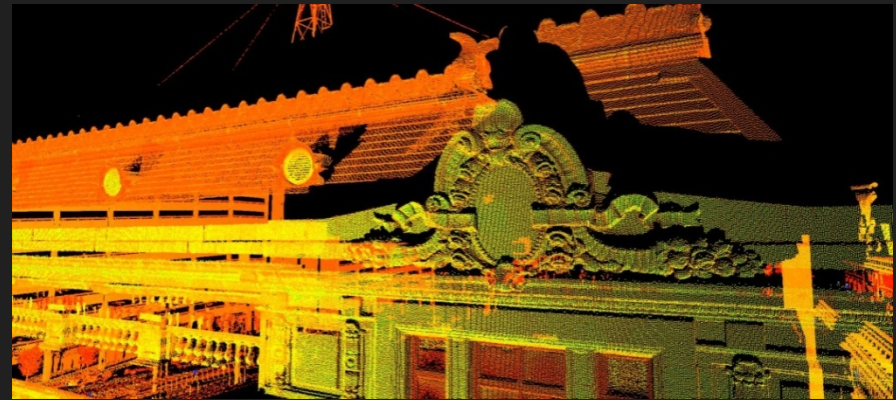# STRAIGHT TO DIGITAL: SAVING FIELD TIME WITH LIDAR AND MOBILE APPS

W. EVÁN FIGUEROA, PE, LEED® AP
JULIE SAMUELS, EIT

W. EVÁN FIGUEROA, PE, LEED® AP
JULIE SAMUELS, EIT

shaping the built environment

2013 ICRI Spring Convention | March 21, 2013
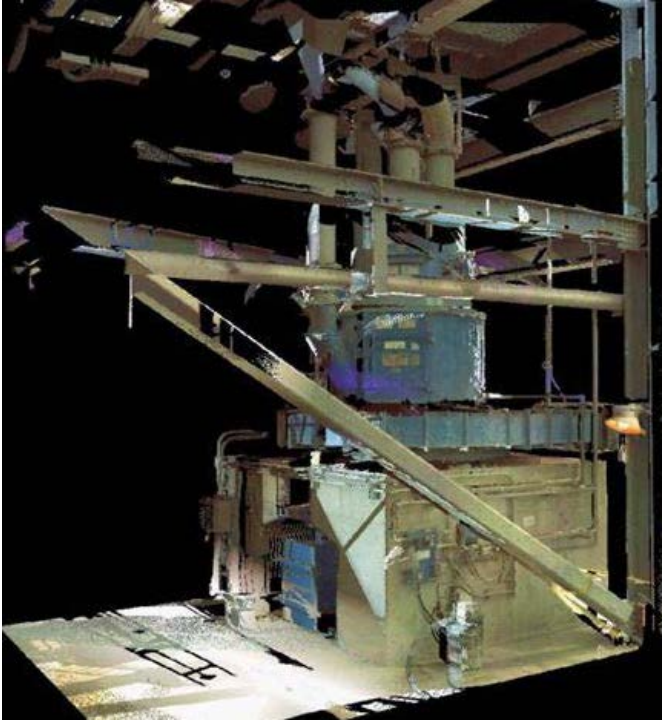St. Pete Beach, Florida

Presentation Outline

<u>LiDAR</u>

- Introduction to Laser Scanning with an Industrial Example

- Designing with LiDAR Data

