroom standards. Learning how the standard has served LAX would be insightful. In addition, two of the airports on our initial list were in the Los Angeles area so it would be an easy addition to our visit. One more location for each hub size was identified (see Exhibit 5-2) in case any proposed locations did not work out.

We set about scheduling our visits and were able to group the airports in two trips for the out-of-state locations. LEX, ATL, and DFW in one three day trip then JAC, LGB, SNA, LAX, and SMF in a four day trip two weeks later. Local airports DLH and MSP were visited in the interim. Jens Rothausen-Vange and Rose Agnew conducted the case studies for the large and some medium hubs. The remaining studies were conducted by Jens. Our case study structure was as follows:

1. **Situation, Background or Introduction** The reason for the case study and profile of the airport, including special considerations, size (large, medium, small hub, non-hub), background on business decisions, and the drivers (e.g. change in air service, carrier relocations between concourses, increase in capacity due to new entrants, daily flights, de-hubbing, maintenance challenges, etc.) for determining whether to undergo airport restroom renovation or new construction.
2. **Problem** The main problem needing resolution (e.g. failure of the current restroom layout, inadequate service life, excessive operation costs, airport design criteria and its impact, etc.). Previous attempts at failed solutions would also be addressed here.
3. **Solution and/or what did not work** The solution in detail, focusing on how the airport solved the problem(s), what changes were made to account for the planning, design, and maintenance of the restrooms, budget impacts, end use of the products, methodologies and other factors that contributed to the overall implementation/installation.
4. **Evaluation** Main benefits of the approach/restroom solution and its impact on the airport's

customer service. Provide details on any of the following project results:

- Lessons Learned
- Airport Design Criteria and/or Ratings
- Awards
- Publishing

### C.1.2 Findings

We used the agenda shown in Exhibit 5-3 as a guide for each session. However, we also allowed the discussion to focus on where the energy was. There was an overwhelming consistency between the airport restrooms we visited, for all hub sizes, what might be called the “State of the Industry.” Viewed as a package, this would include:

- Large format floor and wall tiles with tight joints and gray grout
- Solid surface counters with oval sinks and a hole cut in the top between each pair of sinks for trash
- Touchless paper towel dispensers with large rolls that are mounted between the mirrors above the trash opening
- Concealed trash container stands below the counter
- Faucets and foam soap dispensers are touchless
- A diaper changing table is located on a counter near the sinks
- Longer and/or wider toilet stalls
- Toilet stall and urinal partitions are stainless steel with a diamond texture
- Toilet paper dispensers have at least one extra roll in reserve
- Other accessories in the stall include a toilet seat cover dispenser and a coat hook
- Toilets and urinals are touchless and low flow
- A Family Room adjacent to the Men's and Women's with toilet, sink, and diaper changing

The planning for restroom locations and fixture counts seems to remain a seat-of-the-pants exercise. The smaller airports generally found the building code minimums to be adequate whereas many of the larger airports based their decision on what they had seen at other airports or what had worked for them in the past. More often than not, we were told that the solution was to squeeze as many fixtures into the spaces that were

left over after the revenue-generating spaces like hold rooms and concessions were planned out. Two big drivers for change were making older facilities ADA compliant and, post 9/11, providing space within reach of the passengers for their carry-ons and other belongings.

A feature that is becoming more common in these airport restrooms was shelves behind and above toilets and urinals. A few had shelves at the sinks as well. Some of the larger airports had pet relief areas on both land- and airside. Lactation and/or nursing rooms were rare and, especially at the smaller airports, rarely requested by travelers. Most of the airports provided receptacles in the Family Rooms so a pump could be used.

Standardization of products was a common frustration. Open bidding requirements often allowed substitutions resulting in the airport having to manage and stock multiple versions of the same product. Similarly, vendors for the paper and soap products provide their own dispensers. One airport bemoaned that they are required to rebid vendors every year so products and dispensers are constantly changing. This created a condition at one airport where there were four different types of dispensers in one restroom.

The managers at the airports with multiple terminals and complex operations highly recommended assembling a “Restroom Team” with all the stakeholders to work with the planners and designers to ensure that everyone’s needs have been addressed. It was generally agreed that the biggest challenge is balancing aesthetics with maintenance. Other observations / comments from the sessions included the following:

- Automatic flush valves do not really save money. They are activated several times while a person is in the stall. Water usage has actually gone up.
- People generally avoid the dryers that you slide your hands into, primarily for fear of contacting other users’ germs. Operations staff found them to be high maintenance. Only a few airports provided them.
- The name for Family Rooms varied including Companion Care and Assisted Care.
- The first stall is typically the cleanest because most people seek privacy and go to the most remote.

- The California airports use code required sign shapes for the restroom genders: a triangle for Men and circle for Women.
- All the airports had three cleaning shifts. The two day time shifts primarily cleaned spills, restocked paper and soap, and did spot cleaning. The evening shift does the deep cleaning. Some airports have even more thorough monthly or quarterly cleaning where the restrooms are sprayed down. Most of the airports used green cleaning products but admitted they often need to use more because the solutions are weaker.
- The life span of an airport restroom that is used 24/7 has a lifespan that’s one third of the equivalent office restroom. So a 15-year commercial restroom would last five years in an airport environment.

Many of the case study participants offered the “one thing” that is most important in airport restrooms. The following is a snapshot of the responses:

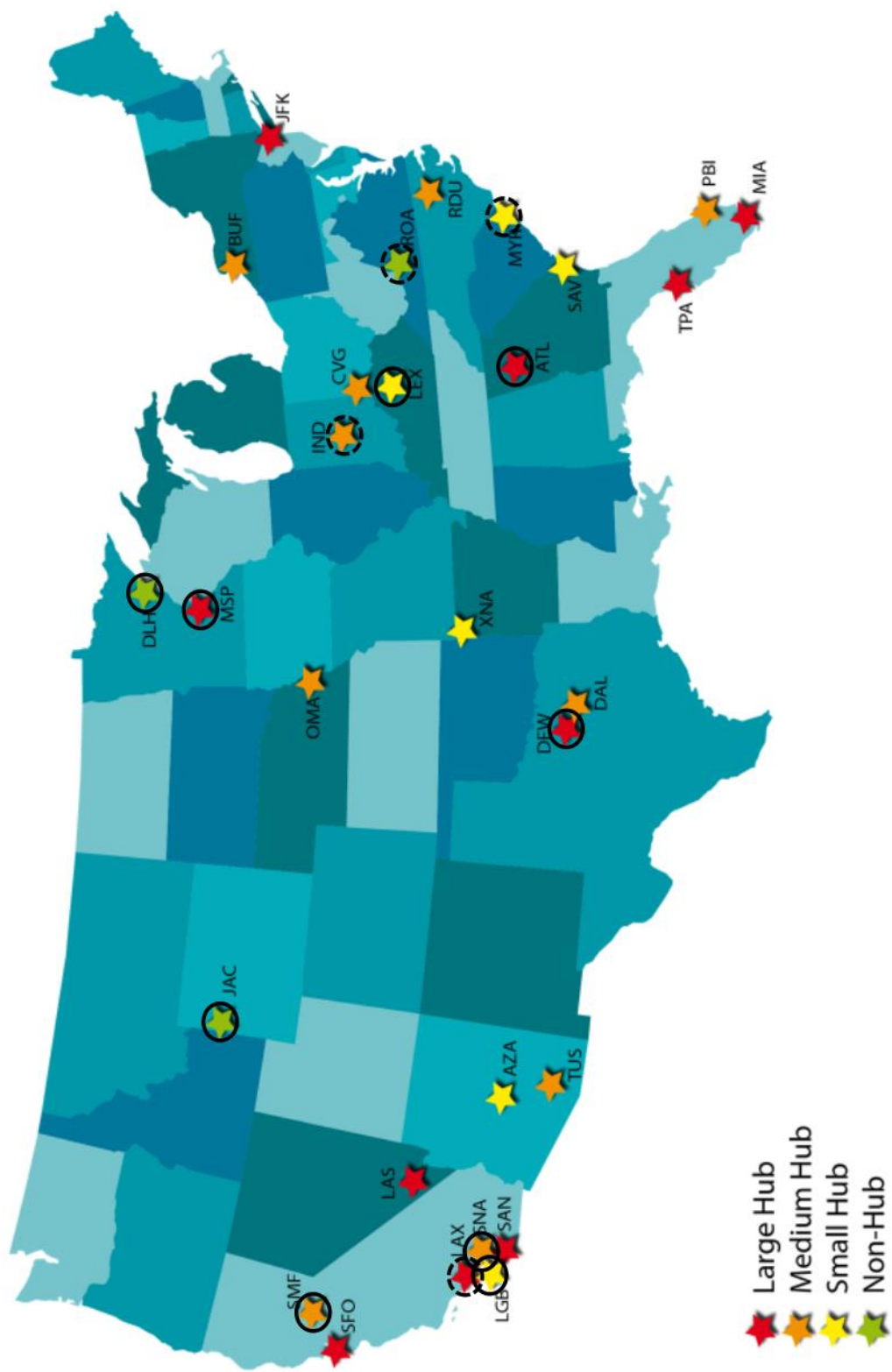
- Customer service
- Design washing and drying in one place
- Standardization
- Cleaning of floor, counter tops, tile, and grout
- Consistency with paper products
- Space and capacity
- Where to put my bag? I don’t want to put anything on the floor!
- What about names of spaces
- Proprietary requirements – legal issues – items that are unique to this airport with justification
- Usability and ergonomics
- Tests and standards
- Relationships with procurement - vendors
- A chapter on Uric acid – and its special impacts on the floor and facility and equipment
- Reliable equipment that is practical, inexpensive and cheap
- Establish a ‘strike team’ when you have a passenger surge.
- Floaters for cleaning
- Get the designer to do a practical dollar estimate – cost benefit and lifecycle.
- A blended approach including design and maintenance

- Cleanliness – how do you design and build and maintain for cleanliness?
- Importance of collaboration with team – all members – finance, operations, maintenance,  
- all team members have ownership – the ownership in the project makes the difference.
- Operational efficiency
- Where do you put the restrooms? Will they use it?

Note that each of the studies includes a floor plan of a restroom visited. All the drawings are at the same scale for comparison.

Rank	Loc ID	Airport	Hub Type	Proposed Visits	Current Enplanements	Construction Type	Year Completed	Consideration
1	ATL	Atlanta	L	→	43,130,585	New/Renovation	2012 & 2014	New International Terminal. Concourse D modernization
2	LAX	Los Angeles	L		28,857,755	Renovation/Expansion	2010-2014	Renovation of the Tom Bradley International Terminal (TBIT) and includes a development program for new gates and concourse areas of TBIT.
3	DFW	Dallas/Ft. Worth	L	→	27,100,656	Renovation	2011-2017	\$1.9 billion terminal renewal and improvement program, including bathroom renovations in Terminals A, B, C and E.
4	JFK	New York/Kennedy	L		22,934,047	New/Expansion	2008, 2013	New JetBlue Terminal 5. Delta Terminal 4 International gate expansion.
5	SFO	San Francisco	L		19,359,003	Renovation	2011	Terminal 2 renovation (Formerly the International Terminal)
6	LAS	Las Vegas	L		18,996,738	New	2012	New International Terminal 3
7	MIA	Miami	L		17,017,654	Expansion	2007-2013	North Terminal D Expansion
8	MSP	Minneapolis-St. Paul	L	→	15,512,487	Renovation/Expansion	2012	New Restrooms and prototype program.
9	SAN	San Diego	L		8,430,509	Renovation/Expansion	Aug. 2013	The Green Build, 10 gate expansion, includes renovation of bathrooms in Terminal 2
10	TPA	Tampa	L		8,137,222	Expansion/Renovation	2014	Main Terminal Transfer Level expansion, concessions expansions
12	RDU	Raleigh-Durham	M		4,465,736	Expansion	2009	Terminal C expansion
13	SMF	Sacramento	M	→	4,424,279	New Terminal	2011	\$1 billion Big Build Terminal Program
14	SNA	John Wayne-Orange County	M	→	4,278,623	New Terminal/Renovations	2011	New Terminal C, Current restroom renovations
15	CVG	Cincinnati	M		3,906,826	Renovations	2012	Recent Terminal Restroom renovations
16	DAL	Dallas Love Field	M		3,783,407	New	2014	New Terminal
17	IND	Indianapolis	M		3,728,698	New	Nov. 2008	New Terminal
18	PBI	Palm Beach	M		2,958,416	Renovations	2012 AIP	Restroom Renovations
19	BUF	Buffalo Niagara	M		2,602,968	Renovations	2012 AIP	Restroom Renovations
20	OMA	Eppley Airfield	M		2,097,958			An assessment of this airport's bathrooms can provide a baseline assessment of airport bathrooms located in similar aging terminal facilities, SWA Hub
21	TUS	Tucson	M		1,844,228	Renovations	2013 Survey	Recent Restroom Renovations
22	LGB	Long Beach	S	→	1,451,404	Renovations	2012	Main Terminal renovations
23	SAV	Savannah/Hilton Head	S		798,194	Renovations	2013 Survey	Recent Restroom Renovations
24	MYR	Myrtle Beach	S		782,737	Expansion	2010/2012 AIP	Terminal Expansions
25	XNA	Northwest Arkansas Regional	S		549,195	Expansion	2010/2012 AIP	Terminal Expansions
26	LEX	Blue Grass	S	→	539,492	Renovations	2013 Survey	Recent Restroom Renovations
27	AZA	Phoenix-Mesa Gateway	S		417,862	Renovations	2013 Survey	Recent Restroom Renovations
28	ROA	Roanoke Regional	N		316,478	Renovations	2013 Survey	Recent Restroom Renovations
29	JAC	Jackson Hole	N	→	288,325	Expansion	2010	Terminal Expansion including restrooms
30	DLH	Duluth	N	→	150,556	New	2013	New Terminal including restrooms
	AMS	Amsterdam Airport Schiphol	INTL		22,605,875	Renovations		Recent renovation showcasing artist-inspired bathrooms

**Figure C.1-1. US Airports with FAA AIP Funding Showing 2013 Enplanements (Airports in Blue Indicate Originally Proposed Locations).**



**Figure C.1-2.** Locations of US Airports with FAA AIP Funding (Solid Circles Indicate Case Study Locations. Dashed Circles Indicate Alternate Locations).

**Discussion Topics for Hartsfield-Jackson Atlanta International Airport Case Study**

- 1. Overall customer service goals (level of service):**
    - a) Did you have any specific business drivers for restroom renovation?
  - 2. Restroom philosophy/goals (business operations drivers and logistics):**
    - a) Did you have a robust / usage goal? Other goal?
    - b) What were your processes related to:
      - i. New construction or renovation
      - ii. Customer service requirements / metrics
      - iii. Safety/ security audit
      - iv. Disability/access audit
      - v. Maintenance/sustainability standards/metrics
    - c) Describe operations / logistics in terms of:
      - i. Existing conditions assessment
      - ii. Hours of operations
      - iii. Practical maintenance and cleaning requirements and schedule/solutions
      - iv. Cost benefit analysis (e.g. number of restrooms)
    - d) Describe information and communication systems (e.g. wayfinding, signage, etc.)
    - e) What products and systems were used and why?
  - 3. Planning goals:**
    - a) Did you plan and design differently for the secure and non-secure areas? Any new insights?
    - b) Feasibility study (e.g. future demand assessment)
      - i. Number of locations required for airport for both the airside and landside areas
      - ii. Number of toilets per location (square footage or passenger numbers, service level)
      - iii. Rationale for selected locations (e.g. proximity to major concessions areas, reasonable walking distances, etc.)
    - c) Passenger demographics (e.g. Female toilet increase factor)
    - d) Describe your sustainable goals
    - e) Describe your accessibility goals
    - f) Describe your aesthetic goals (colors, contrasts, textures)
    - g) What worked? What were your surprises?
  - 4. Functional goals:**
    - a) Did you have a cost per square foot goal?
    - b) Did you expand your footprint to address new passenger demographics?
    - c) Describe comfort goals (e.g. ease of maneuvering, privacy/dignity, sensory experience)
    - d) Describe fixtures and accessories goals (e.g. toilets, urinals, sinks, dispensers, waste, conveniences)
    - e) Describe demographic needs (gender, age, companion):
    - f) Describe systems goals (e.g. lighting, ventilation, temperature, wayfinding, emergency)
    - g) Describe maintenance goals (e.g. clean, sturdy, in working order)
    - h) What were your design parameters? (10-, 20-, 30-, 40-year horizon or other?)
  - 5. Cost-effective / lifecycle cost parameters:**
    - a) Did your airline partners / stakeholders determine and/or impact your restroom decisions?
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**Figure C.1-3. Sample Agenda for Case Study Session.**

#### THE CASE STUDY PROCESS FOR ACRP 07-12

##### Background on ACRP 7-12

- **Title:** *Guidebook for Airport Terminal Restroom Planning and Design*
- **Objective:** To create a user-friendly guidance manual to help determine the location, number, size, and configuration of airport terminal restroom facilities to meet various customer (e.g., passenger, employee, and family) needs.
- **Project Team:** A group of industry professionals, who bring a variety of knowledge and expertise to the task, including architectural and engineering consultants who have planned, designed and developed restroom renovations.
- **Sponsor:** ACRP (Airport Cooperative Research Program) is managed by the Transportation Research Board (TRB) of the National Academies and sponsored by the Federal Aviation Administration (FAA).

