Life Cycle of BIM at the Port Authority
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Engineering Cost Management

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Agenda

• What is BIM?
• Benefits and Challenges of BIM
• Port Authority Criteria for Using BIM
• Port Authority BIM Projects
• 4D Modeling
• Future BIM Uses at the Port Authority
• BIM and Asset Management
• Lessons Learned
Engineering Department Organization

OFFICE OF THE CHIEF ENGINEER

Chief Engineer
James Starace, PE

Deputy Chief Engineer/Director
Jack Buchsbaum, PE

DESIGN
Csaba Kertesz, PE
Chief of Design

OPERATIONS
Denise Berger, AIA
Assistant Chief Engineer

CONSTRUCTION
Wally Caban, PE
Chief of Construction

QUALITY ASSURANCE
John Lin, PE
Assistant Chief Engineer
What is BIM?

BIM is a process for creating and managing all of the information during the lifecycle of a project (Design - Build - Operate).

BIM creates a digital representation and graphical database of physical and functional characteristics of a project or asset.
Benefits of BIM – Industry wide

• A savings of up to 10% of the contract value through clash detections
• Up to 40% of unbudgeted change orders eliminated
• Up to 7% reduction in construction time
• Up to 80% reduction in time taken to generate cost estimates
• Quantity Take-Off accuracy within +/- 3%

Stanford University Center for Integrated Facilities Engineering (CIFE) figures based on 32 major projects using BIM (Terminal 5 of Heathrow Airport, London & Fulton Street Transit Center, New York, among others)
Benefits of BIM – to the Port Authority

Managing the full lifecycle of a project is important for the Agency since we own our Facilities

• Projects can move from Stage to Stage without losing data
• Quality of our designs will improve
• Projects will have less errors and/or omissions due to early findings (clash detection)
• Project Estimates will be more accurate
• Project Schedules will be more precise
• Asset information can be leveraged from BIM Models into O&M
BIM Challenges

• Must overcome the mindset that:
  – It’s a software application (replaces CAD)
  – It’s a 3D model
  – It’s only a Design Tool (Clash Detection and/or QTO)
  – It’s just another Deliverable
  – It’s more Work

• For owners, BIM requires a Data Management Approach (not just drawings)

• Keeping Staff engaged on BIM projects to develop skills

• How much detail is really needed?
## Port Authority Criteria for Using BIM

### 1. Publicly advertised RFP

### 2. Model already exists within the project area

### 3. If a project scores “Excellent” base on criteria (score of 11 or higher +)

<table>
<thead>
<tr>
<th>Criteria Description</th>
<th>Points</th>
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<tbody>
<tr>
<td>Immediate area</td>
<td>3 points</td>
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<tr>
<td>Portion of Facility</td>
<td>2 points</td>
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<tr>
<td>No BIM models exist</td>
<td>1 point</td>
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<tr>
<td>$50M or more</td>
<td>3 points</td>
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<tr>
<td>$20M - $49M</td>
<td>2 points</td>
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<tr>
<td>New Construction/Replacement</td>
<td>3 points</td>
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<tr>
<td>Upgrade/Renovation/Rehab</td>
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<td>Repair</td>
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<tr>
<td>Four or more analysis tools will be used</td>
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<tr>
<td>Between two and three analysis tools will be used</td>
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<tr>
<td>Only one or none analysis tools will be used</td>
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<tr>
<td>All of the project’s systems and services</td>
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<tr>
<td>Six or more of the project’s systems and services</td>
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</tr>
<tr>
<td>Five or less of the project’s systems and services</td>
<td>1 point</td>
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</table>
New BIM Projects for 2017

Applying our BIM Criteria, we identified 83 potential projects in the 2017 Capital Plan.

- Planning 19
- Stage I 20
- Stage II 4
- Stage III 40
New BIM Projects for Aviation in 2017

- **JFK Airport**
  - Van Wyck Substation
  - Central Substation
  - Bergen Substation
  - Farmers Substation

- **LGA Airport**
  - DELTA Terminal

- **EWR Airport**
  - Terminal A
  - Main Terminal Garage
  - Pedestrian Bridge
  - Bridges N57, N58 & N59
BIM and the Project Lifecycle

PLAN - DESIGN

BUILD

OPERATE
## Current BIM Uses at the Port Authority

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Port Authority BIM Requirements

BIM Standards

• Models shall be done in either Revit and/or Civil 3D
• Models need to be developed using native components
• All the information shall be contained within the Models
• Drawings shall be generated from the BIM Model
• No parallel effort in CAD accepted
• Folder Structure, File Naming Conventions, Workflows, Processes, Procedures, etc.