- Modeling Example - Dallas Municipal Building

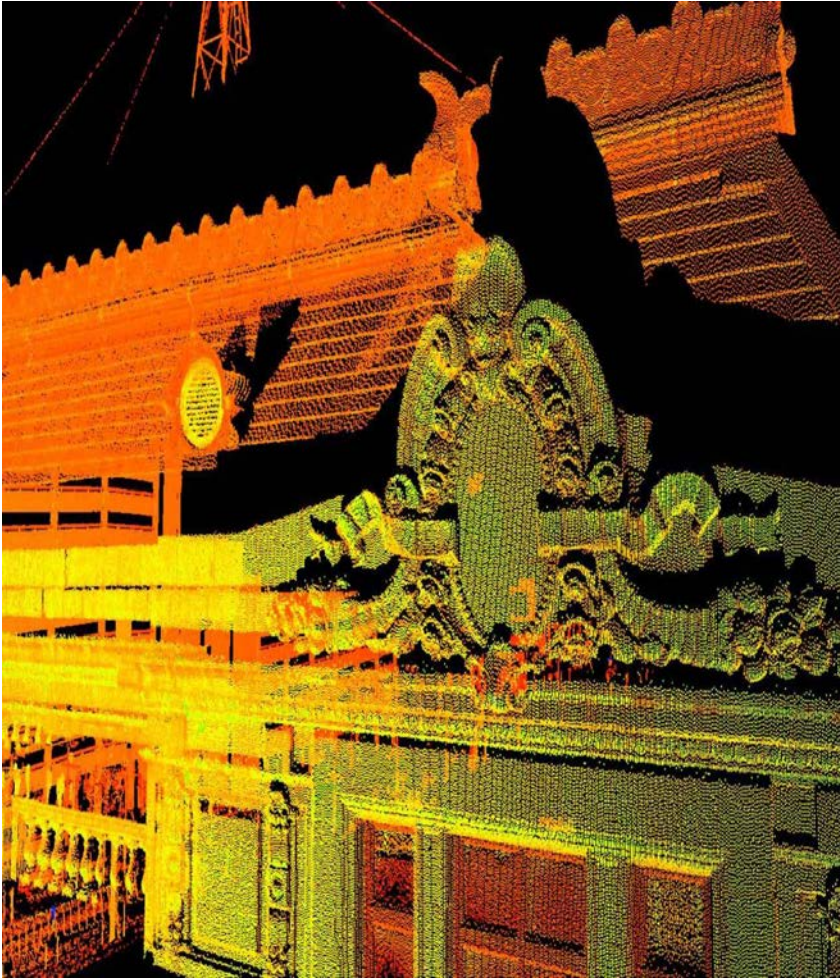<u>Mobile Apps</u>

- Tablet Tasks

- Applications

Scan

Photo

What is LiDAR?

- **Li**ght **D**etection **a**nd **R**anging (LiDAR)

- "Laser scanning" is often used and has the same meaning

Low Resolution Scan

- Quick 30-second scan to obtain targets
- Points are discernible

Medium Resolution Scan

In typical scans, the points are not discernible at this scale.

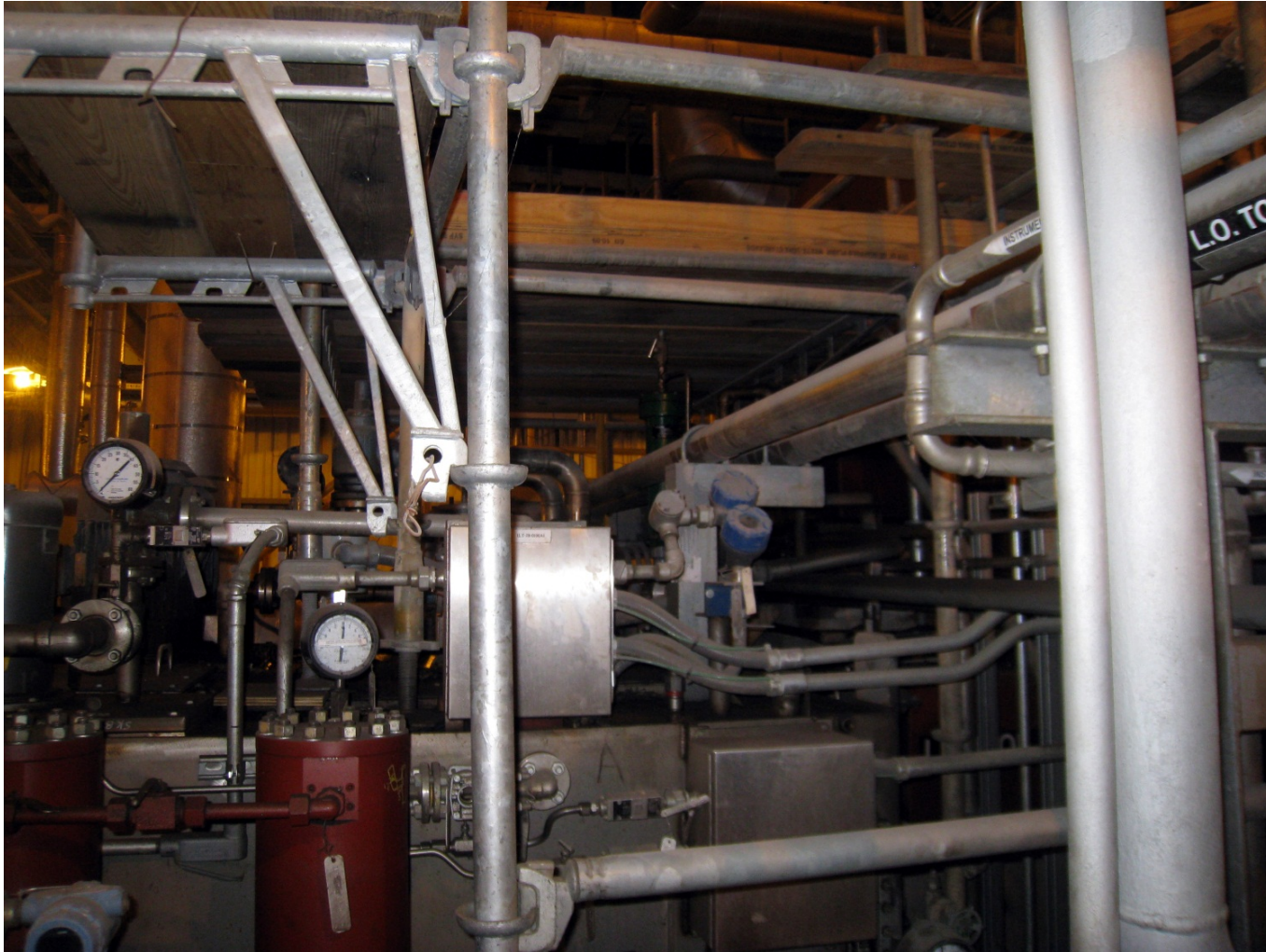# Why use LiDAR?