**Case Study Input Needed:** Your input is essential to help us develop a case study as part of the guidebook for airports that will:

- Provide restroom solutions for airports of all size considering upgrades, renovations or new construction through prototypical layouts;
- Enable airports to assess their restroom inventory based on changing demographics as well as develop and prioritize potential project lists and schedules;
- Consider all aspects of the customer experience at an airport, including how easy restrooms are to find and access, how appealing they are to the senses, and how well their location relates to other airport amenities.

**The Case Study Roundtable Process:** Our research team believes that the most effective way to understand an airport's experience designing and constructing major restroom projects is to gather a group and discuss project experiences in a roundtable format. The case study roundtable will take 60 minutes with an optional restroom tour. This interactive roundtable will specifically focus on: customer service, cost parameters, planning needs, operations and logistics requirements, and functional design requirements. If schedules permit, ideally we recommend the following attendees: Lead Planning & Engineering Manager, Customer Service Manager, Maintenance (include local plumber if possible), and IT-specific technologies (e.g. cleaning, drying, etc.).

##### Contact for this ACRP Project

Jens H. Rothausen-Vange AIA, LEED AP, CDT  
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Architectural Alliance  
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**Figure C.1-4.** Back Page of Session Agenda.



# ***LARGE HUB CASE STUDIES***

Atlanta Hartsfield-Jackson International Airport (ATL)  
Dallas/Ft. Worth International Airport (DFW)  
Los Angeles International Airport (LAX)  
Minneapolis-St. Paul International Airport (MSP)

## ***Hartsfield-Jackson Atlanta International Airport (ATL)***

### ***“A Full-time Attendant in the Women’s Restrooms”***

#### **Overview**

Hub Type: Large Hub

Hours of Operation: 24/7

Designed Life: 20 years

Annual Enplanements: 43,130,585

Airport Size: 6.8 million square feet

Number of Gates: 207

Number of Restrooms:     51 Women’s  
                                     49 Men’s  
                                     25 Family

Case Study Project: New International Terminal Restrooms opened in May, 2012

Date of Case Study: September 12, 2013

#### **Background**

In 2000, the Wall Street Journal documented their observations in an article about their visits to the 20 busiest airports in the nation. Hartsfield-Jackson Atlanta International Airport was among the five worst. A primary aspect of this distinction was their lack of restrooms. An airport spokesperson admitted that the shortage was the biggest of their complaints. This wake-up call set in motion master planning for the entire airport. Front and center was increasing the size and locations of their restrooms as well as address poor lighting, inadequate exhaust, and the perception of dirtiness. Now the airport has 51 restroom sets for Women, 49 for Men, and 25 Family Rooms, a noticeable jump from the 30 sets for men and Women in 2000.

A unique aspect of Atlanta airport is the management of airport operations by the Atlanta Airlines Terminal Corporation (AATC). Formed by several major airlines in 1979 to provide “World Class” performance in airport facility maintenance and operations, this group’s management scope includes the restrooms. As such, the airlines have significant influence in the planning and design of the airport restrooms.

The airport opened the new Maynard H. Jackson, Jr. International Terminal in May, 2012. This terminal has ten restroom sets spread over three levels to accommodate arrivals and departures for 12 gates in the 1.2 million square-foot facility.

#### **Problems/Solutions**

Customer service has been the driver for the Atlanta airport’s recent restroom upgrades. For the past seven years, the airport has been collecting data on various fronts including ASQ’s (Airport Service Quality) monthly interviews with departing passengers, staff impressions from weekly cleaning inspections, and through a phone number posted on a sign in each restroom.

The airport has a “restroom team” that represents the various airport departments involved with the restrooms and worked with their architects to determine the locations of the restrooms and quantities of fixtures. When planning and designing for the high usage of their restrooms, the airport staff follows this guiding principle: “Build it like a tank.” Learning from previous renovations, the restrooms in the terminal addressed the following issues:

##### Small Toilet Stalls

- Enlarged the standard stalls to 3’ wide by 5’-6” deep.

## ***Hartsfield-Jackson Atlanta International Airport (ATL)***

### Water on Floors between Sinks and Paper Towels

- Installed paper towel dispensers at sinks directly above trash openings

### Water Leaking Through Floor Tiles to Spaces Below

- Installed waterproofing under tile floors

### Overflowing Trash

- Provide large capacity under-counter trash cans between each pair of sinks with hole in counter

### Graffiti

- Installed graffiti film on mirrors that can be peeled off when marked
- Stall partitions are stainless steel with a diamond texture

### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, flushometers
- Eliminated entry doors

### Paper Waste

- Use large roll paper towels that feed 8"-10" at a time
- Use single-ply toilet paper on coreless rolls
- The airport chose not to use hand dryers due to the noise and the aversion by many travelers to put their hands in an enclosure that may harbor other people's germs

### People Walking Into Wrong Restroom

- Installed an additional sign within entries to indicate gender of restroom one last time before person is inside restroom

### No Restroom for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- Provide a Family Room with each restroom set

### No Diaper Changing

- Dedicated area at end of lavatory counter with integral side walls

### Not Enough Fixtures

- Building codes are not sufficient for the surges in an airport – provided more

### High Water Consumption

- Installed low-flow fixtures
- Looked at waterless urinals but the low slope of the 1970s piping in the domestic terminals and concourses did not adequately flush out and created odors. They work well in the new International terminal.

### Inadequate Chase Access for Plumbing Maintenance

- Installed surface mounted flushometers so repairs can be made within the restroom
- Provided 24" wide access doors for minimal access to chases.

## ***Hartsfield-Jackson Atlanta International Airport (ATL)***

### Inadequate exhaust

- Increase exhaust rate and located diffusers over stalls in new terminal and F Concourse
- Also addressed smells with battery-powered air fresheners, but they were not as effective as hoped. Scented urinal strainers for urinals have worked well (need to be replaced every 4-6 weeks)

### Poor Lighting

- Increase existing foot-candle levels by four
- Provided task lighting over stalls and sinks
- Added windows where possible for natural light.

### Inefficient Cleaning

- Overhead-braced stall partitions
- Durable 12" x 12" quartz tile on floors and walls with 3/16" sealed epoxy grout joints
- Women's restrooms have two entrances so one half can be shut down at a time for cleaning or repairs

### Product Stocking

- Custom toilet paper towel enclosures contain the chassis of the dispenser that holds the paper roll and a back-up roll that drops down when the first runs out. There is also a shelf with storage for a third roll.
- The toilet paper dispenser has two rolls available for use and two in reserve above that drop down to ensure the dispenser never runs out
- Foam soap is plumbed from storage tanks in a cabinet below the counter to the dispensers at the sinks

A unique feature at Hartsfield-Jackson is that the Women's restrooms each have a fulltime attendant who continually cleans up spills, check the paper supply, and provide assistance when needed. The airport has found that this person's presence increases the perception of cleanliness. The airport currently feel an attendant is not necessary in the Men's due to the lower dwell time and volume of traffic of the male travelers. Overall, the facility employs 780 cleaners including management teams.

### **Evaluation**

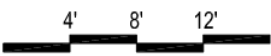
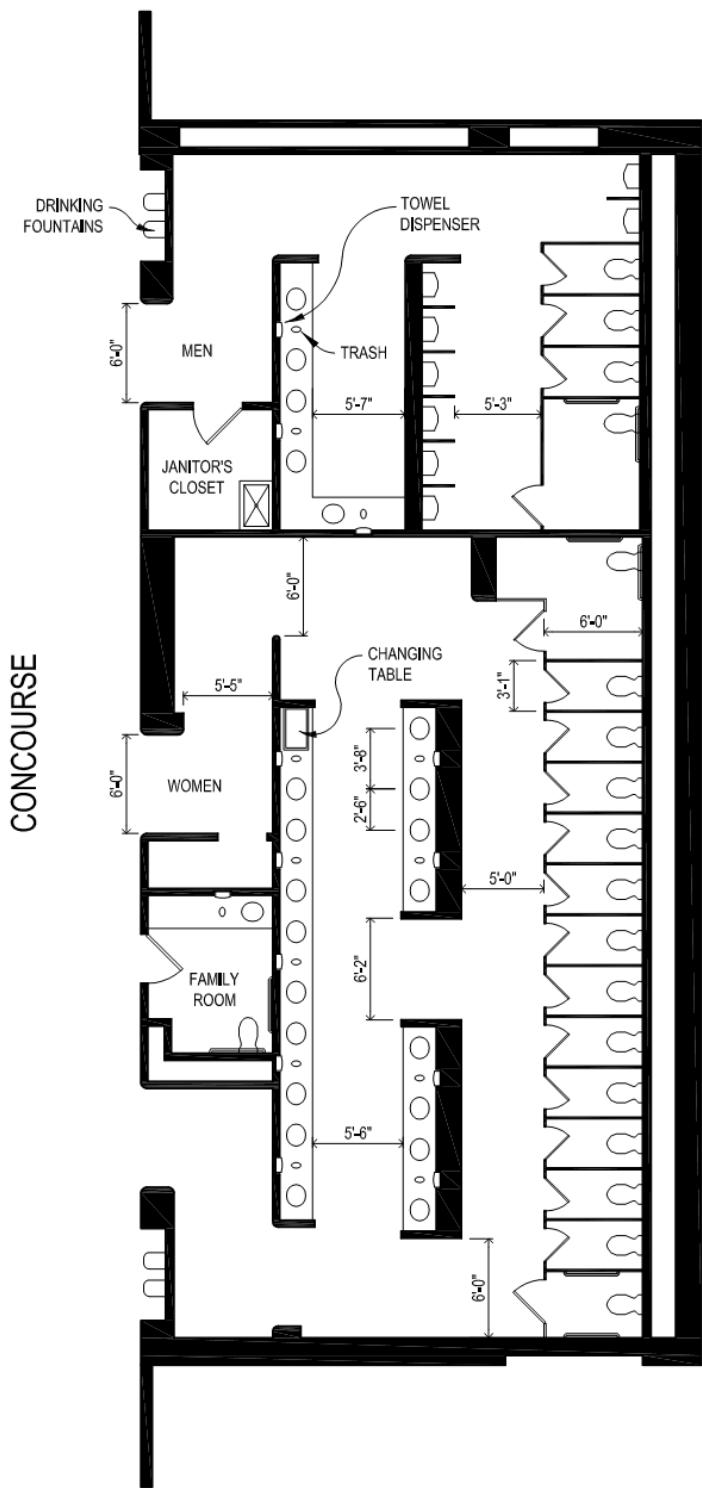
With over a year in operation, the staff at the Atlanta airport is happy with the restrooms in the new International Terminal. The following positives and negatives have been observed that either remain or have developed as a result of their initiatives and will be considered in future restroom work:

- Reflectivity of porcelain tile in certain locations provides a sightline into the restroom from the concourse.
- The stainless steel trash cans below the counters are heavy to lift out to empty. Office grade plastic containers are being considered for replacement.
- There are still lines at some Women's restrooms, especially from March to August when families tend to travel more. Large restrooms for Women or additional sets for Women are being considered.
- The Janitor's Closets are often too small. Should be sized to store a minimum of 24-hour's worth of supplies.
- Bottle fillers on drinking fountains are very popular.
- The stainless steel textured partitions are good at hiding fingerprints and preventing graffiti.
- Overhead braced stalls require frequent re-tightening of fasteners due to racking when doors swing.
- Considering epoxy terrazzo flooring to eliminate joints, but have found that coved base corners are difficult to clean.

- Older concourses rely on in-draft from the concourse which often does not provide enough exhaust
- Have found that the natural tile on the walls is absorptive and can “cloud” with dirt.

One case study participant closed the meeting by suggesting, “Build the restrooms for volume of traffic and ease of maintenance with the durability of a prison.”

**Hartsfield-Jackson Atlanta International Airport (ATL)**



## ***Hartsfield-Jackson Atlanta International Airport (ATL)***



**Restroom Entrance with overhead, ADA, and Entry Signs**



**Restroom Set – Blue for Men, Pink for Women, Family and Family Room between Women Entrances**



**Family Room Overhead Sign**



**Drinking Fountains with Bottle Filling Station**



***Hartsfield-Jackson Atlanta International Airport (ATL)***



**Overhead-braced Stainless Steel Stalls**



**Urinals with Tall Screens for Privacy**



**Diaper Changing Area**



**Counter Area with Paper Towels,  
Trash, and Child Step Lower Right**



***Hartsfield-Jackson Atlanta International Airport (ATL)***



**Full-height Mirror in Women's and Men's**



**Storage under Counter**



**Four-roll Toilet Dispenser**



**Guts of Custom Paper Towel Dispenser**

## Appendix C.1

## ***Hartsfield-Jackson Atlanta International Airport (ATL)***

### **Participants**

#### Airport

Kofi Smith – Executive Director – AATC

Rod Ozust - Deputy Executive Director – AATC

Stephen Morris –Assistant Director – Central Passenger Terminal Complex – HJDP

Brian Kingston – Senior Vice President– AirServ Corporation

Todd Butler – Vice President – CPS

#### Moderators

Rose Agnew – Aviation Innovation

Jens Rothausen-Vange – Architectural Alliance International

## ***Dallas/Fort Worth International Airport (DFW)***

### ***“Triple Bottom Line: Social (Passenger Needs), Cost, Environment”***

#### **Overview**

Hub Type: Large Hub

Hours of Operation: 3:30 a.m. – 12:00 a.m.

Designed Life: 15+ years

Annual Enplanements: 27,100,656

Airport Size: 5,160,000 square feet

Number of Gates: 155

Number of Restrooms:     59 Women’s  
                                     59 Men’s  
                                     8 Family  
                                     1 Mother’s Room  
                                     2 Pet Relief Areas (1 landside, 1 airside)

Case Study Project: Terminal A Improvements partial completion in April, 2013

Date of Case Study: September 13, 2013

#### **Background**

DFW opened in 1974 with four terminals and in 2005 opened a fifth, International Terminal D. In 2009 a \$1.9 billion “Terminal Renewal and Improvement Program” (TRIP) for the original four terminals began with the renovation of Terminal A. Gates A9-A26 was completed in April 2013 and included the renovation of the associated restrooms.

Ten years ago, the airport began to seriously focus on customer service. Among their efforts, they participate in the Airports Council International (ACI) Airport Service Quality (ASQ) survey and for the two restroom-related metrics – Cleanliness of Washrooms and Availability of Washrooms – has scored 3.92 to 4.41 in the last two years. Despite these good ratings, the airport knew that the 40-year-old infrastructure was aged, the finishes worn, the spaces too small, the utilities were inefficient, and the amenities non-compliant with the ADA.

Compounding the state of the restrooms, those in each of the four legacy terminals were built to suit the resident airlines, so there were no standards. In 2007, the DFW Airport Planning Department published their “Guidelines for Public Terminal Toilets,” which addresses design concepts, fixtures and accessories, finishes, and provides an appendix of product specifications. The manual was updated in 2012 upon the completion of the programming for the TRIP initiative. The airlines now comply with this standard. With each project, the planning staff assembles a task force, which gives all the stakeholders a voice in the outcome.

