Designing Beyond - Improving Airport Operations through BIM

September 22, 2020
Mark Day
Blue Grass Airport

Q  Director of Development and Facilities
Five Ways to Get Involved!

1. Join the ACRP IdeaHub community
2. Volunteer for a project panel
3. Prepare a research proposal
4. Answer an ACRP survey
5. Apply the research results

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Jack Ray
Principal Investigator

Q Vice President and COO, CCI Engineering Services
Q CM-BIM
Q Over 60 BIM Projects in Aviation, Healthcare, Universities and Public Utilities
Q 30+ years of technology and information management experience
Angela Newland, P.E., A.A.E.

Q Senior Project Manager, CCI Engineering Services
Q Former Assistant Director of Aviation – Airport Development, Broward County Aviation Department (FLL, HWO)
Q Former Vice President of Planning & Engineering, Columbus Regional Airport Authority (CMH, LCK, TZR)
Josephine Pofsky
San Francisco International Airport (SFO)

- Director of Infrastructure Information Management
- Oversees both enterprise GIS and BIM operations
- Technology visioning lead for Planning, Design and Construction
Designing Beyond – Improving Airport Operations through BIM

Mark Day, Blue Grass Airport - Moderator
Jack Ray, CCI Engineering Services
Angela Newland, CCI Engineering Services
Josephine Pofsky, San Francisco International Airport
ACRP Report 214 Oversight Panel

Mark J. Day, Blue Grass Airport, Panel Chairman
Eddie R. Clayson, Salt Lake City Department of Airports
Jennifer L. Mims, Jacobs Engineering
John M. Payne, Pueblo Technology Group, Inc.
Mindy J. Price, Direct Effect Solutions, Inc.
John A. Walewski, Texas A&M University
Danielle J. Rinsler, FAA Liaison
Paul J. Eubanks, Airports Council International – North America Liaison
Christine Gerencher, TRB Liaison
Marci Greenberger, ACRP Senior Program Officer
ACRP Report 214: BIM Beyond Design Guidebook Overview

- Assist airports in developing the business case to use Building Information Modeling (BIM) for asset management
- Provide guidance in developing BIM strategy, identifying stakeholders, determining BIM governance structure, and establishing BIM performance metrics
- Help airports identify how to scale the use of BIM
Webinar Agenda

1. Major components of a comprehensive, lifecycle BIM program - Angela
2. Metrics to establish effective BIM controls and to measure BIM program success - Jack
3. Overview of airport survey data on current uses of BIM – Angela
4. Airport Case Studies – Jack Ray and Josephine Pofsky, SFO
Learning Objectives

At the end of this webinar, you will be able to:

- Describe lifecycle BIM practices
- Identify how to implement BIM effectively
Major components of a comprehensive lifecycle BIM program

BIM Organizational Assessment

- Perform a BIM Needs Assessment
- Develop a Data Flow Diagram
- Perform a BIM Capabilities Assessment
- Develop a BIM Roadmap
Major components of a lifecycle BIM program – Korean Rail BIM Roadmap

**Railway BIM2030 Roadmap**

**People / Process / Technology**

**BIM Goals**

- **Procurement & Planning**
  - Communication between managers and project participants using BIM visualization tools
  - Application of AR/VR for design reviews or public hearings

- **Design Expansion of BIM application**
  - Application for environmental assessment
  - Design review and coordination, budget review
  - Elimination of unnecessary social cost using visual information
  - Visualization/digitalization of construction plans and budgets

- **Company-wide level**
  - Company-wide BIM team
  - Ability to manage the 2D to 3D conversion process
  - Ability to handle BIM models

- **Individual project manager level**
  - Coordination process
  - Design coordination between a limited number of team members

- **Procurement & Planning**
  - Tending and management process
  - Application of existing tending and project management methods

- **Company-wide level**
  - Monitoring, support, and management of multiple BIM projects
  - Ability to lead two-track BIM Design review using BIM

- **Individual project manager level**
  - Increased importance of coordination between drawings and BIM models
  - Limited use of BIM for specific issues by specific teams

**Process**

- **Infrastructure**
  - Policy
  - Procurement & Planning
  - Tendering and management process

**Technology**

- **Fundamental technology**
  - BIM authoring tools
  - BIM model checkers
  - BIM viewers

- **BIM analysis tools**
  - Detailing tools
  - Interoperability

- **Management technology**
  - A system that enables project participants to share BIM models and error reports acquired through design conversion (e.g., CDE, Big Room System)
  - A system that tracks and manages design errors

- **Coordination technology between 2D and BIM processes**
  - (e.g., 3D scanning, model version management)
Major components of a comprehensive lifecycle BIM program