Our Standards are located at: http://www.panynj-cadstandards.com/
Port Authority BIM Requirements

BIM Implementation Plan

- Project requirements
- S/W to be used: what is acceptable and what is required
- Means of collaboration
- Frequency of model submission and reviews
- Other items from Plan Template
PANYNJ - BIM Projects

La Guardia Airport Redevelopment Program

- Main Terminal
- East End Sub-Station
- East End Garage
- Roads & Bridges
- West End Garage
PANYNJ - BIM Projects

Newark Airport Redevelopment Program

- Terminal A
- Garage
- Sub-Station
- Pedestrian Bridge
- Bridges N57, 58 & 59
PANYNJ - BIM Projects

Stewart Airport

- FIS Expansion
PATH
Laser Scanning & Model Development of the Grove Street Station.
PANYNJ - BIM Projects

PATH

• Harrison Station - East Head Houses
PANYNJ - BIM Projects

PATH

- Harrison Station - West Head Houses
PANYNJ - BIM Projects

Sub-Station

Clash Detection

Quantity Take-Offs
PANYNJ - BIM Projects

Bayonne Bridge
PANYNJ - BIM Projects

George Washington Bridge Bus Station
PANYNJ - BIM Projects

Poth Authority Bus Terminal

• Model from Laser Scan
4D BIM

4D is the integration of a 3D model with a construction schedule in order to visualize the sequence of construction.

4D models can be created to various levels of detail, from staging analysis during the design, to detailed coordination during construction.
4D Modeling in Design

Current Uses:
• Determine MOT, Phasing, Sequencing, and Staging Plans
• Develop Realistic Construction Schedules and Duration
• Improves Design Constructability and development of construction sequencing alternatives
• Optimize Schedules
• Increased stakeholder communication through visualization and better understanding

Future Uses:
• Implement 5D BIM to drive a precise estimate and cost/resource loaded schedule
4D Modeling in Construction

- 4D BIM model assists in construction coordination and in reviewing constructability.
- Understand how the process will proceed in a particular point of time.
- Reduced number of RFIs and Cos.
- Detailed analysis of construction sequencing.
- Comparisons can also be made between the ‘as-built’ and the ‘planned’ schedules for the sake of improving the overall management.
4D Scheduling Process

CAD Data linked to Schedule (4D=Time) to Create an Interactive simulation of the Construction and Logistics
4D BIM Benefits

- Enables step-by-step visuals of your project’s development
- Increases scheduling efficiency and reliability
- Improves constructability/staging/MOT
- Improves coordination and communication
- Optimizes resource use
- Valuable to all stakeholders

Reach the common goal: a project delivered on-time, on-budget, and with high quality
PANYNJ - BIM Projects

4D Analysis
Scheduling
PANYNJ - BIM Projects

Construction Sequencing
## Future BIM Uses at the Port Authority

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BIM and the Project Lifecycle

- PLAN - DESIGN: 5%
- BUILD: 15%
- OPERATE: 80%
Asset Management

The Port Authority selected IBM Maximo as their enterprise asset management system in early 2016.

PATH will use Asset Works (legacy system)
Key Concepts of BIM for Asset Management

For any BIM project - Begin with the End in mind
- What data do we need for Asset Management, Operations and/or Maintenance?

BIM generates asset data which can feed Asset Management (AM) systems
- What assets are data needed for?
- What data is needed about those assets?
- How will the asset data be formatted and utilized?

Significant effort can be spent moving asset data into an AM System
- This is a body of work that has not fully matured yet.
- A mechanism is needed to move the data from BIM models to AM systems
Modeling Design Development

All equipment (assets) is modeled and information is added to the model early in design as equipment is selected.
Modeling Design Development

Parameters are added as needed to building components:

- cooling capacity
- cfm
- voltage
- model number
- manufacturer
- html link
- other information
Schedule of Equipment/Materials

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<tr>
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<td>A068</td>
</tr>
<tr>
<td>Brodie</td>
<td>A062</td>
</tr>
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Schedule Equipment by type
- All equipment itemized
Key Concepts of BIM for Asset Management

Capture asset data for installed equipment for use during O & M

• Asset Classes and Asset ID's need to be planned out.

• The BIM model can serve as a repository for data gathered during an asset’s lifecycle (Design-Build-Operate)
Key Concepts of BIM for Asset Management

Data Architecture – Where to put the data?

- Multiple systems
- Multiple functions
- Handoff of data
- Variety of data
Workflow

Revit Manage
BIM Coordination

IBM MAXIMO

Asset Management System
BIM to Asset Management Integration
Asset Management – the Old and the New

- **Turnover Contractor Files – Traditional Deliverables**
  - Native Files (3D, CAD)
  - Barcoded equipment, make, model & serial numbers tags, O&M manuals, warranties, equipment cut sheets, etc.
  - Commissioning / Decommissioning Reports

- **Turnover Asset Data and Models – Current & Future Deliverables**
  - Composite As-Built Models
  - Laser Scans – point clouds
  - Electronic Asset Data
Lessons Learned

- BIM is a Process
  - Model needs to be maintained and used throughout the project lifecycle
- All stakeholders need to be engaged
- Contract Language is critical
- Standards are essential
- How you build the model depends on how you use the model
  - Data is just Data – we must integrate systems/applications to turn data into actionable information
- Somebody needs to be in charge (BIM Coordinator/BIM Manager) to manage the BIM Process and Deliverables
Thank You

QUESTIONS?

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