#### **Problems/Solutions**

One of DFW’s customer service initiatives is a posted QR code for passengers to register comments on the restrooms. The most common complaints are odors and water on the counters. There are also “Ambassadors” who roam the airport and provide day-to-day input. There are rarely lines at the restrooms; however, the spaces feel crowded. The triple bottom line philosophy of the airport is to address Social (passenger needs), Cost, and Environment. To that end, the restrooms in the Terminal A renovation addressed the following issues:

##### Small Toilet Stalls

- Enlarged the standard stalls
- Shelf above toilet and urinals for belongings

## ***Dallas/Fort Worth International Airport (DFW)***

### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, flushometers
- Eliminated entry doors

### Water on Countertops

- Installed paper towel dispensers at sinks directly above trash openings, but water still drips from

### Graffiti

- Installed graffiti film on mirrors that can be peeled off when marked
- Caused by both passengers and employees

### People Walking Into Wrong Restroom

- An additional “verification” sign is installed farther into the entry to confirm the restrooms gender

### No Diaper Changing

- Fold down models are provided in Terminal A. Dedicated counters were provide in D where the new construction allowed more space

### No Restroom for Parents Traveling with Small Children or Person’s Requiring Assistance from a Companion

- Use the name “Assisted Care Toilet” instead of Family Room to acknowledge aging population and multiple cultures
- Provide a Family Room where space allows

### Inadequate exhaust

- Increase exhaust rate

### High Water Consumption

- Installed low-flow fixtures – cut consumption in half
- Looked at waterless urinals but had concerns about odors

### Poor Lighting

- Provided task lighting over stalls and sinks

### Inefficient Cleaning

- Overhead-braced stall partitions are easier to clean under. A few pilasters go to the floor to prevent racking of the doors.
- Use sustainable cleaning products

### Product Stocking

- The toilet paper dispenser has two rolls available for use

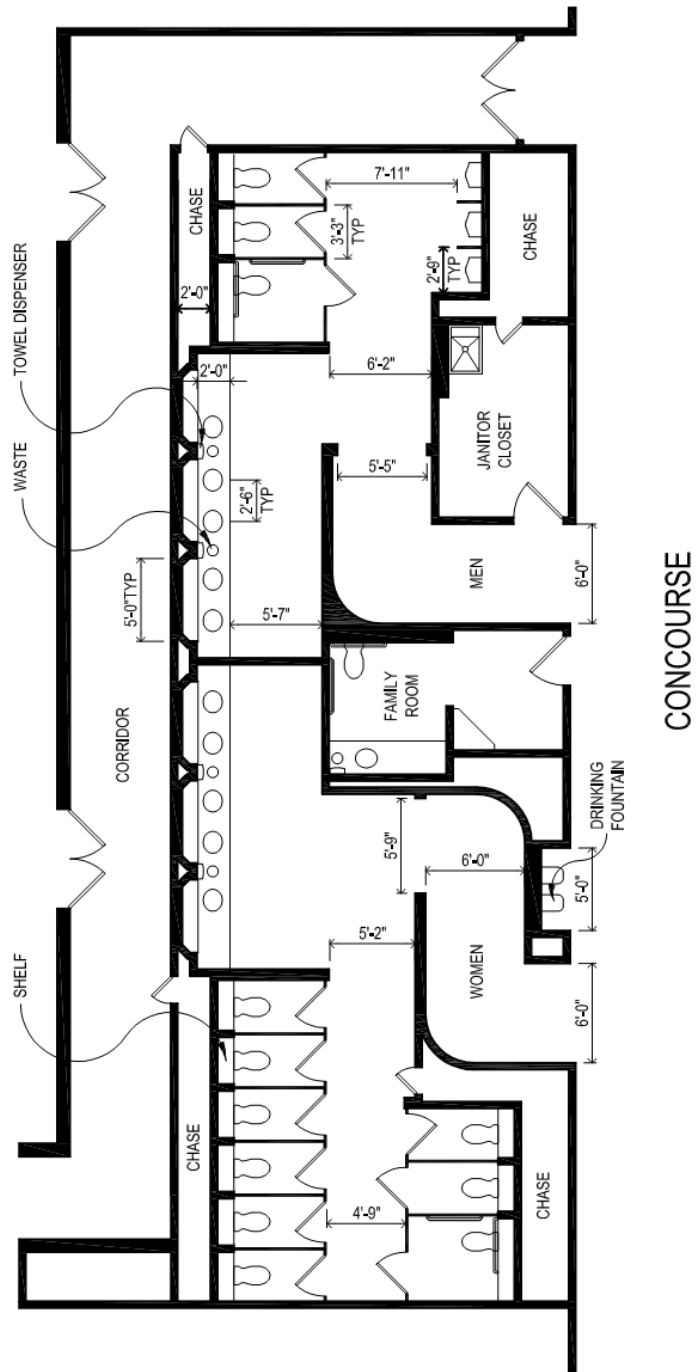
## ***Dallas/Fort Worth International Airport (DFW)***

### **Evaluation**

With restrooms open for a year for evaluation and with years of renovation to come, lessons learned are plentiful. The following positives and negatives have been observed that either remain or have developed as a result of their initiatives and will be considered in the future restroom work:

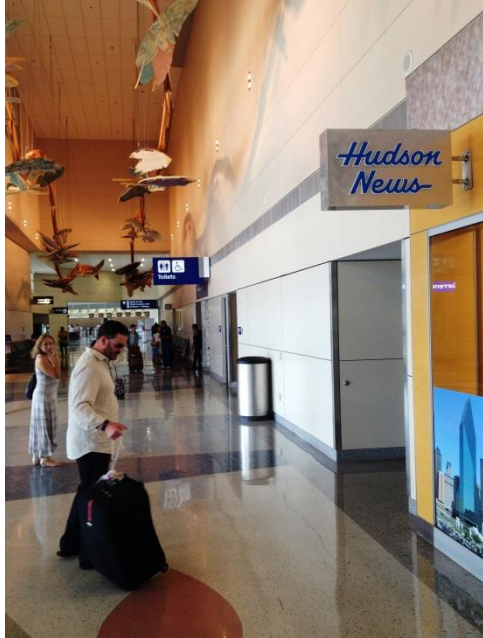
- Trap primers are not cleaned enough so smells are an issue
- Toilet carriages are settling the clay masonry walls. As the fixtures rock back and forth, the pipe joints in the walls loosen and begin to leak.
- Due to multiple vendors throughout the airport, there are eight different styles of paper towel dispensers. The goal is to have an airport-wide standard for this.
- Paper towel dispensers are installed at sinks directly above trash openings, but water still drips from the sink to the dispenser.
- The goal is to have restroom sets no more 300 feet apart with fixture counts that exceed code minimums and additional fixtures for females.
- Terminals A and C have the only restrooms without plumbing chases making maintenance a challenge.
- The airport decided not to provide footbaths, however there is occasional damage to fixtures from people standing on them.
- The first stall within a restroom is always the cleanest. People pass by to get to the most private.
- A floor-mounted toilet or wall-hung toilet with a floor support at front may be required more in the future as people become more obese.

# Dallas/Fort Worth International Airport (DFW)





## Dallas/Fort Worth International Airport (DFW)



Wayfinding Blade Sign Beyond



ADA Sign and "Verification" Sign Beyond and Acoustic Wall Carpet



Room Sign with Directions to Nearest Restroom



Alternate Name for Family Room



***Dallas/Fort Worth International Airport (DFW)***



**Entry Area**



**Sink Area**

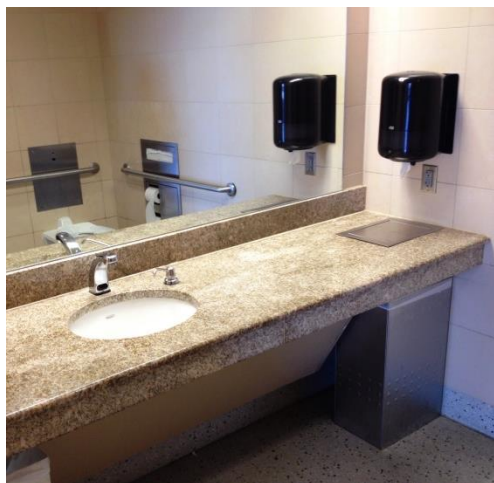


**Urinals with Shelf Above**

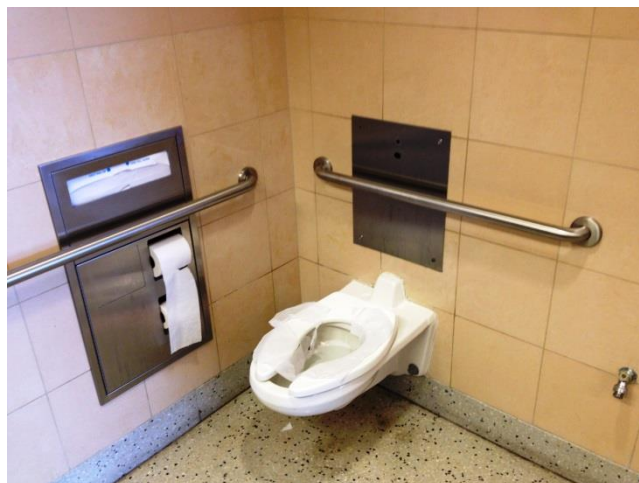


**Typical Stall**

***Dallas/Fort Worth International Airport (DFW)***



**Assisted Care Toilet**



**Assisted Care Toilet**



**Assisted Care Toilet Changing Table and Seat**

# Dallas/Fort Worth International Airport (DFW)

Satisfaction Scores By Terminal												
Mean scores based on a scale of 1 (poor) to 5 (excellent)												
	A	B	C	D	E	DEW						
(Categories listed in order of importance)	(FY11)	(FY10)	(FY11)	(FY10)	(FY11)	(FY10)	(FY11)	(FY10)	(FY11)	(FY10)	(FY11)	(FY10)
<b>DFW Airport</b>												
<b>Q2 FY11 vs. Q2 FY10 comparison by terminal</b>												
<b>ACI Customer Satisfaction Study</b>												
<b>All Passengers</b>												
<b>Airport Environment</b>												
Ambience of the airport	3.91	3.89	0.02	4.05	3.94	0.11	3.97	3.92	0.04	4.08	3.97	0.11
Cleanliness of airport terminal	4.15	4.13	0.02	4.27	4.16	0.11	4.18	4.12	0.06	4.34	4.32	0.03
<b>Airport Facilities</b>												
Comfort of waiting/gate areas	3.91	3.90	0.00	3.92	3.94	-0.02	3.96	3.90	0.06	4.08	4.01	0.08
Cleanliness of restrooms	4.00	3.82	0.17	3.93	3.85	0.07	4.00	3.83	0.17	4.13	4.12	0.01
Availability of restrooms	4.09	3.81	0.29	4.17	4.02	0.14	4.07	3.84	0.23	4.13	4.01	0.12
Courtesy & helpfulness of airport staff (excluding check-in and security staff)	4.20	4.22	-0.03	4.23	4.19	0.04	4.23	4.25	-0.03	4.33	4.18	0.15
Restaurant/cafeteria facilities	3.95	3.97	-0.02	4.03	3.98	0.05	3.98	4.03	-0.05	4.19	4.20	0.00
Shopping facilities	3.77	3.88	-0.11	3.74	3.80	-0.06	3.87	3.19	0.68	3.74	3.76	-0.02
Value for money of shopping facilities	3.23	3.21	0.02	3.17	3.20	-0.02	3.21	3.78	-0.57	3.65	3.07	0.59
Value for money of restaurants	3.34	3.36	-0.02	3.39	3.40	-0.02	3.39	3.44	-0.05	3.35	3.61	-0.26
Business/Executive lounges	3.66	3.89	-0.23	3.68	3.86	-0.19	4.00	3.90	0.10	3.68	3.69	-0.01
Availability of bank/ATM facilities	3.66	3.85	-0.19	3.65	3.73	-0.08	3.81	3.75	0.07	3.65	3.60	0.05
Internet access/Wi-Fi	3.10	3.40	-0.30	3.15	3.11	0.04	3.25	3.22	0.03	3.15	3.14	0.01
<b>Finding Your Way</b>												
Ease of making connections with other flights	4.11	4.00	0.10	4.12	4.03	0.09	4.04	4.00	0.05	4.35	4.12	0.23
Ease of finding your way through airport	4.28	4.24	0.04	4.32	4.23	0.09	4.30	4.31	-0.01	4.45	4.39	0.06
Walking distance inside the terminal	3.91	3.83	0.08	3.92	3.83	0.09	3.92	3.91	0.01	4.12	4.06	0.06
Flight information screens	4.21	4.24	-0.04	4.20	4.22	-0.02	4.24	4.26	-0.01	4.42	4.39	0.03
<b>Personal ID Inspection at Security Check</b>												
Courtesy & helpfulness of inspection staff	4.06	4.24	-0.18	4.14	4.19	-0.05	4.03	4.10	-0.07	4.10	4.19	-0.08
Waiting time at passport/personal ID inspection	4.01	4.09	-0.08	4.10	4.17	-0.07	3.96	3.94	0.02	4.04	4.12	-0.08
<b>Security Check</b>												
Courtesy & helpfulness of security staff	3.99	4.16	-0.18	4.04	4.13	-0.09	4.00	4.09	-0.09	4.06	4.15	-0.09
Feeling of being safe and secure	4.08	4.21	-0.13	4.20	4.15	0.06	4.13	4.16	-0.03	4.13	4.27	-0.14
Thoroughness of security inspection	4.01	4.18	-0.17	4.09	4.10	-0.01	4.02	4.10	-0.08	4.06	4.16	-0.10
Waiting time at security inspection	3.83	4.07	-0.24	4.03	4.08	-0.05	3.87	3.96	-0.09	3.89	4.08	-0.19
<b>Airline Check-In</b>												
Courtesy & helpfulness of check-in staff	4.28	4.38	-0.11	4.24	4.29	-0.05	4.27	4.35	-0.09	4.33	4.47	-0.14
Efficiency of check-in staff	4.30	4.39	-0.09	4.23	4.27	-0.03	4.29	4.34	-0.05	4.39	4.46	-0.07
Waiting time in check-in queue	4.22	4.32	-0.10	4.21	4.39	-0.18	4.17	4.28	-0.11	4.33	4.34	-0.01
<b>Access</b>												
Availability of baggage carts	3.78	3.98	-0.19	3.82	3.87	-0.05	3.76	4.01	-0.25	3.97	4.11	-0.14
Availability of parking facilities	3.75	3.90	-0.15	3.79	3.81	-0.03	3.68	3.88	-0.24	4.07	4.12	-0.04
Ground transportation to/from airport	4.03	4.13	-0.10	3.99	3.99	0.00	4.09	4.06	0.03	4.07	4.26	-0.20
Value for money of parking facilities	3.10	3.33	-0.22	3.12	3.23	-0.11	2.96	3.34	-0.37	3.32	3.52	-0.20
<b>Overall Satisfaction (Q2 FY11)</b>	4.10			4.17			4.11			4.41		
<b>Overall Satisfaction (Q2 FY10)</b>	4.08			4.08			4.08			4.41		
<b>Year-over-year</b>	0.02			0.09			0.04			-0.01		

## ACI Survey for DFW

## ***Dallas/Fort Worth International Airport (DFW)***

### **Participants**

#### Airport

Bob Blankenship – Assistant Vice President, Planning

Darren Deffner – Senior Project Manager, ADE – Architecture

Tommy Huddleston – Assistant Vice President, Energy, Transportation, and Asset Management

Mark Holt – ISM / ETAM

Al Gonzalez – Analyst, Marketing Services

Mark Moreno – Manager, Infrastructure Plan / ETAM

Reeshema Brashear – Facility Services Coordinator

#### Moderators

Rose Agnew – Aviation Innovation

Jens Rothausen-Vange – Architectural Alliance International



## ***Los Angeles International Airport (LAX)***

### ***“Like Painting the Golden Gate Bridges”***

#### **Overview**

Hub Type: Large Hub

Hours of Operation: 24/7

Designed Life: 5 years for cosmetic refresh/10 years for gut

Annual Enplanements: 31,362,268

Airport Size: 5,800,000 square feet

Number of Gates: 140

Number of Restrooms:     67 Women’s  
                                     66 Men’s  
                                     15 Family  
                                     1 Nursing

Case Study Project: Tom Bradley International Terminal addition completed August 2013 and Terminal 1 Restrooms (representative of current standard) completed in 2007

Date of Case Study: September 26, 2013

#### **Background**

LAX is considered the world’s busiest O & D airport with a broad spectrum of travelers pulled in from the sprawling metropolis. As such, the restrooms take a constant beating, to the point where cosmetic updates are needed every five years and total guts every ten to fifteen years. With about 180 restroom sets, there are always restroom renovations underway. One case study participant likened it to painting the Golden Gate Bridge. “A soon as you’ve renovated them all, you start all over again.”

To manage this massive scope of work, the Los Angeles World Airports (LAWA) developed a Design and Construction Handbook in 2011 based in part on standards used by large entertainment venues for its facilities. The handbook is in its third iteration and covers all aspects of construction work at the airports. It is available the airport’s website. The restroom portion is unusually robust for the aviation industry. Lessons learned from both renovation, as in Terminal 1 and new construction, as in the new addition to the Tom Bradley International Terminal will likely spur another update to the handbook. While the new International Terminal restrooms were not available to visit for the case study, existing restrooms in Terminal 1 were toured as a typical representation of the more recent standards.