Complicated Existing Conditions: Safety

Complicated Existing Conditions: Potential Clashes

Complicated Existing Conditions: No Existing Drawings

Inaccessible

Save Time in the Field

Avoid Return Trips

# Eliminate a Step – Model Directly from Imported Data

The Solution: LiDAR + BIM

The Scanning Process

Case Study: Limestone Mills

- Pulverized limestone clogs mill when it is moist.

- Plant personnel were using scaffolding constantly to access the mill to remove the clogs.

- Scaffolding must be inspected daily and plant pays rent.

- New platform framing will be shop fabricated and bolted together.

Case Study: Limestone Mills
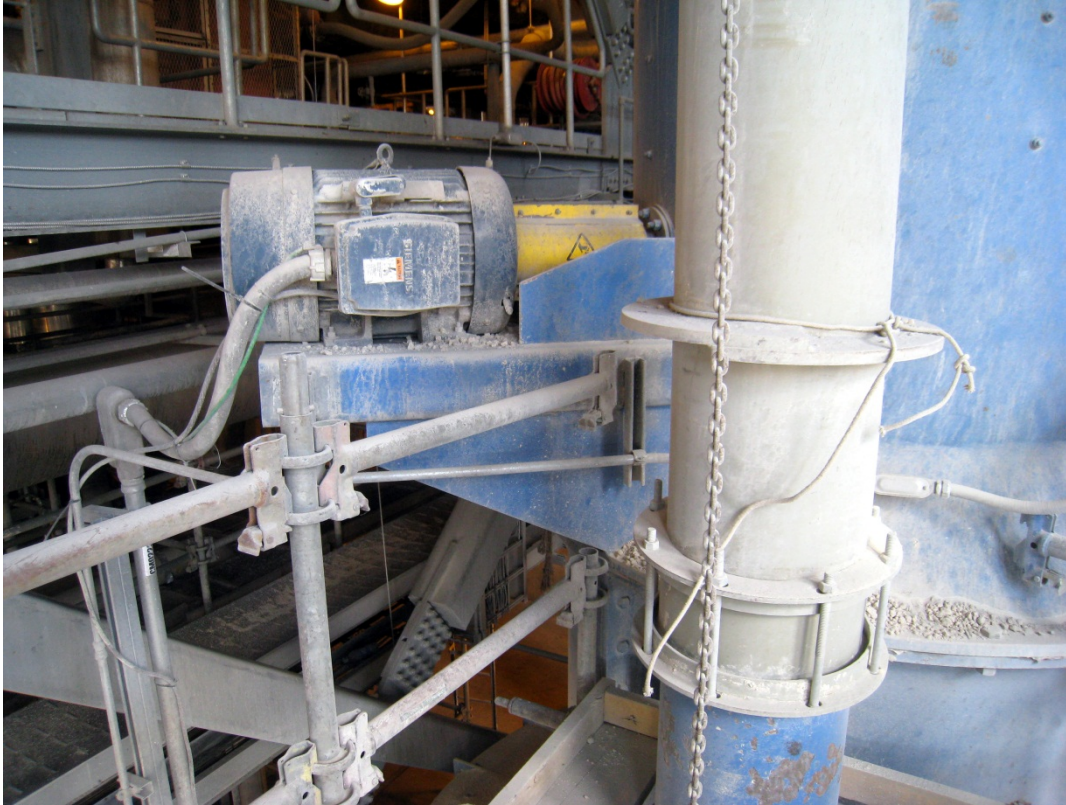
Steel framing needs to fit around existing equipment.
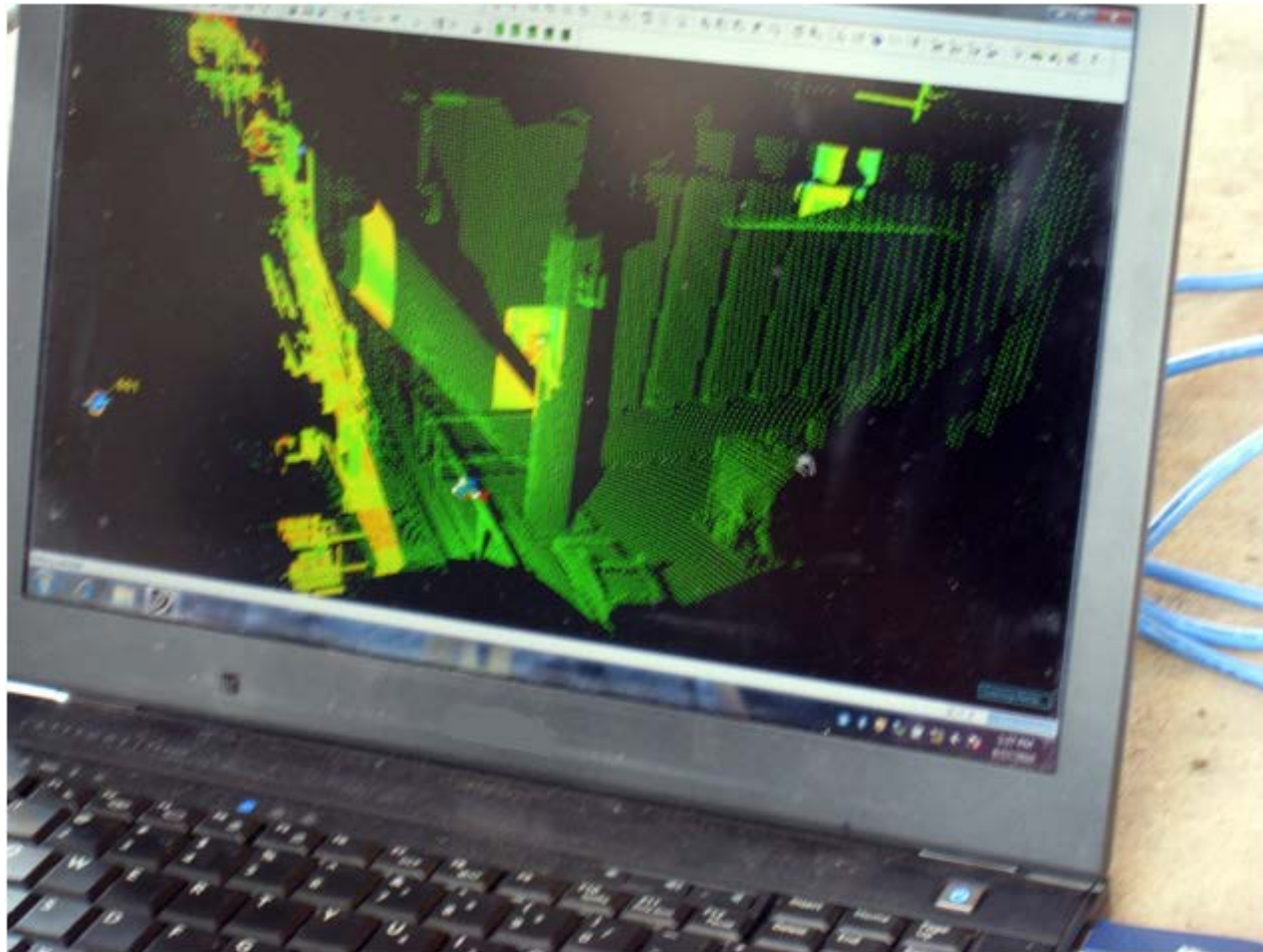
Data Acquisition