Prepare Stakeholders for Implementation

- Develop a BIM Capabilities Maturity Model
- Identify the Airport’s BIM Champion
- Determine who will maintain the Airport’s BIM
- Provide BIM training

Source: buildingSmart Finland
Major components of a comprehensive lifecycle BIM program

**Financial Analysis**
- BIM Pilot Program
- Benefits and costs of BIM
- Business Case for BIM
- BIM Return on Investment (ROI) goals

Source: Six Sigma Plan Do Check Act Cycle
Major components of a comprehensive lifecycle BIM program

**BIM Implementation**

- Technical Architecture
- Integration of BIM with existing systems
- Standards, Execution Plans, Required Data Elements
Major components of a comprehensive lifecycle BIM program

**BIM Controls**
- Governance
- Progress Metrics
- Legal and Liability Issues

![Airport Authority Management Structure Diagram]
Metrics to establish effective BIM controls and measure success

Maintenance Planning

- Wrench Time/Average Time to Resolve Issues
  - Reduced time for field investigations
  - PM tasks bundling reduces travel time
  - Design for maintainability reduces maintenance time per asset
Metrics to establish effective BIM controls and measure success

Maintenance Planning

➔ Asset Uptime
  ▪ Increased wrench time reduces PM backlog and increases asset uptime

➔ Condition Assessment
  ▪ Spatial analysis/correlation of asset condition deficiencies with environmental and PM backlog issues
Metrics to establish effective BIM controls and measure success

**Asset Management**

- Time to enter new assets after capital project completion
  - BIM to Enterprise Asset Management (EAM) exports/ integration
- Asset Inventory
  - Reduce reliance on institutional memory
- Capital Planning
  - Spatial visualization of condition deficiencies, asset end-of-life
Metrics to establish effective BIM controls and measure success

Additional Metrics

- Contractor BIM Capabilities
  - BIM submittal reviews/report cards
  - Ability to meet BIM PxP requirement/standards
    - Level of Development
    - Equipment Information Requirements (EIR)
    - Coordination capabilities
Metrics to establish effective BIM controls and measure success

Additional Metrics

Airport Organizational BIM Capabilities

- Existence of BIM standards and processes
- BIM accessibility to staff/number of BIM accesses
- # of BIM information exchanges with other info systems
- % of staff with BIM training
Metrics to establish effective BIM controls and measure success

Data Collection

- BIM tied to airport coordinate system
- % of capital projects where BIM is utilized
  - Defined criteria for when BIM is required
- % of managed facility space included in BIM/SlimBIM
- Average time for integration of new assets with BIM & EAM systems after new capital projects
- Well defined asset hierarchy, asset attributes used with BIM & EAM
Airport survey data on uses of BIM

Summary

- 64 U.S. airports responded
- Most from FAA Eastern & Southern Regions
- 75% from large & medium hub airports
- Less than 40% are using BIM
- 30% have used BIM in operations & maintenance

--U.S. Airports Receiving Surveys--
Airport survey data on uses of BIM

**Summary**

- 50% maintain BIM after project completion
- Only 10% expect BIM to not be worth the cost
- No airport had a complete BIM for all facilities
- No airport had complete and accurate CAD for all facilities
- 75% plan on using BIM in the next 5 years
Airport survey data on uses of BIM

**Summary**

- Few airports have a BIM Manager
- BIM Manager usually resides in Engineering Department
- 63% rely solely on BIM consultants
- 50% have BIM Standards, 40% have BIM Execution Plans
- 53% have standard contract language for BIM
- 20% have more than 5 completed BIM projects
Non-airport entities using BIM

Case Studies

- Ohio State University
- Western Michigan University
- New York Presbyterian Hospital
- Perth Children’s Hospital
- New Royal Adelaide Hospital
- Sydney Opera House
Denver International Airport BIM:

- BIM Standards and Processes Developed
- Contractor BIM Capabilities Development
  - Submittal Reviews/Report Cards
  - Contract Language
- Organizational BIM Capabilities Maturity
  - Dedicated BIM Team
  - All major facility spaces scanned and BIM accessible
  - All major projects performed with BIM requirements
  - Post construction BIM uses
  - BIM ROI measurements
Massachusetts Port Authority

- BIM Roadmap developed
- BIM Standards and Processes
- BIM supports Lean Process Flows
  - Reduces cost of facility data management
  - Predictive Maintenance capabilities
- Integrated facility management platforms
  - Life cycle planning and management
San Francisco Int’l Airport BIM:

- BIM as a tool to support Progressive Design Build (PDB) methodology
  - Increased collaboration/communication
  - Reduced change orders
  - Reduced schedules
  - Improved quality
  - Improved organizational readiness when new facilities come online
- Rapid post-construction asset creation in EAM
Organization Structure