#### **Problems/Solutions**

As with other airports, customer service is the driving force behind the intense focus on keeping the restrooms at LAX appealing. Other drivers include increased security concerns since 9/11 and the cost of ongoing maintenance. An informal project team is involved in every restroom project that includes the managers from all entities involved in the restrooms – trades, vendors, cleaners, designers, etc. Despite the rigorous process shepherding projects from conception to completion, there remain numerous obstacles that the airport has to contend with such as ever changing vendors for paper and soap that require changes in dispensers. Issues that the facilities staff tries to improve include:

##### Awkward Circulation in Restrooms

- Avoid dead end circulation – prefer loop around wall with sinks on each side and stalls flanking the perimeter
- Accessible stalls should be near entry

## ***Los Angeles International Airport (LAX)***

### Distance to Restrooms

- Try to have a maximum of 250 feet to nearest restroom
- Prefer bigger restrooms that are less frequent to accommodate arrival surges

### Small Toilet Stalls

- Enlarged the standard stalls to 3'-6" wide by 6'-0" deep with a shelf
- Hooks on back of doors dent the front face when the door is slammed open against side wall

### Water on Floors between Sinks and Paper Towels

- Installed paper towel dispensers between every other sink directly above trash openings

### Overflowing Trash

- Provide large capacity under-counter trash cans between each pair of sinks with hole in counter

### Graffiti

- Installed graffiti film on mirrors that can be peeled off when marked
- Found phenolic resin partitions easy to maintain but not good for vandal resistance

### Durability of Finishes

- Provide finishes that are "bullet-proof" to withstand the traffic without looking like a rest stop
- Stainless steel stalls with diamond pattern very durable
- Test for new materials: If it scratches with a key it is not accepted. It cracks when whacked with a sharp heel it is not accepted.

### Hard to Reach Faucets and Soap Dispensers

- Faucets are to one side of the sinks at 45 degrees and soap dispensers are to the other side also at 45 degrees

### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, flushometers
- Eliminated entry doors

### Paper Waste

- Paper is the biggest expense
- Use large roll paper towels – limo drivers would use stacks of C-fold towels to clean their cars
- Paper is preferred. One hand dryer is provided in each restroom for those who like them

### No Lactation Rooms

- Receptacles in Family Rooms allow someone to use a pump.

### No Diaper Changing Area

- Provide fold-down table in accessible stall when there is no other space available.

### Diaper Changing Area Always Dirty

- A flat counter with no depression and no straps keeps clean the easiest.

### High Water Consumption

- Installed low-flow fixtures
- Tried waterless urinals but they did not work well in this application.

#### Inadequate exhaust

- Provide centralized air fresheners. “A clean restroom shouldn’t smell.”

#### Poor Lighting

- Prefer indirect lighting, use downlights that provide punch. If lighting is too dim - the room doesn’t feel clean.

#### Handling Emergencies

- A device in the Family Rooms turns on a light outside the room and sends an alert with the room number to the facility monitoring station when someone is in distress

#### Inefficient Cleaning

- Restrooms always take priority over other spaces when cleaning is required
- Cleaners tend not to take pride in their work when finishes are dated and worn
- Used overhead-braced stall partitions for easy cleaning underneath. Pilasters at every third stall keep partitions from racking.
- Try to make restroom with ability to close half for cleaning or repairs. If there’s only one restroom, you lose all the fixtures for a gender in that location
- Large format tiles that resist cracking are preferred
- Floor color is medium gray to mask dirt
- Avoid getting water behind mirrors

#### Sustainability

- A reclaimed water system is not available yet, but new restroom renovations include purple piping for future use.

### **Evaluation**

To monitor the facilities, including the restrooms, each of the nine terminals has a quarterly “Terminal Walk” made up of one person from each department. The conditions are evaluated and documented using checklists, photos, and written comments. Positives and negatives have been observed in the most recent restrooms include:

- The mirrors in some of the new locations provide a reflected sightline into the restroom.
- Touch screens will be used in future renovations to collect passenger comments.
- Don’t like to have “Employees Must Wash Hands” in public restrooms. It sends a bad message about the airport workers.
- Concerns about how uric acid affects epoxy. Degrades epoxy grout over time and retains smell. What happens to an epoxy terrazzo floor? Provide a zinc strip 2-0” out from wall at urinals to aid future floor replacement.
- The current color scheme is too dark. The dark counters and floor show water spots and light dirt.
- Choose flooring color to match color of dust (will be different in various parts of the country) – hides the dirt. At LAX it is dark gray.
- Looking at trough-sinks for next renovation in Terminal 5 to avoid counters with standing water.
- Looking at different ways to prevent splashing from urinals
- Receptacles in accessible stalls would be useful for various medical devices, etc.

***Los Angeles International Airport (LAX)***



**Entrances to New Tom Bradley International Terminal Restrooms (Image from LAX)**



**Sink Area in New Tom Bradley International Terminal Restroom (Image from LAX)**



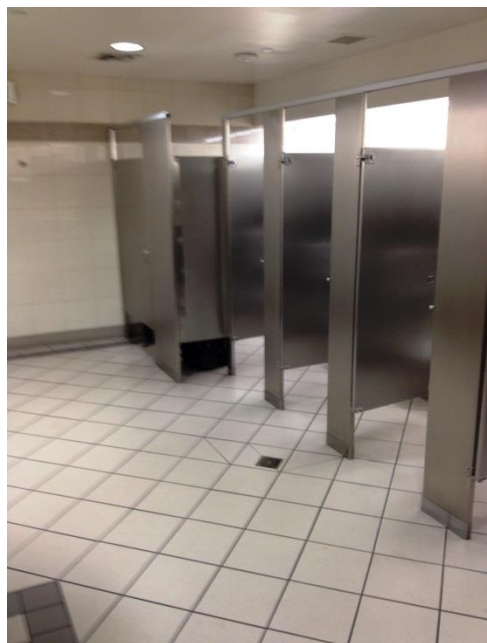
## ***Los Angeles International Airport (LAX)***



**Terminal 1 Restroom Entrances with Overhead and ADA Signs, Drinking Fountains Between**



**Sink Areas**



**Stalls with Accessible Stall at Fare End**

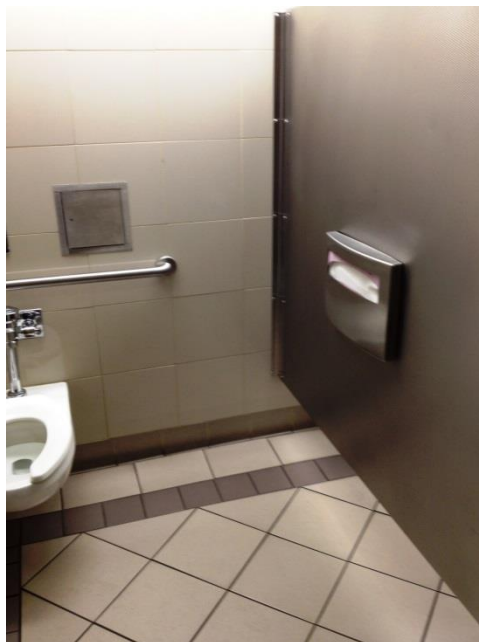


**Urinal Area**

***Los Angeles International Airport (LAX)***



**Accessible Stall**



**Accessible Stall**

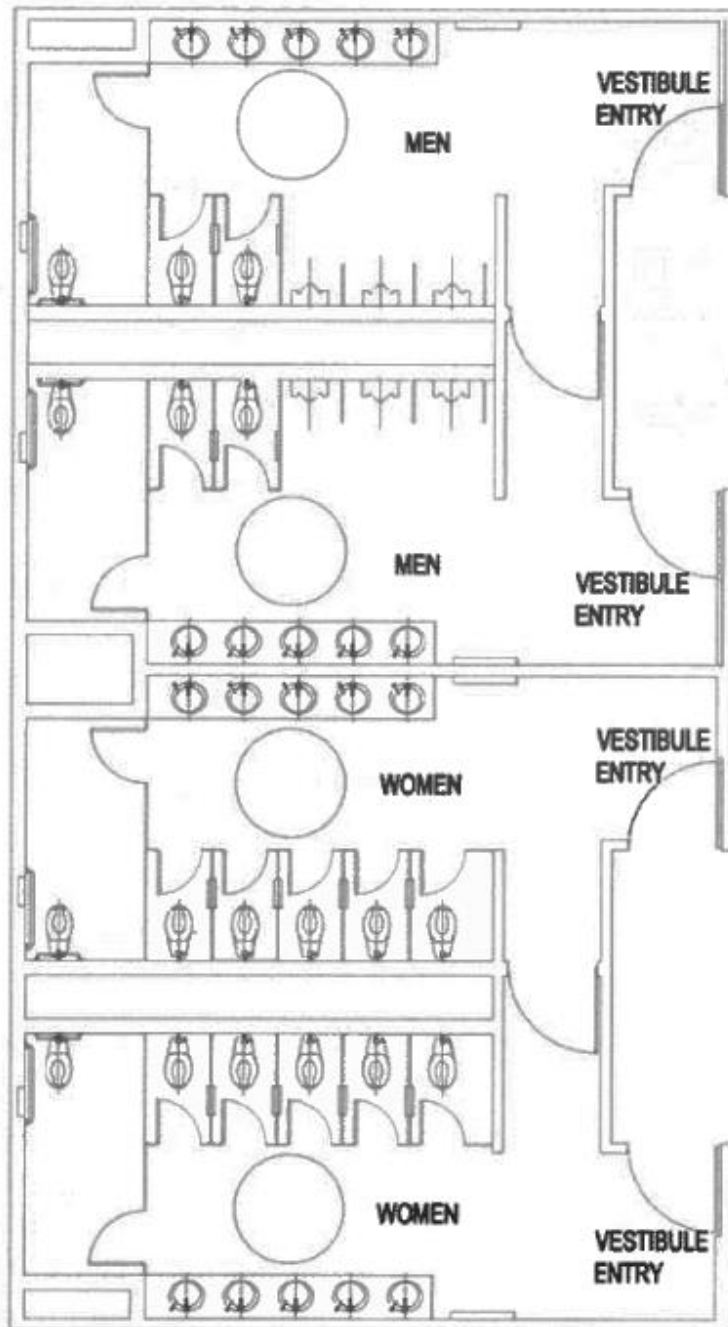


**Typical Stall**



**Hand Dryer for Travelers Who Prefer Them**

***Los Angeles International Airport (LAX)***



**“Optimal” Floor Plan from LAWA Design and Construction Handbook. The Door between the Entrance and the Pipe Chase Allows One Half of the Restroom to be Shut Down for Cleaning or Repairs. When more space is available, put sinks in the middle with space to walk around them on both sides.**

## **RESTROOMS, DESIGN INTENT**

The following recommendations shall serve as minimum standards and in no way are intended to limit the Design Professional's creativity or their success in meeting the objectives.

1. Restroom shall have a minimum of 15 air changes per hour. Separate single use Family Restrooms shall be provided in new construction and where space is available for renovation projects.
2. All Public Restrooms to be equipped with a diaper changing station.
3. Diaper changing station to be fixed-type, constructed of stainless steel at all new restrooms, and where possible in remodel projects. "Fold down" type will be acceptable in space confined stalls.
4. Lighting should be ample but comfortable. There should be no areas that appear dark and unlit. Special lighting may be required at baby change stations, entry vestibules, and in front of mirrors.
5. Unless otherwise required by Code or unique space constraints exist, doors shall not be used to enter restrooms. Vestibules shall have 48" wide minimum clear openings that are arranged to allow free-flow traffic without sightlines into the restrooms.
6. Wall Finish assembly should be full height ceramic tile or stone – glass mosaic or other approved accent finish may be used
7. Where feasible, metal studs should be set on a raised 6" concrete curb
8. Stainless Steel (306, No 6 Finish) corner guards shall be used at all outside corner walls at a minimum of 42" AFFL. Corner guard shall be installed above the base tile.
9. Ceiling heights shall be 9'-0" minimum, except in stall compartment area where the soffit should be 8'-0".
10. Porous ceiling materials are not acceptable. Ceiling shall be cement plaster or water-resistant drywall. All ceilings to be painted.
11. Access for water shut-off valves, temperature control valves, electrical transformers, etc. shall be located near a ceiling access panel to the extent possible.
12. All doors, frames and hardware shall be in compliance with the door and lock specifications provided in Section 08 00 00 of the Guide Specifications (Design & Construction Handbook).
13. Provide ADA and LAFD approved Emergency Strobe Lights and Speakers as required.
14. New restroom designs shall incorporate a pipe chase with a 30" minimum door.

### ***LAX Restroom Scope Guidelines***



## Los Angeles International Airport (LAX)

Terminal 3 Walk 7.25.13			
***PLEASE REFER TO THE ATTACHED PHOTO FILE***			
MEP: Mechanical, Electrical & Plumbing		Date last completed Thursday, July 25, 2013	
Responsibilities/Maintenance/Preventive Maintenance	Disruption to Airport Ops: Use Disruption Matrix	Comments	Date W/R Open Closed
<b>Mechanical: LAWA FMG/CUP/OPS</b>			
HVAC: Heating, Ventilation, Air Conditioning	0	No reportable issues reported or observed.	
Chillers	0	No reportable issues reported or observed.	
Air Handlers	2	See photo file page 9, Work request SZ0378.	8/5/2013
Pump Room (s):	0	No reportable issues reported or observed.	
High Temperature Hot Water System	0	No reportable issues reported or observed.	
<b>Electrical: LAWA FMG/CUP</b>			
Heating and cooling systems	0	No reportable issues reported or observed.	
Wiring, electrical cords, and plugs	0	No reportable issues reported or observed.	
Smoke detector and alarms	0	No reportable issues reported or observed.	
Communications	0	No reportable issues reported or observed.	
Controls	0	No reportable issues reported or observed.	
Low Voltage Systems	0	No reportable issues reported or observed.	
Circuit breakers	0	No reportable issues reported or observed.	
GFI outlets	0	No reportable issues reported or observed.	
<b>Plumbing: LAWA FMG/CUP</b>			
Drinking water fountains	0	No reportable issues reported or observed.	
Drains	0	No reportable issues reported or observed.	
Domestic Water	0	No reportable issues reported or observed.	
Fire Water	0	No reportable issues reported or observed.	
Low Voltage Systems	0	No reportable issues reported or observed.	
Pipes	0	No reportable issues reported or observed.	
Toilets	0	No reportable issues reported or observed.	
Plumbing shut-off valves	0	No reportable issues reported or observed.	
Water heater	0	No reportable issues reported or observed.	

Sample of LAX OPS Walk Report (page 1 of 3)

# Los Angeles International Airport (LAX)

Public Areas: LAWA FMG/OPS/LEASEHOLDER/TENANT/CPPG/CGD				
Check area for cleanliness, lighting, stanchions, Way Finding signage, FLS issue (tripping hazards, exposed or protruding fixtures, anything that exposes LAWA Risk.	0	See photo file pages 1, 2, 3. Work Request S20363.	8/5/2013	
Check all signage to include way finding inside and outside the terminal. Ensure LAWA standards are being adhered to to ensure uniformity.	0	See photo file pages 4, 10, 13.		
Check for stability and leaks on a scheduled preventive maintenance schedule. Ensure lighting is maintained. Ensure ventilation is properly maintained in order to alleviate uncomfortable smell.	0	No reportable issues reported or observed.		
Ensure concessions leasehold areas are free of public hazards. Ensure leasehold are properly maintained in appearance and cleanliness.	0	See photo file page 11.		
Check area for cleanliness, lighting, stanchions, Way Finding signage, FLS issues (tripping hazards, exposed or protruding fixtures, anything that exposes LAWA Risk.	N/A			
Check area for cleanliness, lighting, stanchions, Way Finding signage, FLS issues (tripping hazards, exposed or protruding fixtures, anything that exposes LAWA Risk.	0	See photo file page 6, 12.		
Test for proper operation on a scheduled preventive maintenance schedule. Inspect systems controls to ensure public safety issues are mitigated. Ensure proper labeling of all conveyance system providing unit ID and safety decals.	0	See photo file page 2.		
Ensure leasehold areas are free of public hazards. Ensure leasehold are properly maintained in appearance and cleanliness. Inspect conveyance system (s) to ensure they remain fully operational at all times by ensuring a scheduled preventive maintenance schedule.	0	No reportable issues reported or observed.		
Check for cleanliness in all areas including stairwells and conveyance systems. Ensure public hazards are mitigated.	0	No reportable issues reported or observed.		
Check for possible public hazards, ensure FLS capabilities are not compromised and are fully operational. Ensure Way Finding signage is accurate and provides adequate way finding for the traveling public.	N/A			
Check area for cleanliness, lighting, stanchions, Way Finding signage, FLS issue (tripping hazards, exposed or protruding fixtures, anything that exposes LAWA Risk. As part of Quality Assurance check that leaseholder signage complies with LAWA CPPG standards.	0	See photo file pages 9, 10, 11, 12.		
Check area for cleanliness, lighting, stanchions, Way Finding signage, FLS issue (tripping hazards, exposed or protruding fixtures, anything that exposes LAWA Risk. Check baggage claim carousels for cleanliness and operational status.	0	See photo file pages 13, 14. Work Request S20473.	8/5/2013	
Check seating for appearance, cleanliness, wear and tear and for possible public safety concerns that expose LAWA Risk.	0	No reportable issues reported or observed.		
Clean and monitor window seals for deterioration on a scheduled preventive maintenance schedule. Check to see if weep holes are open. Clean out dirt and dust. Lubricate rollers and latches. Check caulking around windows and doors. Check window and door sealers. Adjust or replace if necessary.	0	See photo file pages 2, 9, 10. Work Request S20380 & S20470.	8/5/2013	
Check for deteriorating or damaged fixtures on a scheduled preventive maintenance schedule. Check inventory supply to ensure appearance is maintained.	0	No reportable issues reported or observed.		
Check for deteriorating bricks and mortar. Check siding for damage or rot. Check painted surfaces for flaking.	0	See photo file pages 6, 12. Work Request S20365, S20370, S20377, S20471 & S20472.	8/5/2013	
Check for deteriorating or damaged ceiling tiles. Check inventory supply to ensure appearance is maintained.	2	See photo file pages 1, 2, 5. Work Request S20366, S20368 & S20369.	8/5/2013	
Check for burned out bulbs, damaged fixtures or exposed wiring that could present a public hazard.	0	No reportable issues reported or observed.		
Check for cleanliness, public hazards, and deterioration in all areas including stairwells. Ensure public hazards are immediately mitigated via LAWA FMG.	0	See photo file pages 4, 8.		