Data Acquisition

Targets are used to tie multiple scans together (registration).

Shadows

Shadows are areas out of the line of sight of the scanner.

Resolution

Resolution is affected by distance and time spent scanning.

Post Processing

1. Registration
2. Elimination of points outside the area of interest
3. Break the fully assembled point cloud into smaller usable "volumes"
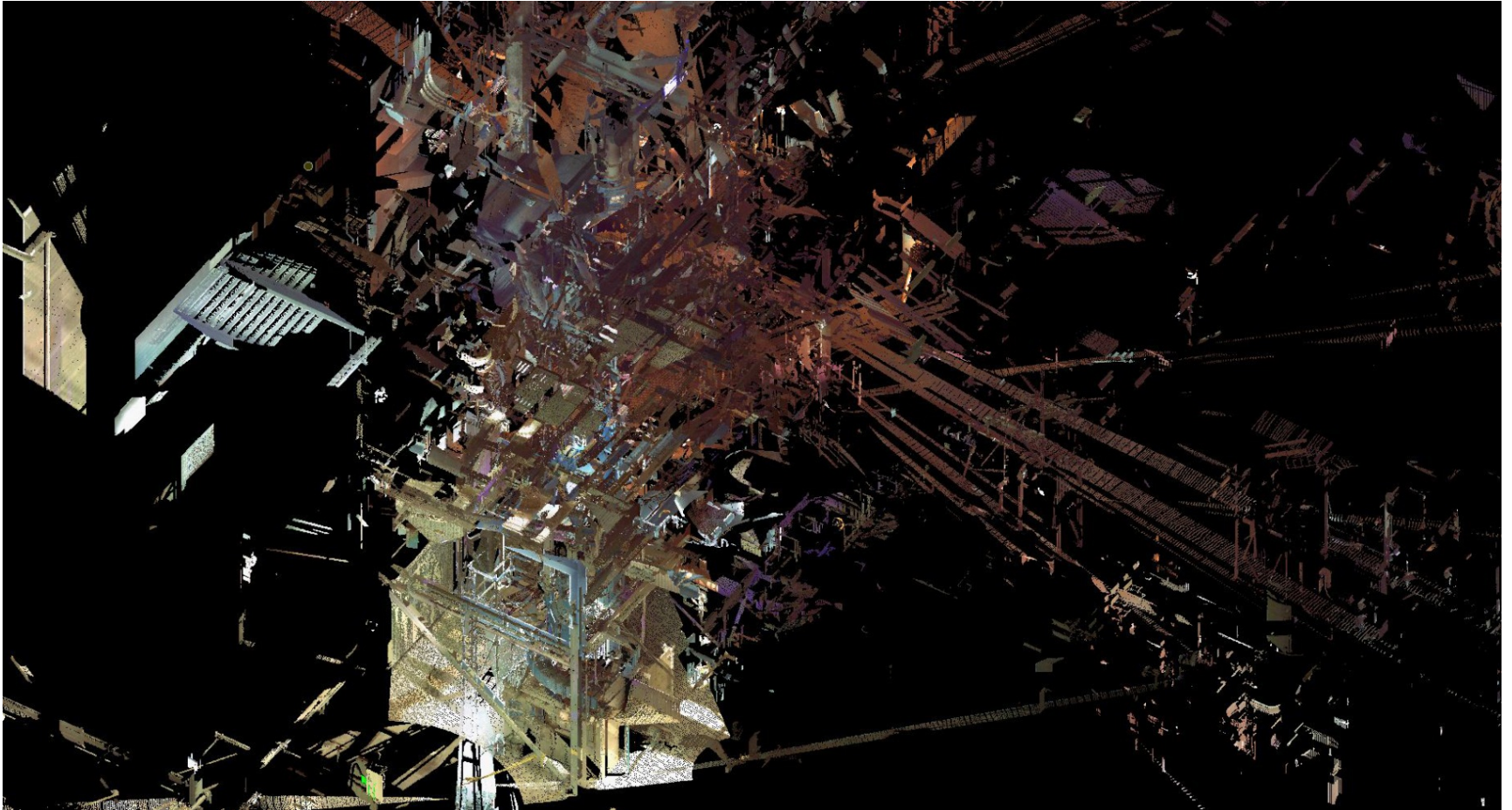4. Registration with scans from prior projects
5. Remove undesirable elements

