5 Guys & Laser Scanner
LiDAR at LAX

Shobhit Baadkar
Managing Principal, TITAN AEC
“I'm excited about not just transforming the terminal facilities and airfield facilities but the front door to the airport…and how people move and get to the airport from their homes, their businesses, and hotels.”

Deborah Flint  
CEO  
Los Angeles World Airports
Project Introduction
Lamp at LAX

Traffic into and on the roadways in the LAX Central Terminal Area is a major concern, with an estimated 50 percent of air travelers driving to and from the airport by car. The number of vehicles is expected to increase as annual passenger volume continues to break records. The $5.5-billion **Landside Access Modernization Program** (LAMP) will give airport guests choices that provide a first-class, swift, convenient, and reliable way to access LAX.
Panel Introduction
Shobhit Baadkar
Managing Principal
TITAN AEC

Shobhit Baadkar is one of the founding partners of TITAN AEC with offices in Northern and Southern California. TITAN AEC implements design technology solutions throughout the world. Provides executive project management and BIM technology strategy for the project.
Dennis Rodriguez
Enterprise BIM Manager
Los Angeles World Airports

Building Information Modeling (BIM) Enterprise Manager for Los Angeles World Airports and brings over 26 years of project management and process development experience. He has developed enterprise BIM implementation/integration strategies for airports both nationally and internationally. This process integrates design, construction, and commissioning together with facility/asset management and GIS into all aspects of facility operations and maintenance.
Brian Kennedy
Construction Technology/VDC Manager
Austin Commercial

Overseeing all the Construction Technology and the managing the building information modeling efforts for the Tom Bradley International Terminal (TBIT) for the Terminal Cores & APM Interface project at Los Angeles International Airport (LAX)
Mario Trujillo
Technical Specialist – Civil / VDC
TITAN AEC

Overseeing all of the project protocols and managing the building information modeling efforts and for Terminal 6 & 7 for the Terminal Cores & APM Interface project at Los Angeles International Airport (LAX). Mario has led the BIM integration utilizing survey control, LiDAR and virtual reality on this project.
Blaine Grantham, CM-BIM

Principal / Co-Founder

TITAN AEC

Blaine Grantham is one of the founding partners of TITAN AEC. With over 15 years in the AEC industry, Blaine has implemented BIM workflows on projects totaling over $10B.

Blaine is also an Autodesk Implementation Certified Expert. Blaine currently implements BIM solutions throughout the state and instructs various firms on the use of BIM. Blaine has scanned over 30M square feet with TITAN AEC.
Building Information Modeling Mandate

THE REQUIREMENT FOR BIM
Los Angeles World Airports (LAWA) recognizes that Building Information Modeling (BIM) represents a fundamental change to the industry. This change affects the traditional processes and deliverables for planning, architecture, engineering, construction and facilities management. The goal of Los Angeles World Airports is to integrate BIM from cradle to grave in its organizational, development and maintenance departments.

THE USE OF TECHNOLOGY
LAWA also recognizes that BIM involves rapidly evolving processes, industry standards and technology. As building information modeling technology advances, LAWA will look forward to integrating those changes into existing processes.

THE INCLUSION OF LIDAR
The contractor shall deliver a registered Point Cloud for each of the overall scanned area. A Licensed Surveyor must ensure that LiDAR equipment setup is tied to the LAX Survey Control Network. Point Clouds must include clear visibility of the Survey Monument from the LAX Survey Control Network and/or City of LA Benchmark to which the LiDAR scan is tied. Point Cloud resolution must be sufficient for alignment of Point Clouds and Revit models. Include all files required to properly open and display the registered Point Clouds in Autodesk ReCap. An aggregation of all Point Clouds into a single Navisworks (.nwd) formatted file of all scan areas shall also be submitted to LAWA.
Scanning Hardware
Scanning Hardware

The design-build team utilized LiDAR scanners from Faro Technologies

- 350 Meters
  - 1550 nm Wavelength
  - 165 MP Color
- 976,000 points/second
- Integrated GPS Receiver
- Outdoor Scanning
- Integrated Compass
- Altimeter (Elevation Sensor)
When Does Scanning Happen?