Sample of LAX OPS Walk Report (page 2 of 3)



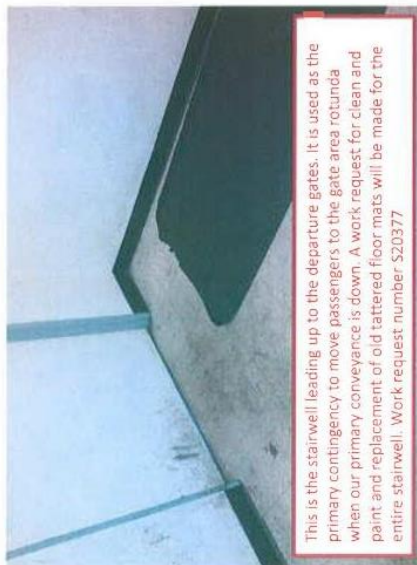
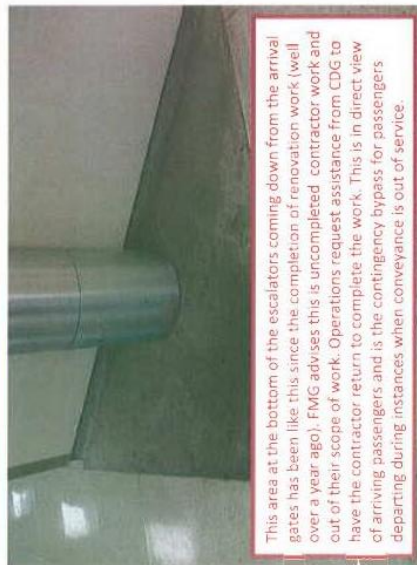
## Los Angeles International Airport (LAX)

Exterior Public			
Signage/Way Finding: LAWA CPPG/OPS	Check all signage to include way finding outside the terminal. As part of Quality Assurance ensure LAWA standards are being adhered to to ensure uniformity. Review and update any outdated sign ensuring correct information is displayed.	0	No reportable issues reported or observed.
Construction Impact: LAWA ADG/OPS/FMG/CPGG	Check for possible public hazards, ensure FLS capabilities are not compromised and are fully operational. Ensure Way Finding signage is accurate and provides adequate way finding for the traveling public.	N/A	
Foundation: LAWA FMG/STREET SERVICE/GENERAL SERVICES/OPS	Inspect visible areas, vents, and ducts for cracks, leaks, or blockages.	0	No reportable issues reported or observed.
Landscaping: LAWA FMG/LANDSCAPING/OPS	Check for proper drainage. Inspect areas for cleanliness and appearance.	0	No reportable issues reported or observed.
Concrete and asphalt: LAWA FMG/STREET SERVICE/GENERAL SERVICES/OPS	Clean oil and grease on a scheduled preventive maintenance schedule. Ensure public hazards are immediately mitigated via LAWA FMG and Airport Police Traffic Services Division.	0	No reportable issues reported or observed.
Exterior Non-Public			
Roof	Check for leaks. Check for damaged or loose articles that may threaten public safety. Check vents and louvers for birds, nests, squirrels, and insects. Check flashing around roof stacks, vents, and skylights for leaks.	0	No reportable issues reported or observed.
Gutters and downspouts	Clean and check for leaks, misalignment, or damage.	0	No reportable issues reported or observed.
Exterior walls	Check for deteriorating bricks and mortar. Check siding for damage or rot.	0	No reportable issues reported or observed.
Windows	Check painted surfaces for flaking.	0	No reportable issues reported or observed.
Landscaping	Clean and monitor window seals for deterioration on a scheduled preventive maintenance schedule.	0	No reportable issues reported or observed.
Concrete and asphalt	Check for appearance and cleanliness.	0	No reportable issues reported or observed.
	Check for cracks or deterioration. Reseal or repair if necessary.	0	No reportable issues reported or observed.
Terminal Fact Sheet			
<div style="display: flex; justify-content: space-between;"> <div> Leaseholder: LAWA  4.1 Million Annual Passengers: 363K Domestic, 3.617K International  327,520 Sq. Ft.  Major Airlines:  Jet Blue (B6) Virgin America (VX) Virgin Australia (VA) Spirit Airlines (NK)  Allegiant Airlines (G4) Frontier (F9) </div> <div style="text-align: right;"> 2013 Terminal 3 Fact Sheet </div> </div>			
Disruption Matrix			
<div style="display: flex; justify-content: space-between;"> <div> <b>N/A:</b>  <b>Not applicable</b> </div> <div> <b>Disruption to Airport Operations</b> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div> <b>0:</b> No Impact - Normal Operations </div> <div> <b>1:</b> Low - Medium Impact with Reasonable Contingency </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div> <b>2:</b> High Impact with Contingency </div> <div> <b>3:</b> Significant Impact with Unacceptable Contingency </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div> <b>4:</b> Significant Impact with NO CONTINGENCY </div> </div>			

**Sample of LAX OPS Walk Report (page 3 of 3)**

## Los Angeles International Airport (LAX)

### Terminal 3 Stairwell Leading up to Gate Concourse Level From Long Sterile Corridor



7/25/2013

8

**Sample of LAX Building Condition Photos)**



## ***Los Angeles International Airport (LAX)***

### **Participants**

#### Airport

Ellen Wright – Director, Airport Terminal Planning

Mike Doucette – Chief of Airport Planning

Manuel Cheng – Assistant Director, Maintenance/FMG

Victor Rocha – Superintendent, Maintenance/FMG

#### Moderators

Rose Agnew – Aviation Innovation

Jens Rothausen-Vange – Architectural Alliance International

## ***Minneapolis-St. Paul International Airport (MSP)***

### ***“Prototypes”***

#### **Overview**

Hub Type: Large Hub

Hours of Operation: 24/7

Designed Life: 50 years

Annual Enplanements: 15,512,487

Airport Size: 3,331,700 square feet

Number of Gates: 124

Number of Restrooms:     78 Women’s  
                                     73 Men’s  
                                     32 Family

Case Study Project: New Concourse E and F Prototype Restrooms opened in January 2013

Date of Case Study: October 3, 2013

#### **Background**

The original 1958 terminal at Minneapolis-St. Paul International Airport has been expanded several times adding five concourses to the original terminal as well as a second terminal connected by light rail. With the additions have come renovations to keep the airport among the top-rated airports in terms of customer service. The effect on the restrooms is a legacy of spaces with identifiable vintage, the originals now surpassing five decades in age.

With the added complexities to traveling by air after 9/11, customer service became an industry hot-button. In response, the airport shifted from an operational focus to that of the customer. A participant in the ASQ Benchmarking Survey, MSP developed a new vision statement, “To give our customers the best airport experience in North America.” The Metropolitan Airports Commission (MAC) decided to go a step beyond a facelift in 2010 and endeavored to completely rethink the modern airport restroom. For a year, a group made up of managers, representatives from all the airport trades, vendors, and the design team met weekly to evaluate each of the 100 sets of public restrooms and dissect every aspect of the facilities. The major airlines also provided comments as they are equally interested in providing good service.

The end result was the development of a prototype restroom set, with one set constructed on two concourses in 2012 as a test. Since that time, additional sets are being developed for lactation rooms, service pet relief areas, less public restrooms, and fine-tuning the prototype for the next sets. The MAC plans to renovate all of the public restrooms over the next twenty years.

#### **Problems/Solutions**

Noting that the original restrooms remain in essentially their original state, the MAC realized that they needed to construct restrooms with a fifty-year life span. While fixtures and technologies will change, the bones needed to be durable, easy to maintain, and timeless. To this end, part of the planning effort is to place restroom sets in the “right” location inferred from providing IATA Level of Service A. This will occasionally incur the costs of relocating tenants, but the MAC’s feeling as that the payoff in long-term customer service is worth the effort.

Problems that have been addressed include the following:

##### Long Lines at Women’s

- Provided two times the fixtures for women compared to men

## ***Minneapolis-St. Paul International Airport (MSP)***

### Security Issues

- Pipe chases are sized so that tool carts can be brought inside them so tools aren't exposed to passengers who might take them. Otherwise, an additional staff person is needed to watch over the cart.

### Accessibility Issues

- Providing ADA minimums not enough for different needs. Engaged individuals representing various disabilities to determine needs.

### Dated Materials/Design

- Created a modern/timeless aesthetic with a focus on durability and cleanability. Art is used to provide focal points. Tried to balance between the durability of a bus terminal restroom and the elegance of a club lounge.

### Water on Floors between Sinks and Paper Towels

- Installed hand dryer and paper towel dispensers at sinks directly above trash openings

### Overflowing Trash

- Provide large capacity trash cans that are emptied in pipe chase where chase is available.

### Graffiti

- Restrooms on non-secure side more prone to graffiti, loitering, needle disposals broken into, vandalism, etc. Future prototypes will be developed for these locations that will address these issues

### Small Toilet Stalls

- Enlarged the standard stalls to 3' wide by 6'-0" deep. Typical stalls are all set up as ambulatory stalls.

### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, flushometers
- Eliminated entry doors

### Paper Waste

- Use large roll paper towels
- Use toilet paper on coreless rolls

### Wayfinding Ineffective

- There are too many signs competing for attention in already cramped concourse. Blade signs were removed and the restroom façade became the sign.
- Large, inset quartz super-graphics signify the restroom's gender.
- Backlit ADA signs include a monitor indicating the nearest restroom when the restroom is closed for service. This action is activated when staff swipes their card at the reader hidden behind the sign glass. This activation also doubles the exhaust to pull out cleaning chemical fumes.

### No Restroom for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- Provide a Family Room with each restroom set with a privacy wall between toilet and sink area

### No Pet Relief Area on Secure Side

- First airport to provide indoor pet relief area. Formalizing a program for entire airport.

## ***Minneapolis-St. Paul International Airport (MSP)***

### No Diaper Changing

- Built-in changing table with adjacent sink and hand drying. Shelf along wall like by sinks for belongings.

### High Water Consumption

- Followed EPA “Water Sense”
- Installed low-flow fixtures
- Looked at waterless urinals but had concerns about odors

### Clogged Drains

- Design drainage path so that toilets flow toward urinals and then flow to sinks to provide as much water pressure as possible to clear out drain pipes

### Inadequate exhaust

- Supply air low under sinks where possible to dry wet floor and exhaust high above toilets

### Poor Lighting

- Provided daylighting where possible
- Provided task lighting over stalls
- Provided vertical lights integrated in mirrors
- Bright surfaces use light more efficiently

### Sustainability

- While not pursuing LEED certification, as many criteria as are practical were pursued

### Inefficient Cleaning

- Seamless epoxy terrazzo floor
- Large-format 52” x 108” quartz wall panels with sealed butt joints
- Thermal motion detectors are connected to the facilities monitoring system and notify the cleaners when a threshold of passengers has visited a restroom so a cleaner can be dispatched.

### Product Stocking

- The toilet paper dispenser has two rolls available for use
- Foam soap is plumbed from large storage tanks in pipe chase
- Large storage area between restrooms

A unique opportunity on these prototypes was the creation of new products or modifications to existing ones to suit the passenger needs. These included:

- A two-person trough sink, new to the market, that was modified to be 4” shallower from front to back to enhance reach to the faucets and the rear shelf and had an additional drain added so that a clogged drain wouldn’t take out both locations. A single-person version was also developed that included an overflow. The basin was also modified to accommodate a small plunger.
- A combination unit for the toilet stalls that met ADA requirements was created that combined a double-roll toilet paper with a hinged waste receptacle sized to hold an adult diaper.
- A biohazard disposal was created to house the unsightly red plastic disposal in a recessed stainless steel enclosure that matched the other accessories.

- A stainless steel patten/texture was developed that was more effective at eliminating finger=prints scratches.
- LED clerestory light boxes were developed to compliment the lighted mirrors and to provide a more inviting ambient light.

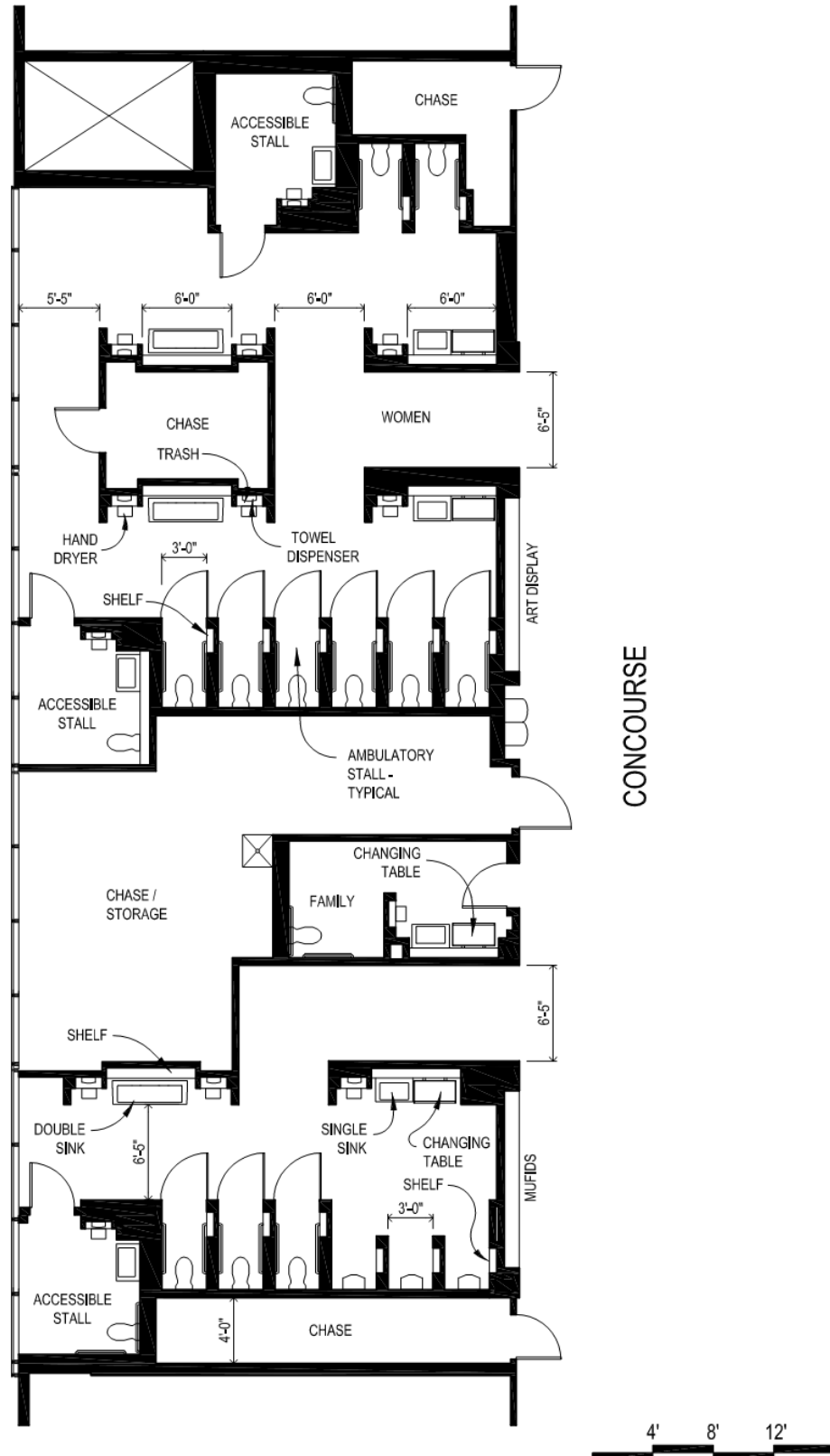
## **Evaluation**

In the spirit of the design process, all the trades, vendors, and design team members were invited to evaluate how the prototypes are performing. Passenger comments via texting (a number is posted in each restroom) also contribute feedback.