Registered Point Cloud
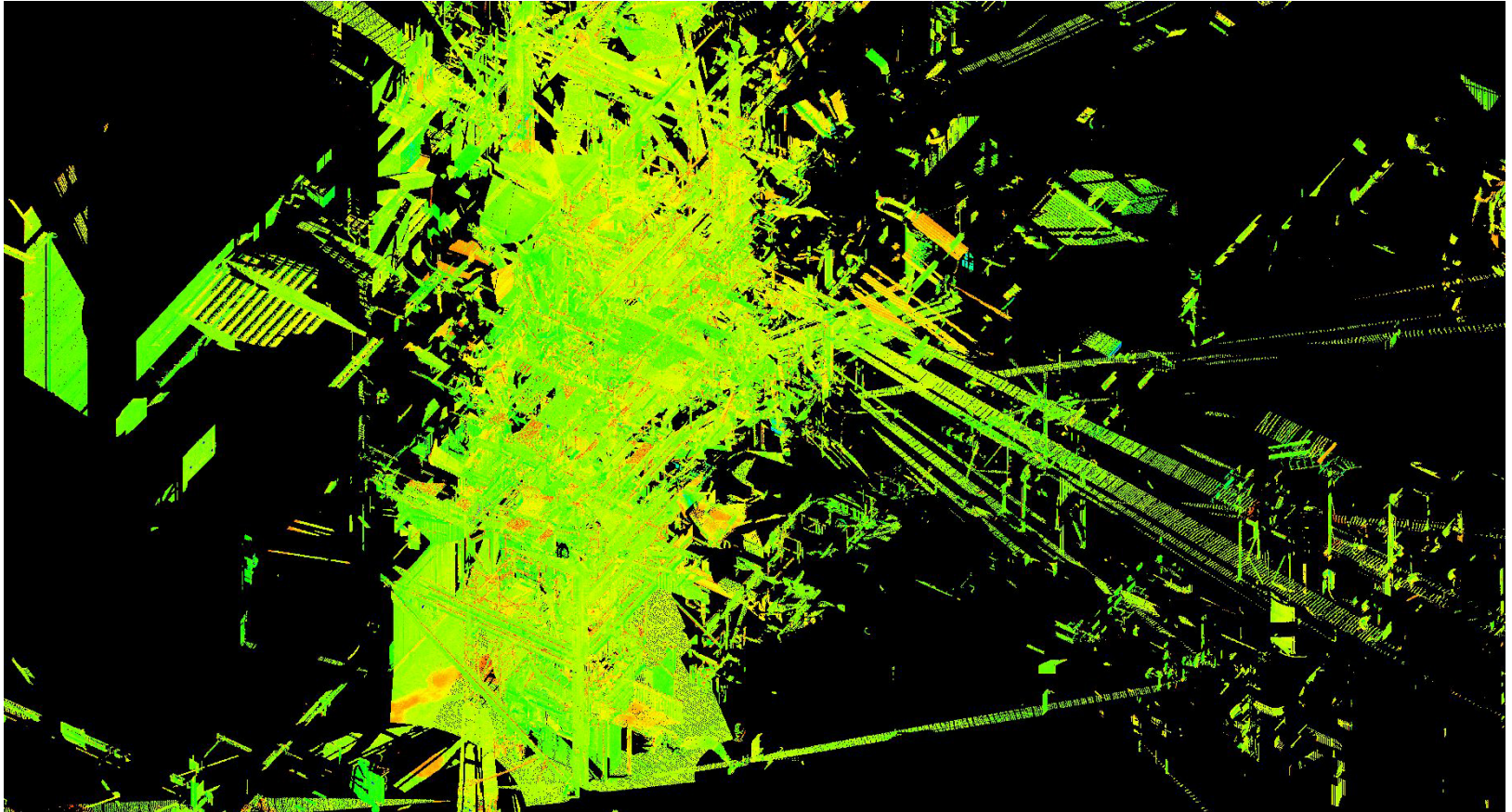
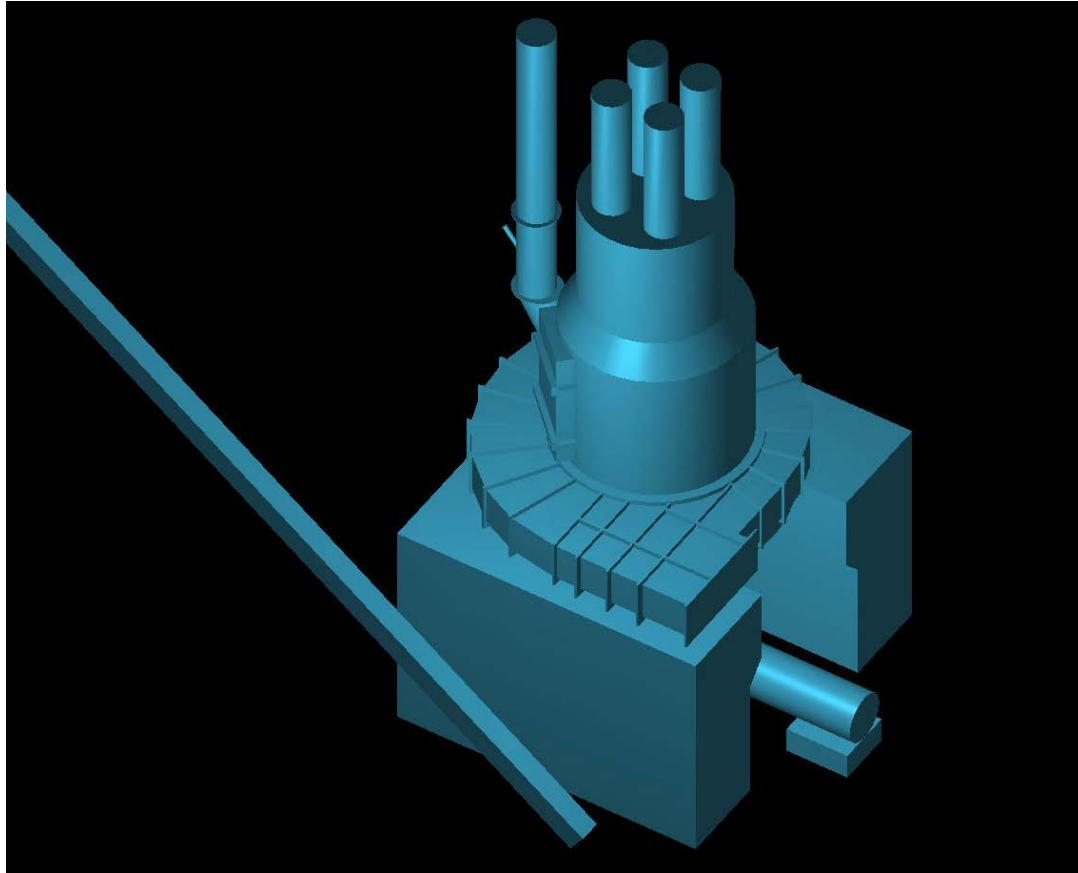Without color attributes from