Planning, Design & Construction
(Chief Development Officer)

Infrastructure Information Management

Tech Visioning
GIS
BIM
Systems & Servers
Apps & Progs
Digital Doc. Mgmt
Capital Program
Virtual Design & Construction Principals

People, Organization, Process + Technology

Collective Collaboration
Organized Data
Established Processes
Model What We Planned
Build What We Modeled

POP + T

People, Organization, Process + Technology
Stakeholder Engagement
Stakeholder Engagement

END GOAL:
Preventive Maintenance

USE CASE DEVELOPMENT:
Stakeholder Engagement Process

IMPLEMENTATION:
Defining data attributes

SFO ORGANIZATION:
Facilities/Operations

Mechanical Maintenance
Electrical Shop
In-house Designers
Facility Scheduling
BIM
GIS
Project Workflow

Model Content Authors

Architects & Engineers
Trade Partners
General Contractors

Model Data Authoring

Data Collection and Verification

Self Auditing and Verification

Conformed Design Models
Validated Database

SFO Target Systems

CMMS
EMS
UNIFIER
GIS

Model Content Users

Owner Responsibility
Owner Stakeholders

Project Responsibility
Project Stakeholders
Project Workflow

Validated Database

Contractors, Specs, Standards and Processes

Architects & Engineers

Trade Partners

General Contractors

Data Authoring

Data Collection and Verification

Conformed Design Models

Self Auditing and Verification

Target Systems

Users

Data Authoring

Authors

Contracts, Specs, Standards and Processes

Validated Database

CMMS

EMS

UNIFIER

GIS
Standards and Guidance
Collaboration Tools

Engagement Strategy (Execution Roadmap)

Deliverable Checklist (Performance Tracking)

Model and Data Acceptance Criteria (Sign-off for Closeout)
## Collaboration Tools

### Model & Data Validation Report Transmission

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### Purpose:
The airport verifies the incremental development of models to avoid the need for labor-intensive, extensive rework or reorganization. The checks are based on current industry best practices and recommended modeling techniques. Refer to the SFO Revit Standard for further details. No checks should result in recommended corrective actions at project handover. Follow recommended corrective actions if appropriate after intermediate reports.

List all models submitted below with the intended checks you wish the SFO BIM Integration Team to perform. Insert rows as needed. Please note, some checks are mandatory at all milestones and will be reflected accordingly.

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BIM to GIS

- 911 Communications
- Facilities Maintenance (CMMS)
- Space Planning (COVID / Safety by Design)
- Commissioning and Activation
- Wayfinding
- Indoor Navigation
BIM to GIS
Summary – Improving Airport Operations through BIM

ACRP Research Report 214

- Based on extensive research of airport and non-aviation BIM uses beyond construction
- Describes lifecycle BIM practices
- Identifies how to implement BIM effectively for each airport’s specific needs
- Continued research is recommended as BIM continues to be more widely used in operations and maintenance
FOR ADDITIONAL INFORMATION

Jack Ray
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BIM and Airport COVID Responses

- Facility disinfection planning tool
  - Surface cleaning and treatment specific asset attributes using CDC recommendations
  - Generate facility cleaning maps and “quantities” of surface types for budgeting and manpower scheduling
- BIM transit analysis tools can be used to plan required terminal modifications to enforce spatial distancing requirements and the impacts on airport capacity
- BIM and computational fluid dynamics (CFD) can be used to identify areas of low air flow/turnover where air filtration is not providing adequate protection- and design required HVAC system improvements
- BIM and lighting analysis tools can be used to optimize the placement of permanent/temporary UV lighting sources for overnight disinfection
COVID Responses (SFO)
ACRP is an Industry-Driven Program

- Managed by TRB and sponsored by the Federal Aviation Administration (FAA).
- Seeks out the latest issues facing the airport industry.
- Conducts research to find solutions.
- Publishes and disseminates research results through free publications and webinars.
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Other ACRP Research on Today's Topic

Report 19A: *Resource Guide to Airport Performance Indicators*

Report 155: *Guidebook for Advanced Computerized Maintenance Management System Integration at Airports*

Report 172: *Guidebook for Considering Life-Cycle Costs in Airport Asset Procurement*

Synthesis 70: *Building information Modeling for Airports*

Synthesis 94: *Attracting Investment at General Aviation Airports Through Public-Private Partnerships*

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October 7
Weather the Storm - Climate Resilience at Airports

October 29
Set the Stage - Estimating Market Values for Small Airports

November 5
Wetland Mitigation at Airports