- The toilets with the blow-out feature proved to be very noisy, startling users and are a distraction to people out in the concourse. Different models are being looked at for future restrooms.
- The hand dryers are quite noisy and make an awkward arrangement with the paper towels and trash. Negative passenger feedback has led the MAC to consider eliminating hand dryers from future restrooms.
- While the restrooms are distinctive within the concourses, they are still hard to see from a distance. A new waiting area that architecturally spans the concourse will be added to create a stronger identifier. This will also include space for vending so that each restroom set becomes an amenity node.
- Some of the new features, like bottle fillers and active signage can now be incorporated into existing restrooms so there's an immediate benefit until those restrooms are renovated.
- Custom jambs and modified hinges and latches were created for the stall doors to prevent sight lines between the door and partition and to be self-closing to a few inches from completely closed so you can see if the stall is occupied. These proved to not be durable enough because the stall doors, a prototype product and finish, ended up being manufactured with an MDF instead of aluminum core, making them quite heavy. All the hinges and latches had to be replaced after only a few months. A simpler jamb detail with standard door hinges and latches are planned for the next round of restrooms.
- The large trash cans in the pipe chases are heavy and unwieldy. Handles and a sliding shelf will be added to make emptying the trash easier.
- The ADA requirement to have the toilet paper low created a difficulty in replacing toilet paper rolls because the dispenser is low to the floor, making it awkward to get the rolls inside.

The case study group concurred that they are not competing with other airports, but rather with their own facility to keep improving the spaces and thus the travelers' experience.

# **Minneapolis-St. Paul International Airport (MSP)**



## ***Minneapolis-St. Paul International Airport (MSP)***



**Entrance with Mosaic Tile Art Wall and Adjacent MUFIDS**



**Lavatory Block**



**Illuminated Room Signage on Right with Information Monitor**



**Typical Aisle with Double-lavatory Stations on Left and Stalls on Right**



***Minneapolis-St. Paul International Airport (MSP)***



**Lavatory Area**



**Changing Table Area**

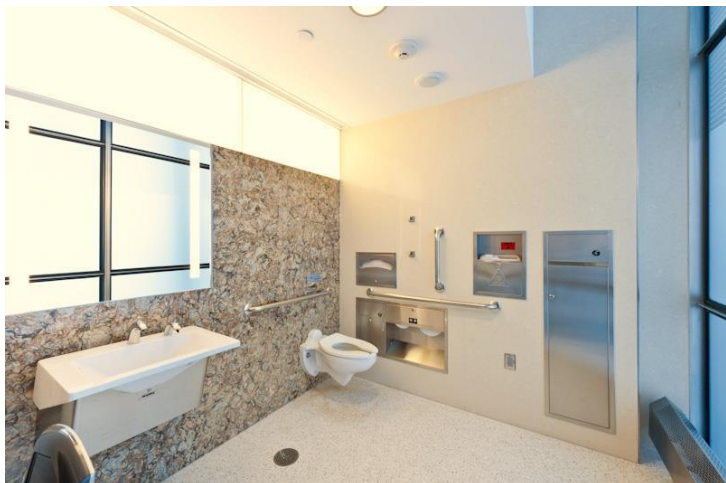


**Typical Stall with Thickened Walls and Shelf/Alcoves for Belongings**



**Urinals with Thickened Walls Similar to Stalls**

## ***Minneapolis-St. Paul International Airport (MSP)***



**Accessible “Stall” is a private room with Translucent Daylighting on Right**



**Drinking Fountains with Bottle Filler**

## ***Minneapolis-St. Paul International Airport (MSP)***

### **Participants**

#### Airport

Phil Burke – Operations, MAC

Alan Howell – Senior Airport Architect, MAC

Tim Fox – Plumbing, MAC

Steve Gentry – Customer Experience and Operations Analyst, MAC

Shannon Gale – Assistant Manager, Facilities, MAC

Denise Faulke – Account Manager, ABM

#### Moderators

Rose Agnew – Aviation Innovation

Jens Rothausen-Vange – Architectural Alliance International

# ***MEDIUM HUB CASE STUDIES***

Sacramento International Airport (SMF)  
John Wayne Airport (SNA)

## ***“Balance Aesthetics with Maintenance”***

### **Overview**

Hub Type: Medium Hub

Hours of Operation: 4:30 a.m. – 1:00 a.m.

Designed Life: 10 years

Annual Enplanements: 4,424,279

Airport Size: 670,000 square feet

Number of Gates: 32

Number of Restrooms:   11 Women’s  
                                  11 Men’s  
                                  11 Family

Case Study Project: New Terminal B opened in October, 2011

Date of Case Study: September 27, 2013

### **Background**

The Sacramento Metropolitan Airport opened in 1967. Continual growth that surpassed expectations and the addition of Southwest Airlines, Alaska Airlines, Horizon Air, and TWA precipitated the construction of Terminal A in 1998. Shortly after, Terminal A opened, at which point the facility became Sacramento International Airport. The ageing Terminal B was replaced in 2011 by a new terminal three times as large. The airport participates in the ASQ customer service survey process.

### **Problems/Solutions**

One of the biggest issues in the original terminals was the marble partitions and doors. The heavy doors frequently cause the stall door hardware to fail incurring significant maintenance costs. In addition, the marble is from Italy so not only is it costly to transport pieces to California, there is a long lead time. One of the sustainable strategies used in the design of the LEED Silver terminal was to use locally sourced materials. The new restrooms have large readily available format tiles and use lighter stainless steel stall partitions and doors. A “strike team” of cleaners hit restrooms after surges.

One of the challenges for the airport staff was getting the design team to balance their architectural ideas with the needs of the maintenance staff. While the representatives from the airport trades and airlines participated in the process, not all recommendations were incorporated into the design.

Learning from previous renovations, the restrooms in the terminal addressed the following issues:

#### Small Toilet Stalls

- The typical stall size was increased for easier maneuvering and to have space for carry-ons
- A shelf behind the toilet and urinals provides a place to place belongings
- Hooks in stalls are heavy duty to support heavy bags

#### Graffiti

- Installed graffiti film on mirrors that can be peeled off when marked

#### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, flushometers
- Eliminated entry doors

## ***Sacramento International Airport (SMF)***

### Paper Waste

- Change from C-fold to large rolls saves custodial time
- Paper towels are sometimes used to cover toilet seats, which can clog the toilet drains
- The airport chose not to use hand dryers

### No Restroom for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- Provide a Family Room with each restroom set
- An outlet is provided in each Family Room for lactation pumps.

### No Diaper Changing

- Both built-in and fold down types were used depending on the space available

### High Water Consumption

- Provided low flow fixtures

### Inadequate exhaust

- Each restroom has a dedicated exhaust system in Terminal A.

### Poor Lighting

- Provided task lighting over stalls and sinks
- Motion detectors are used in some of the new restrooms
- Restrooms are on emergency power

### Awkward Maintenance Access

- The access panels under the sink counters were originally constructed of stainless steel on MDF boards. Each panel weighed 75 pounds and hung on two hooks making it very difficult for staff to get access. Terminal B used lightweight plastic panels with a finish that blends with the surrounding materials.

## **Evaluation**

The following positives and negatives have been observed that either remain or have developed as a result of new initiatives:

- Ideally, you would configure the restroom layouts so that a portion can be shut down for cleaning and maintenance at a time rather than the entire restroom.
- Expensive materials and equipment are not necessarily better. There should be a balance between reliable and affordable.
- Plumbing maintenance is best located in chase so that restroom availability isn't interrupted.
- Access to plumbing chases is often within the restrooms, which creates a problem when staff of the opposite gender needs to work in the chase. Access should ideally be from the concourse.
- The current chases are too narrow to effectively work inside.
- The urinals did not come with permanent strainer so they frequently clogged from paper, gum, etc. that is tossed in. Disposable splashguards have helped.
- Because low flow fixtures use less water, it is easier for waste to get hung-up in the pipes. The plumbers found that the interior surfaces of old cast iron pipes below grade create a lot of friction compared to smoother PVC. The lower flow would also work better with the pipes sloped steeper.

### ***Sacramento International Airport (SMF)***

- The curved bases integral in the epoxy terrazzo flooring has had a learning curve for the cleaners since they have to be cleaned by hand – the cleaning equipment only work with right-angle floor/wall transitions.
- “Don’t use Black Counters” – it shows water on counters. A water softener system is being tried at terminal A to reduce water stains. Dark floors have the same problem.
- The trap primers are located in a bad spot in the drainage system so it’s difficult to manage smells.
- The designers tried to make a simple wayfinding system that was intuitive; however, it is difficult to find another restroom if one is shut down.
- Some light fixture locations are difficult to access for lamp replacement
- LED lamps are being considered for future use
- A toggle switch to request maintenance in each restroom would be useful. QR codes are being considered for passengers to communicate comments
- Stainless steel is difficult to keep clean



# **Sacramento International Airport (SMF)**



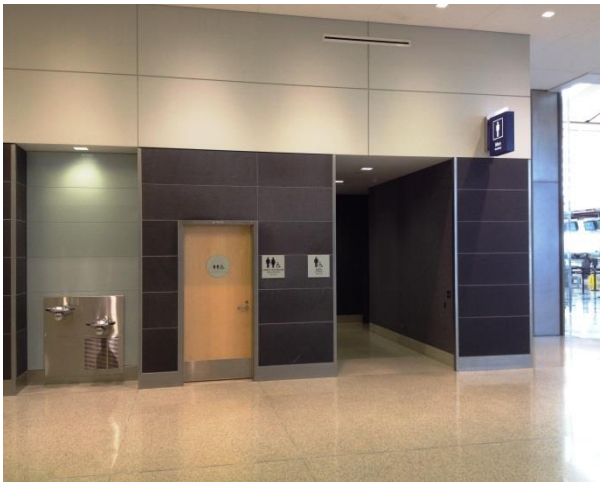
## ***Sacramento International Airport (SMF)***



**Overhead Wayfinding Sign**



**Acoustic Wall Carpet and Changing Table in Entry**



**Drinking Fountains, Family Room, and Men's**



**Sink Area with Changing Table Beyond**

**Sacramento International Airport (SMF)**



**Stainless Steel Stalls**



**Urinals with Shelf Above**



**Family Room**



**Family Room**

## ***Sacramento International Airport (SMF)***

### **Participants**

#### Airport

Carl Mosher – Deputy Director, Facilities and Infrastructure

Lisa Stanton – Airport Chief Operating Officer

Chris Martin – Airport Manager, Facilities

Greg Nowakowski – Airport District manager, DGS

Brian McKenzie – Trades Coordinator, DGS

#### Moderators

Rose Agnew – Aviation Innovation

Jens Rothausen-Vange – Architectural Alliance International

## ***John Wayne Airport (SNA)***

### ***“Passengers Should Not Be Aware of Terminal Support Systems”***

#### **Overview**

Hub Type: Medium Hub

Hours of Operation: 7:00 a.m. – 11:00 p.m.

Designed Life: NA

Annual Enplanements: 4,278,623

Airport Size: 730,505 square feet

Number of Gates: 20 bridged, 6 ground-level-loaded

Number of Restrooms: 12 Women’s

12 Men’s

6 Family

2 Pet Relief Areas (landside)

Case Study Project: New Terminal C opened in November, 2011

Date of Case Study: September 26, 2013

#### **Background**

The John Wayne Airport in Orange County, California is an Origin & Destination (O & D) airport (approximately 5% of passengers transfer) that is used heavily by tourists visiting nearby destinations such as Disneyland and Newport Beach. There is also a significant business-based travel demand. In 2008, a multi-year program to renovate the existing 20-year-old restrooms was begun. All but two sets have been completed. Terminal C was completed in 2011, adding six bridged gates bringing the total to 20. The new restrooms in Terminal C followed a refined version of the 2008 program incorporating lessons learned from the renovations. Despite its smaller physical size, John Wayne Airport has peaking conditions similar to major hub airports such as Chicago’s O’Hare International Airport.

Passenger comments are typically communicated via courtesy phone to John Wayne Airport’s Customer Relations staff. In addition, every two years since 1994 a survey by an independent third party is conducted of the passengers. The restrooms routinely get high marks (the 2011 survey gave the cleanliness of the restrooms an A, the same as in 2009). The airport’s philosophy is that the terminal support systems should never diminish the quality of the passenger-traveling experience. The airport has also decided not to have ads in the restrooms as that may increase dwell time and aesthetically add clutter.

#### **Problems/Solutions**

Two of the most important considerations for the restrooms are cleanliness and sufficient space to maneuver. The new terminal set a standard that the existing restrooms have followed as they are remodeled. The studs in the old restrooms were found to be severely rusted and so were gutted, new curbs were added to bring the structure off the potentially wet slab, and new walls were rebuilt on top. More durable and contemporary finishes that tied into the color palette and architectural vocabulary of the new concourse replaced the existing outdated 2” x 2” tiles enabling a brighter and more open feeling throughout. Restrooms on the landside are generally smaller since passengers tend to want to get through security quickly. The airport believes that being an O & D airport also minimizes graffiti problems.

The following issues found in the original restrooms as well from the recent renovations were addressed in the new expansion:

## ***John Wayne Airport (SNA)***

### Toilet Stall Sizes

- The length of the new stalls was increased to make space for people's carry-ons
- Code minimums are not enough – additional fixtures were provided where space allowed

### Fixtures and Surfaces

- Hands-free dispensers for soap and paper towels, faucets, flushometers
- Faucets and soap dispensers are located 45-degrees to each side of sink to make them easier to reach
- Eliminated entry doors

### Paper Waste

- Trash used to be located far from the paper towel dispenser, now it's integrated with the dispenser
- Single-ply toilet paper is provided in the public restrooms due to the volume of paper used. Two-ply is used in employee restrooms.
- Hand air dryers are not used

### Water Consumption

- Installed low-flow fixtures
- Tried waterless urinals but problems with odors occurred when following recommended maintenance

### Adequate Air Exhaust

- Proper ventilation is a priority
- Drains are cleaned frequently
- Deodorizers are avoided because some people are sensitive to fragrances

### Adequate Lighting

- Provided task lighting over stalls and sinks
- Lights are on 24/7
- Only lights are on emergency back-up. The airport has a co-generation plant so it is unlikely all power would fail completely.

### Restroom Way-Finding

- Blade signs are not intuitive, especially when competing with other signs. A linear concourse floor plan makes it easier to locate restrooms and other spaces because they are more visible as passengers approach.

### Restrooms for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- Provided a Family Restroom adjacent to primary restrooms, (space permitting)
- A fold down seat is located in each Family Restroom for family member or a companion

### Efficient Cleaning

- Wall-hung toilets are easiest to clean. If mounted properly, there shouldn't be a problem with fixtures working loose due to heavy use.

### Product Stocking

- The toilet paper dispenser provides two rolls
- Foam soap was replaced with liquid soap. Liquid soap has performed more satisfactorily.



## ***John Wayne Airport (SNA)***

All the restrooms are checked on by the cleaning staff every fifteen minutes and spot cleaned and restocked if needed. Airport managers have found that even if restrooms are dirty or out of paper, travelers are more forgiving if they see someone taking care of it.