integral camera, it is difficult to discern specific objects at this scale.
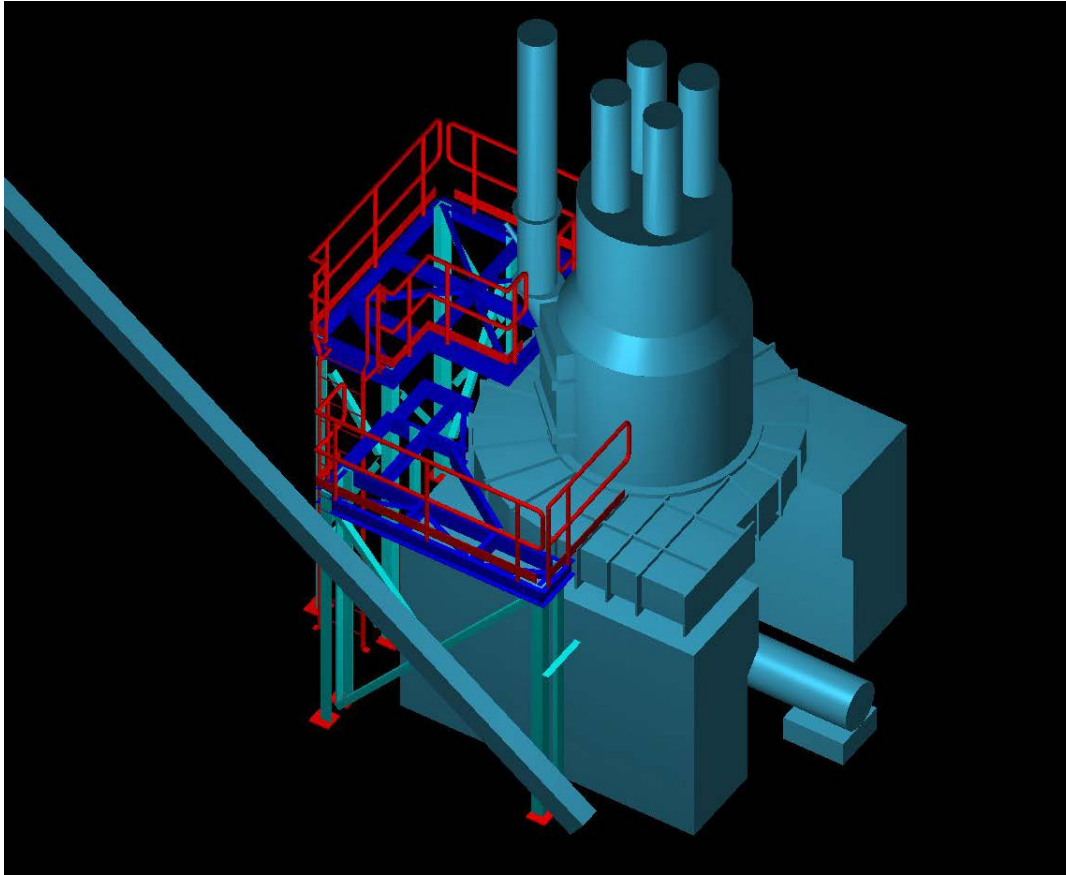
Registered Point Cloud