- Preconstruction
- Construction
- Post-Construction
Technology Considerations
Workstation Configuration

- 32GB RAM (minimum)
- 64GB+ of RAM
- Solid State Drives (SSD)
  - Samsung Pro
  - NVME
- Intel i7
  - Samsung Pro
  - NVME
- Graphics
  - NVIDIA Quadro
    - P5200
  - NVIDIA GTX
    - 1070
    - 1080 TI
    - 2080 TI
Data Considerations

- **Point Clouds Size**
  - 50GB +

- **Network**
  - Gigabit Ethernet

- **Server**
  - RAID
  - SSD

- **Cloud Storage**
  - Autodesk BIM 360
  - Egnyte
  - Faro WebShare
  - Amazon Web Services
Mobile Device Usage

- Planning
- Tracking Scan Locations
- Coordinating Multiple Scanners
- Coordinating Multiple Scan Times
- iPad Pro
  - Apple Pencil
  - 128GB +
Technology Stack
Project Workflow
Setting Expectations

• Define laser scanning efforts for project stakeholders
  o Project Owner
  o General Contractor
  o A/E Team
• Define level of development for BIM
• Document in BIM Execution Plan

Expectations

Budget
BIM Implementation Plan

UNDERSCORED BY SURVEY/LIDAR STANDARDS

- Registered Point Cloud Required
- Use of a Licensed Surveyor
- Use of Survey Control Network
- Point Cloud Resolution
- Aggregation in Autodesk ReCap

4. LIDAR

4.1 Overview

LIDAR (Light Detection And Ranging) scans are primarily used to provide coordinate horizontal and vertical location information on a per project basis. This information is used by LAWA and must be registered to the LAX Survey Control Network by 2017.

4.2 LAX Survey Control Network

The contractor shall refer to the LAX Consolidated Survey Control Network - ISSUED - 01_06_15.pdf and LAX Survey Control Network_2018.pdf for survey control and monument location information. These documents are available in the LAWA Design and Construction Handbook (DCH).

4.3 Required Deliverables

The contractor shall deliver a registered Point Cloud for each of the overall scanned areas. A licensed Surveyor must ensure that LIDAR equipment setup is tied to the LAX Survey Control Network. Point Clouds must include clear visibility of the Survey Monument from the LAX Survey Control Network and/or City of LA Benchmark to which the LIDAR scan is tied. Point Cloud resolution must be sufficient for alignment of Point Clouds and Revit Models. Include all files required to properly open and display the registered Point Clouds in Autodesk ReCap. An aggregation of all Point Clouds into a single (Navisworks (.nwb)) format file of all scan areas shall also be submitted to LAWA.

4.3.1 Units

Imperial Units should be the default means of measurement in any area. Standard (International) feet is required as the unit of measurement, not Survey feet.

4 International ft = 0.99999300004 Survey Foot

4.4 Interior Scans

LIDAR scans of any interior buildings must be registered to the nearest Survey Monument. At a minimum, targets on two different planes must be used for interior LIDAR scanning registration.
Level of Development

- Manages Stakeholder Expectations
- Risk Management
- Allows for Decision Making
- Clarity of Design Intent
- Effective Modeling
# Level of Accuracy

## Level of Accuracy

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| Upper Range (Imperial) | - | 5cm | 15mm | 5mm | 1mm |
| Lower Range (Imperial) | 5cm | 15mm | 5mm | 1mm | 0 |
Autodesk Revit & Point Clouds

- Multiple Sections within Revit Model
- Managing the Revit Model
- Managing Worksets
- Level of Development (LOD)
- Minimal Point Visibility
Project Team Configuration

- Multiple Sections within Revit Model
- Managing the Revit Model
- Managing Worksets
- Level of Development (LOD)
- Minimal Point Visibility
Autodesk BIM 360

- Project Site for Owner
- Site Administration
  - TITAN AEC
  - Austin Commercial
  - Los Angeles World Airports
- Document Control
  - Austin Commercial
Virtual Reality

- Completely Immersive
- Increasing Stakeholder Engagement
- Interactive BIM
- Virtual Mock-Up
LAX Central Terminal Area
Contractor Benefits
Contractor Benefits

- SAFETY!
  - Ability to verify dimensions without ladder or lift
- Minimizes Risk
  - Accurate As-Built
- Field Verification
  - Jobsite 1 mile away from PMO
  - Certain areas accessible
- Useful Design Tool
  - Used to Model Verified Conditions
Contractor Benefits

- Used by project stakeholders
- Before & After
  - Utilizing existing to compare against new
- Scope Definition
  - Used by Trade subcontractors for bidding purposes
Owner Benefits
• Why even do it?
  • Needed to capture/record
  • Multiple Uses for Single Capture
• Record of Existing / As-Built Conditions
  • Critical Horizontal & Vertical Data
• Understanding of its use
  • Must know BASIC survey
  • Can save time & money
• Utilization of data for internal & external teams
  • Guidelines for client capture
  • It’s a tool; not a toy

Owner Benefits
Questions ?
Questions?