### **Evaluation**

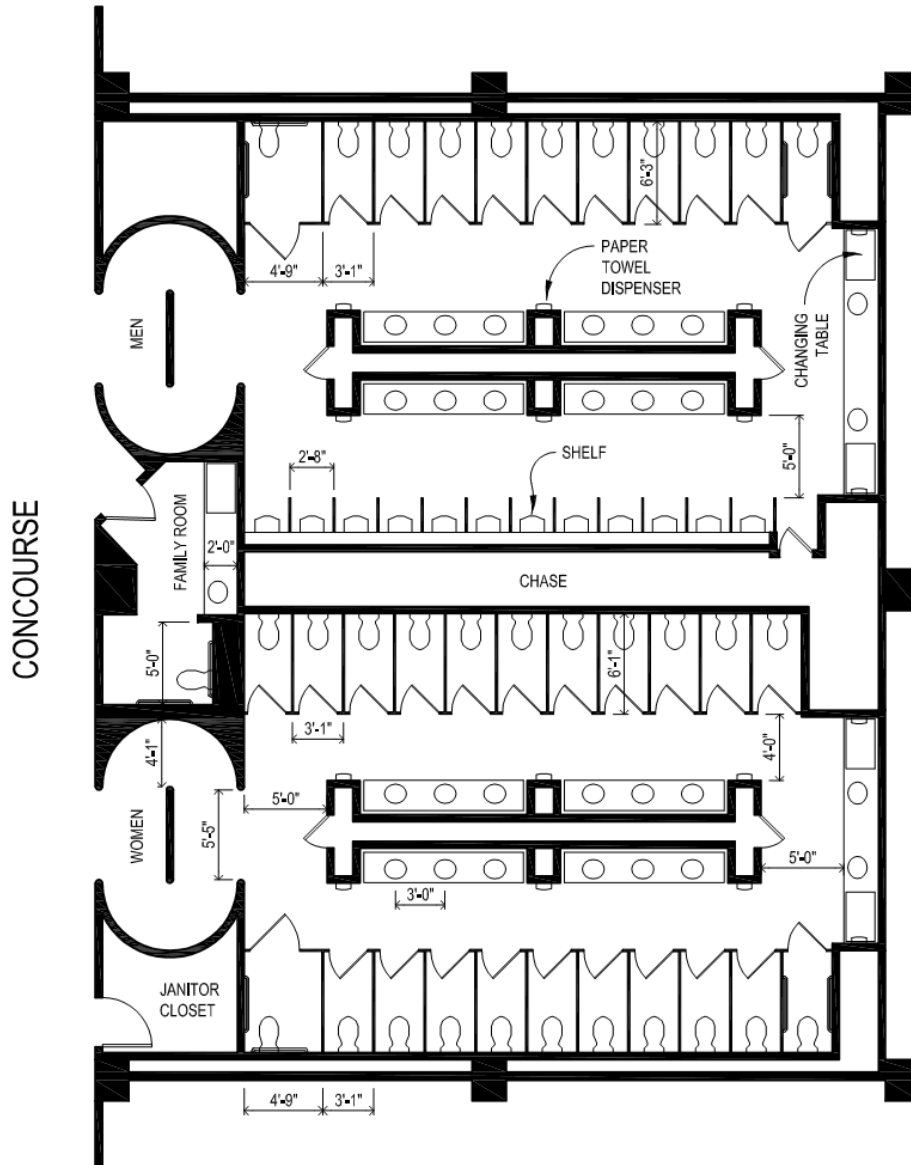
John Wayne Airport (JWA) Considers “Lessons Learned” with each restroom renovation. As new products are made available, they are incorporated as appropriate. The following points have been addressed as a result of JWA initiatives and will be considered in future restroom work:

- Counters have a gap in back at the wall to allow water to drain off. However, the water remains on the flat counters.
- The restroom set in the Customs area has a shared entry area for Men and Women. Because travelers are distracted and tired, they often walk into the wrong restroom. All future restrooms will likely have separate entries.
- JWA considered trough-style urinals but they are illegal in California
- The automatic flush valves are good for cleanliness but they do not save water because they may be activated several times during every use.
- Low-flow urinals don’t provide enough water to flush liquid waste through drain pipes.
- Existing pipe chases between sink banks are wasted space. They are not wide enough to work inside. It would be more efficient to eliminate the chase and do maintenance from the restroom side.
- The ambulatory stalls were located in a space sized for a fully accessible stall. This leaves an unusable space that might have accommodated cleaning carts had it been a little bigger.
- Hooks for coats and bags should be large enough to accommodate large bags or bags with wide straps.
- There are two pet relief areas on landside, but there are no options once through security. An airside pet relief area is planned.

An additional issue is the difficulty in maintaining standard hardware products, accessories, fixtures, etc. During construction, bidders may substitute hardware products and vendors may change out dispensers as new products become available. This can create a maintenance issue keeping track of locations for different models, maintaining attic stock, and ordering replacement parts.



# John Wayne Airport (SNA)



## ***John Wayne Airport (SNA)***



**Wayfinding Medallion Signs**



**Entrance to Men's – Note California  
Required Triangular Sign for Vision  
Impaired**



**Sink Area**



**Double Sink with Changing Table**

***John Wayne Airport (SNA)***



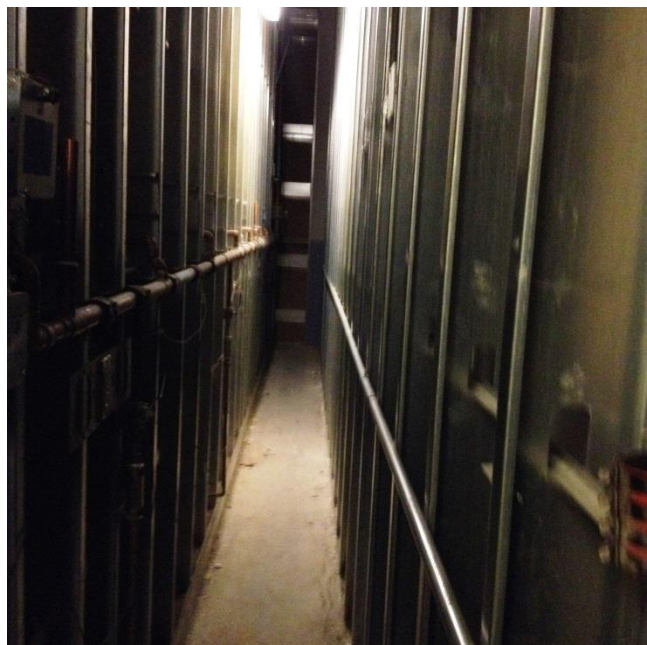
**Double-Loaded Aisle**



**Urinals with Shelf Above**



**Typical Stall on Older Restroom Set**



**New Pipe Chase with Studs on Concrete Curbs**



***John Wayne Airport (SNA)***



**Family Restroom Sign**



**Family Restroom with Changing Table / Sink**



**Fold Down Seat in Family Restroom**

## ***John Wayne Airport (SNA)***

### **Participants**

#### Airport Management

Gary Blankenship – Airport Architect

Ambi Thurai – Manager, Airport Engineering

Rick Cathey – Senior Project Manager

#### Airport Custodial

Mariella Lewis – Regional Airport Manager

Aleida Ponu – Customer Service Manager

#### Moderators

Rose Agnew – Aviation Innovation

Jens Rothausen-Vange – Architectural Alliance International

# ***SMALL HUB CASE STUDIES***

Long Beach Airport (LGB)  
Blue Grass Airport (LEX)

## **Long Beach Airport (LGB)**

### ***“Historic Terminal”***

#### **Overview**

Hub Type: Small Hub

Hours of Operation: 5:00 a.m. – 10:00 a.m.

Designed Life: 20 years

Annual Enplanements: 1,451,404

Airport Size: 77,850 square feet

Number of Gates: 11

Number of Restrooms: 4 Women’s

4 Men’s

2 Family

Case Study Project: New Concourse Restrooms opened in December, 2012

Date of Case Study: September 25, 2013

#### **Background**

The original terminal opened in 1941. The streamlined modern building is on a registered Cultural Historic Landmark so modernization has been minimal. The four original restrooms remain essentially unchanged, because renovation may require ADA compliance and that would reduce the fixture count, which is already inadequate. After years of housing passenger functions in trailers around the old terminal, including the restrooms, a new concourse was finished in late 2012 spurred by the arrival of Jet Blue in 2001.

The brightly day-lit modern facility is comprised of two separate hold room buildings connected by an outdoor plaza shaded by towering palm trees. This unusual configuration was the result of a sometimes contentious, ten-year planning process. The airport is land-locked with very restrictive noise ordinances so expansion was strictly limited. The restrooms were considered by the City to be part of the hold rooms, which squeezed the restroom sizes to allow larger gate lobbies. The planners split the building, which allowed them to increase the number of plumbing fixtures by using the building code minimum for each separate building.

A separate checkpoint building is located in the plaza area between the original terminal and the new concourse. The checkpoint building does not have restrooms, as passengers tend to flow through without lingering. The new concourse is Silver LEED, and an upcoming project to add photovoltaics should bring it a Gold certification.

#### **Problems/Solutions**

The biggest driver for the new restrooms followed those of the new concourse – to provide facilities that offer the quality experience travelers expect that trailers simply cannot provide and the historic terminal is not capable of delivering. The new restrooms receive consistently good feedback, which is monitored by available email and Twitter addresses. The biggest complaint was that baby changing tables had not been provided. This has since been remedied. Other issues the new restrooms addressed include:

##### Not Enough Fixtures

- The fixture count is based on building code requirements. Lines have not been observed.
- One set is provided in each new terminal building.



## ***Long Beach Airport (LGB)***

### No ADA Stalls

- The new terminals are fully accessible, replacing the trailers that had been provided before.

### Dated Materials and Colors in Original Terminal

- Provided a clean, simple appearance with durable, easy to maintain finishes and fixtures.

### Graffiti a Problem

- Use a peel off film that is graffiti resistant.

### Too Much Signage Clutter

- Tried to minimize need for signage by making concourse open and easy to see all areas.

### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, and flushometers – soap dispensers by vendor
- Eliminated entry doors

### Paper Waste

- Use large roll paper towels – dispensers provided by vendor

### No Restroom for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- A Family Room is provided at each new set.

### High Water Consumption

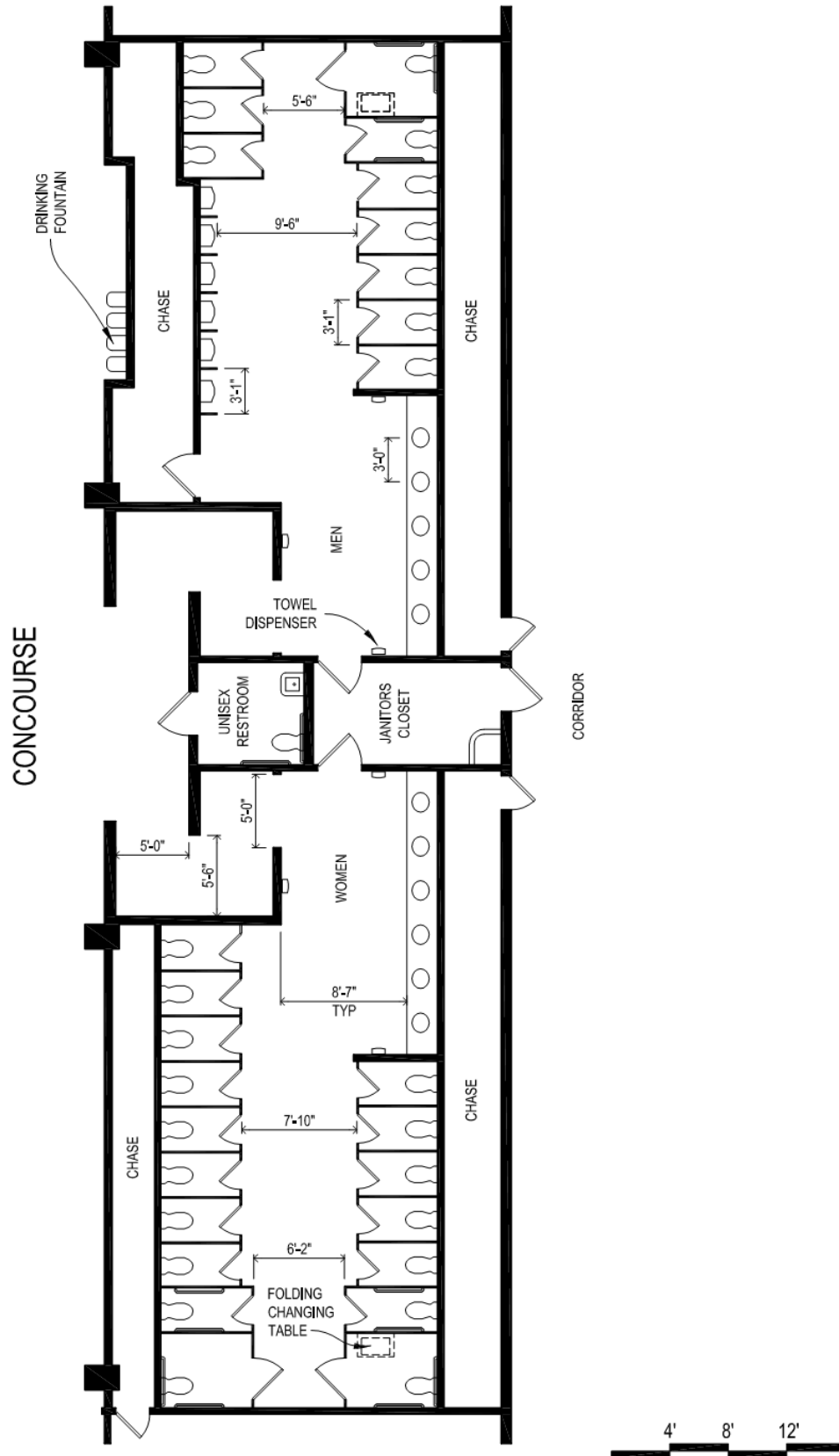
- Provided dual flush valves for the toilets
- Waterless urinals have worked well. They are serviced regularly and have no issues with odors.

## **Evaluation**

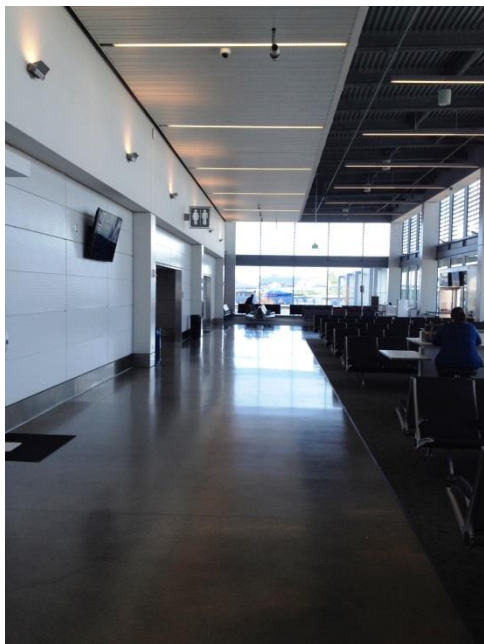
With over a half year in operation, the public is delighted with the modern and open design of the new terminal, especially the new larger restrooms. The following positives and negatives have been observed that either remain or have developed as a result of their initiatives and will be considered in future restroom work:

- Changing tables were added after construction was complete. There was in each accessible stall. There was not room in the Family Room to add one.
- The Janitor's Closets have a door that leads into the SIDA area. It does not have the usual panic hardware so maintenance staff occasionally forgets to swipe their card and set off the alarm. Training has helped this situation.
- The airport is considering adding a restrooms set for the extensive outdoor plaza area, which includes access to the security checkpoint.
- The airlines have requested signage to direct arriving passengers back to the restrooms where the gates are after the restrooms.

## Long Beach Airport (LGB)



## *Long Beach Airport (LGB)*



**Wayfinding Blade Signs**



**Entrance to Family Room and Men's**



**Stall and Urinal Area**



**Typical Stall**

***Long Beach Airport (LGB)***



**Changing Table in Accessible Stall**



**Sink Area**



**Family Room**



**Family Room**

## ***Long Beach Airport (LGB)***

### **Participants**

#### Airport

Jeffrey Sedlak, P.E., Senior Civil Engineer

Fred Peña, Facilities Management Officer

#### Moderators

Jens Rothausen-Vange – Architectural Alliance International

## ***Blue Grass Airport (LEX)***

### ***“Touch-free Environment”***

#### **Overview**

Hub Type: Small Hub

Hours of Operation: 4:30 a.m. – 12:00 a.m.

Designed Life: 15-20 years

Annual Enplanements: 539,492

Airport Size: 216,000 square feet

Number of Gates: 14

Number of Restrooms:   9 Women's  
                                  9 Men's  
                                  2 Family

Case Study Project: Renovated baggage claim restrooms opened in 2009

Date of Case Study: September 11, 2013

#### **Background**

The second terminal, built in 1976, has been expanded and renovated numerous times. The most recent expansion is a new 6-gate concourse addition completed in 2007. This project created new standards for the airport restrooms that the airport will use for future upgrades. In 2009, the baggage claim restrooms were renovated using these standards to provide additional fixtures in this busy area as well as larger stalls to accommodate traveler's belongings.