With color, specific objects are easier to distinguish.
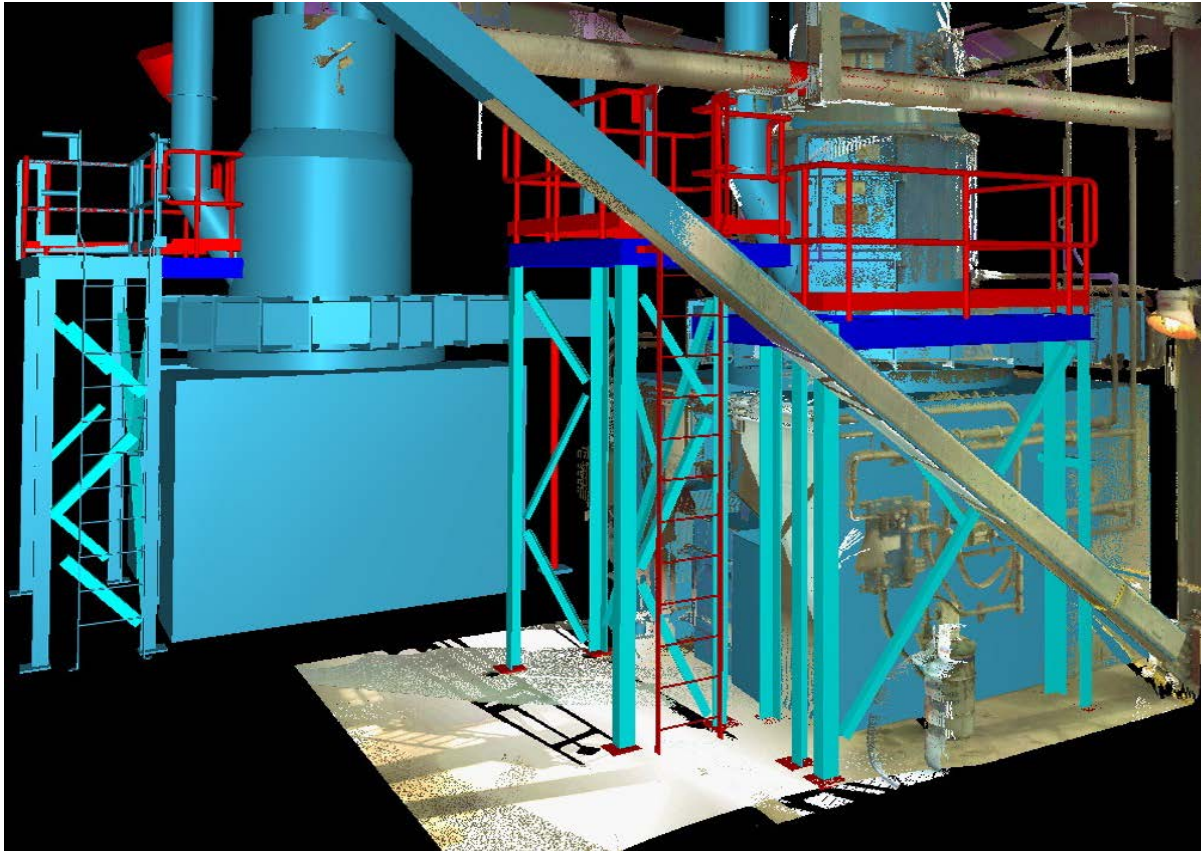
Using LiDAR Data to Create BIM