#### **Problems/Solutions**

The primary goals of the restroom renovations were to provide a touch-free environment, update old and unsightly finishes, and to provide better pipe chase access. The latter keeps plumbers from needing to close down the restroom to make repairs when the work can be done in the chase. Locations of restrooms had originally been planned based on proximity to gates, concessions, baggage claim, etc. versus passenger counts. An adverse effect of this strategy was that the non-secure side restrooms are oversized, but the baggage claim were too small.

The airport has seen the demographics shift from 60% business travelers to a 50/50 mix with leisure. With connections to Florida now there has been an increase in elderly travelers. Lines occasionally form at restrooms when two flights arrive simultaneously. While mothers nursing babies tend to find a private spot in the public areas, outlets are provided in the Family Rooms for lactation. The 2007 restrooms addressed the following issues with some refinements in 2009:

##### Tired Looking Finishes

- Used larger format 12" x 12" tiles without white grout (which eventually turns gray)
- Colors were chosen for the aesthetics as well as ability to hide dirt

##### Small Toilet Stalls

- Widened standard stalls to 3' 6"
- Provided a recessed shelf above and behind each toilet and urinal

##### Graffiti

- Hard tile surfaces are more resistant to graffiti

## ***Blue Grass Airport (LEX)***

### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, flushometers
- Eliminated entry doors

### Paper Waste

- Use large roll paper towels because C-fold types were very wasteful
- The airport used hand dryers in the baggage claim restrooms

### No Diaper Changing

- Diaper changing surface at some counters or at standalone cabinet with paper supply storage below

### No Restroom for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- Added two Family Rooms

### High Water Consumption

- Installed low-flow fixtures

### Inadequate Chase Access for Plumbing Maintenance

- Provided wider chases. While still tight, offer better access.

### Inadequate exhaust

- Exhaust rate above minimum requirement
- Use battery-powered air fresheners with gel packs (last about 2-1/2 months)
- Deodorizers for urinals (last 30 days if lucky)

### Sustainability

- Use primarily green products

### Inefficient Cleaning

- Hard surfaces easier to clean
- Drains cleaned weekly to avoid odors

### Product Stocking

- Janitor's Closet at each set has space for daily paper supply
- The toilet paper dispenser has two rolls available for use and two in reserve above that drop down to ensure the dispenser never runs out
- Foam soap dispensers each have an individual reservoir accessed in the cabinet below the counter. Refilled every 10-12 days.

When there is a flight surge, cleaners continually spot clean amongst the travelers to keep the restroom looking fresh.

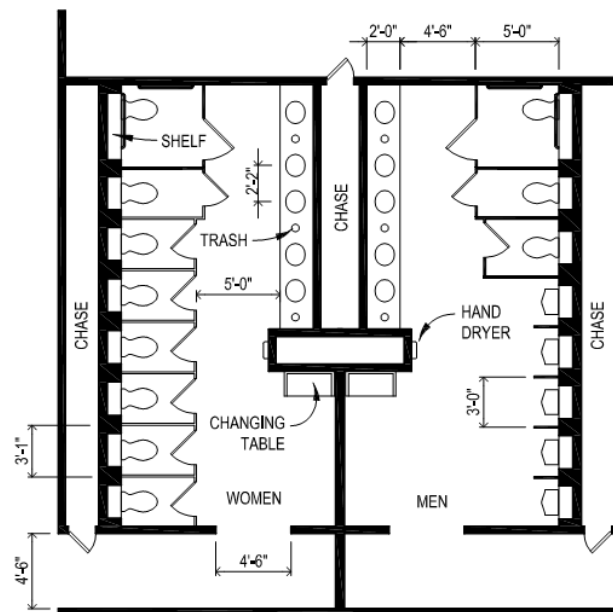


## Blue Grass Airport (LEX)

### Evaluation

Passenger comments on the new restrooms have been minimal and very positive, primarily praising the cleanliness of the facilities. Some considerations from lessons learned include the following:

- In the 2007 restrooms, the sloped trash enclosure below the counters quickly filled because of the way the trash bags had to be squeezed into the space. The 2009 version boxed out an enclosure between the sinks that provided space for a standard trash can.
- Paper towel dispensers require frequent battery replacement. Hard-wired are better and have been implemented.
- Flushometers cause “toilet sneeze” when the occupant moves while sitting or standing and the flush splashes outside the bowl onto the person. Cleaning staff experience the same problem when cleaning.
- Fingerprints on stainless steel partitions require constant cleaning.
- Soap dispenser shoots out soap when people walk by. No way to adjust sensitivity.
- Considering an automatic seat-cover dispenser to help perception of cleanliness.
- Water bottle filling stations are being considered at drinking fountains.



BAGGAGE CLAIM



## ***Blue Grass Airport (LEX)***



**Typical 2007 Version Restroom Entrance**



**Baggage Claim Restroom Entrance  
with Blade Signs**



**Stall and Urinal Area with Recessed Shelves**



**Typical Stall**

***Blue Grass Airport (LEX)***



**Diaper Changing Area in Entry**



**Sink Area**



**2006 Version of Under Counter Storage**



**Sloped Trash Container Below Quickly Clogs with Trash**



## ***Blue Grass Airport (LEX)***



**2009 Version of Under Counter Storage**



**Standard Trash Can Slide Out Easily and Does Not Clog**



**Access to Refill Soap, Traps, and Electrical Below Sink**



**Typical Pipe Chase**

## ***Blue Grass Airport (LEX)***

### **Participants**

#### Airport

Mark Day – Director, Engineering and Maintenance  
Amy Caudill – Director of Marketing  
Anthony J. Harris – Building Maintenance Supervisor  
Leslie Sandusky – Maintenance Manager  
David Burdette – Tech Maintenance Supervisor

#### Moderators

Jens Rothausen-Vange – Architectural Alliance International

# ***NON-HUB CASE STUDIES***

Jackson Hole Airport (JAC)  
Duluth International Airport (DLH)



## ***Jackson Hole Airport (JAC)***

### ***“Located in a National Park”***

#### **Overview**

Hub Type: Non-hub

Hours of Operation: 4:30 a.m. – 11:00 a.m.

Designed Life: 10-15 years

Annual Enplanements: 288,325

Airport Size: 100,000 square feet

Number of Gates: 6

Number of Restrooms:   4 Women's  
                                  4 Men's  
                                  1 Family

Case Study Project: Terminal Expansion and Renovation completed December 2010

Date of Case Study: September 24, 2013

#### **Background**

Nestled within the Teton Range, Jackson Hole Airport is the only commercial airport in the United States located inside a national park. The interface with the surrounding natural habitat and associated stringent government controls has brought sustainability to the fore, particularly in waste disposal. The recent LEED Silver project is now adding a pretreatment system to the septic system. A new set of restrooms was provided in the ticketing hall expansion to the original 1988 terminal and the existing three sets were renovated to match. Another expansion is just beginning that will include additional baggage handling, screening, and waiting areas to process passengers at peak times. This expansion will also have a set of new restrooms.

#### **Problems/Solutions**

Enplanements had increased from about 190,000 in 2003 to 300,000 so the new restrooms provided much needed additional fixtures. The architects led the planning and design effort with periodic check-ins with the airport managers. The existing restrooms were already ADA compliant but were looking dated. The locations were based on available space and adjacency to car rental, baggage claim, and restaurant. The biggest change in demographics has been an increase in international travelers, first Asian, now European.

Issues the new restrooms addressed include:

##### Dated Materials and Colors in Original Terminal

- Architects chose a palette of modern-rustic materials that included narrow, horizontally oriented wall tiles, large format floor tiles, wood ceilings, stone counters, and wood ceilings.

##### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, and flushometers
- Eliminated entry doors

##### No Restroom for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- A Family Room was provided at each new set.
- Only diaper changing location is in the Family Room

## ***Jackson Hole Airport (JAC)***

### High Water Consumption

- Provided low-flow fixtures

### Inadequate Exhaust

- Exhaust system always on – pulls air in from concourse

### Paper Waste

- Hand dryers only

### Supply Stocking

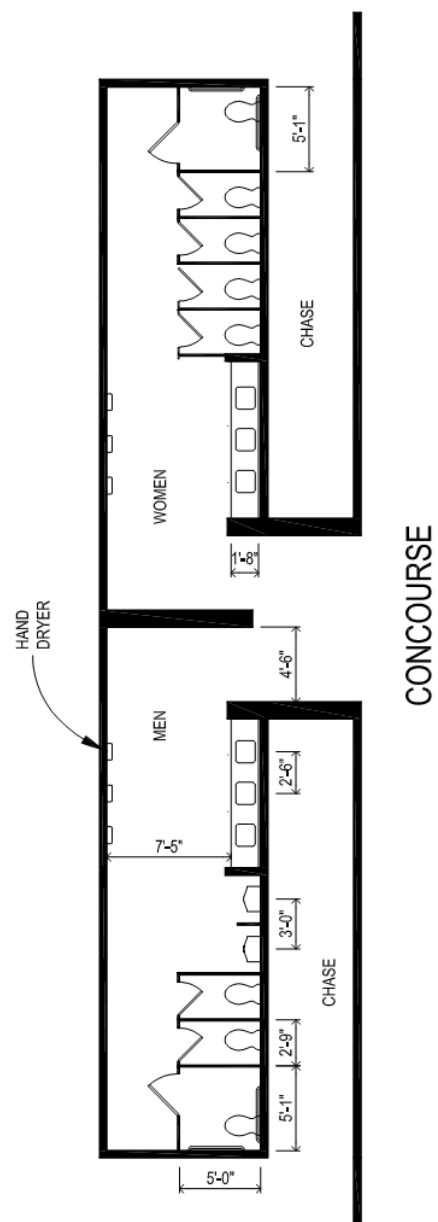
- Large toilet paper rolls prevents paper from running out (2 rolls per stall)

## **Evaluation**

Over the last couple of years, the airport has found a number of initiatives that they will likely refine or change in the upcoming expansion. These include:

- The airport realized that paper towels were still needed to clean off faces, bags, etc. The next set of restrooms will have paper towels in addition to hand dryers.
- Expensive three-dimensional metal signs depicting male and female versions of common animals in the west proved to be too subtle. People didn't take the time to understand the images and so often walk in to the wrong gender restroom.
- Paper supply vendors are required to be bid out annually, which can be a challenge to standardizing dispensers.
- Biodegradable paper clogs the drains because it doesn't break down fast enough, so it is not used.

Jackson Hole Airport (JAC)



## *Jackson Hole Airport (JAC)*



**Wayfinding Blade Sign Beyond**



**Custom Metal Art Sign and ADA Sign**



**Sink Area**

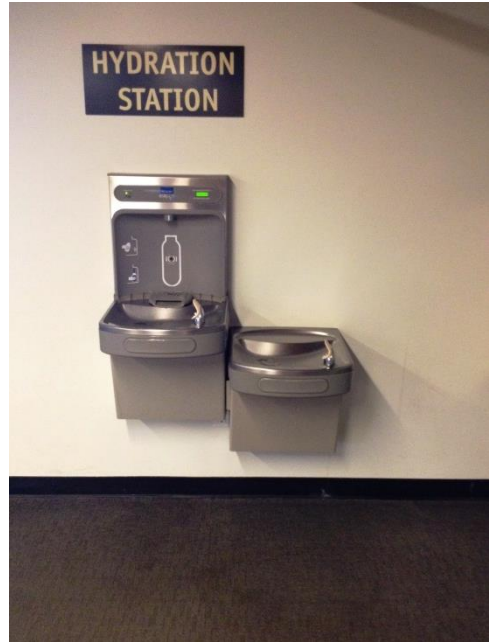


**Hand Dryers and Stalls Beyond**

***Jackson Hole Airport (JAC)***



**Typical Stall**



**Hi-Lo Drinking Fountain with  
Bottle Filler**



**Family Room**



**Family Room**

## ***Jackson Hole Airport (JAC)***

### **Participants**

#### Airport

Ron Campbell, Project Manager, Operations

#### Moderator

Jens Rothausen-Vange – Architectural Alliance International



## ***“Roving Customer Service Patrols”***

### **Overview**

Hub Type: Non-hub

Hours of Operation: 4:30 a.m. – 12:00 a.m.

Designed Life: 40 years

Annual Enplanements: 150,556

Airport Size: 110,000 square feet

Number of Gates: 4

Number of Restrooms: 4 Women’s

4 Men’s

3 Family/Assisted Care

Case Study Project: New Terminal Restrooms opened in January, 2013

Date of Case Study: September 16, 2013

### **Background**

In January 2013, the new terminal for Duluth International Airport opened after three years of development. The new terminal was built in front of the previous terminal that was built in 1973. This expansion was designed to remedy a number of deficiencies. Primary on the list was the increase from three gates to four and the creation of restrooms on the secure side. The previous original airside restrooms were removed after 9/11 when the TSA require more space for the security measures. The new facility is LEED Silver certified.

### **Problems/Solutions**

The key considerations in the new restrooms were to fully comply with ADA requirements, increase the number of fixtures to accommodate an increasing passenger load, provide locations on both landside and airside, and provide materials that were updated and easier to maintain. Customer complaints have been few and are monitored by roving staff who ask questions of passengers and airport tenants. Issues that were addressed in the new restrooms included:

#### Not Enough Fixtures

- The fixture count is based on building code requirements. With the increased size of the new terminal, the count increased proportionally. While the count is based on the code minimum, lines have not been observed.
- One set is provided on each of the two levels on the non-secure side. Two sets are on the main level of the secure side.
- Restrooms were located where they could fit in the overall plan

#### Dated Materials and Colors

- Architect developed palette that is warm and inviting

#### Small Toilet Stalls

- Enlarged the standard stalls to 3’ wide by 5’-1” deep

#### Water on Floors between Sinks and Paper Towels

- Installed paper towel dispensers at sinks directly above trash openings

## ***Duluth International Airport (DLH)***

### Overflowing Trash

- Provide large capacity under-counter floor-mounted trash cans between each pair sink with hole in counter
- Additional trash receptacles provided at the exits of all restrooms

### Touching Fixtures and Surfaces

- Use hands-free dispensers for soap and paper towels, faucets, and flushometers
- Eliminated entry doors

### No Restroom for Parents Traveling with Small Children or Person's Requiring Assistance from a Companion

- A Family & Assisted Care Room is provided at three of the restroom sets. These have an outlet for women who are lactating.

### No Diaper Changing

- Provided a changing table in the Women's and Family Room. A changing table is planned to be installed in the Men's.

### High Water Consumption

- Installed low-flow fixtures

### Inadequate exhaust

- Provided better exhaust

### Poor Lighting

- Provided task lighting over stalls and sinks
- Bright ambient lighting

### Hard to Maintain Surfaces

- Changed from 1" x 1" floor tiles to 18" x 18" with 12" x 3" and 1" x 6" wall tiles. A gray grout color is used to hide staining over time
- Stone counters and backsplashes
- Stalls and sinks are stainless steel

### Paper Waste

- Use large roll paper towels
- The airport chose not to use hand dryers

## **Evaluation**

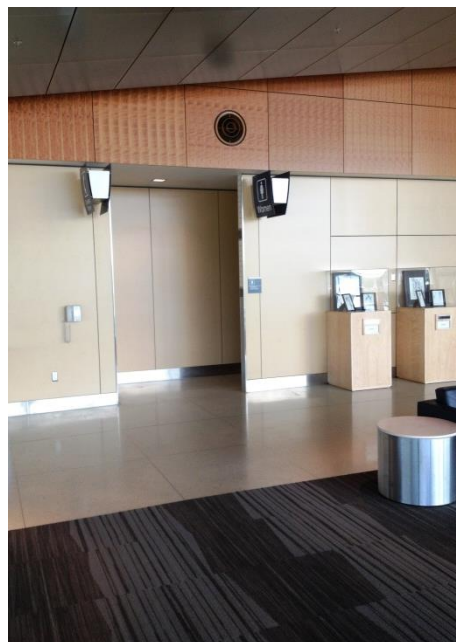
With over a half year in operation, the public is delighted with the modern and open design of the new terminal, especially the new larger restrooms. The following positives and negatives have been observed that either remain or have developed as a result of their initiatives and will be considered in future restroom work:

- Water bottle fillers at the drinking fountains are being considered.
- Noise from the restrooms is an issue with all the hard surfaces. Considering providing music through the paging system.
- There have been maintenance issues with the flush valves on the toilets. Alternates are being studied.

## *Duluth International Airport (DLH)*



**Wayfinding Signage**



**Entrance to Men's**



**Overhead Blade Signs**



**ADA Sign**

***Duluth International Airport (DLH)***



**Accessible Stall**



**Floor-mounted and Overhead-braced Stalls**



**Counter Area with Trash Below**



**Family Room with Diaper Changing on Left**

## ***Duluth International Airport (DLH)***

### **Participants**

#### Airport

Blaine Peterson, Director of Operations

#### Moderators

Jens Rothausen-Vange – Architectural Alliance International

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