Existing conditions are modeled as needed based on imported point cloud.
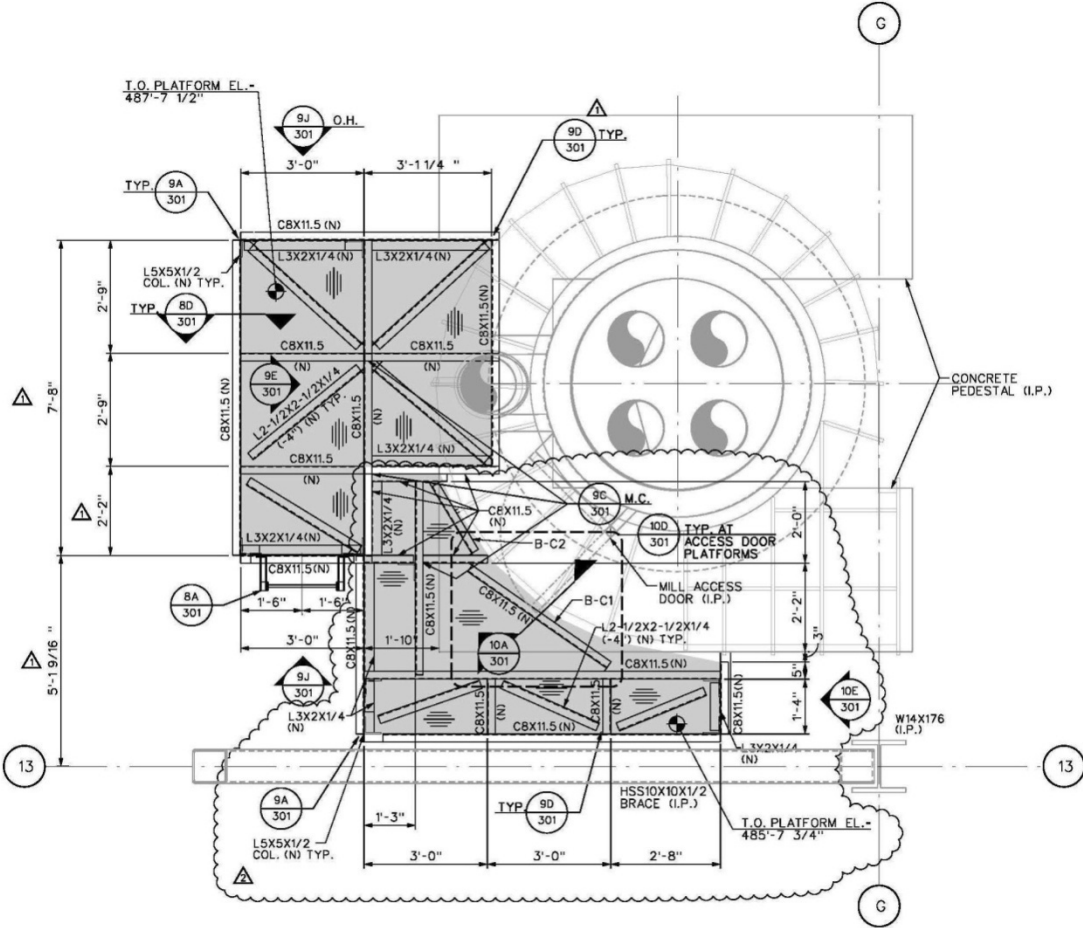
Using LiDAR Data to Create BIM

New components are added to the model.

Using LiDAR Data to Create BIM

New components are compared to the unmodeled point cloud components for clash detection.

Preparing 2D Drawings from BIM

PLATFORM FRAMING PLANS AT LIMESTONE MILL 5B-C

SCALE: 1/2"=1'-0"

Reduce Construction Administration Time

Designs take into account the actual conditions, so
uncertainty during construction is reduced.

What Type of Project Warrants using LiDAR?

- Inaccessible

- Hazardous site conditions

- Complex geometry

- Potential clash conditions

- No existing drawings
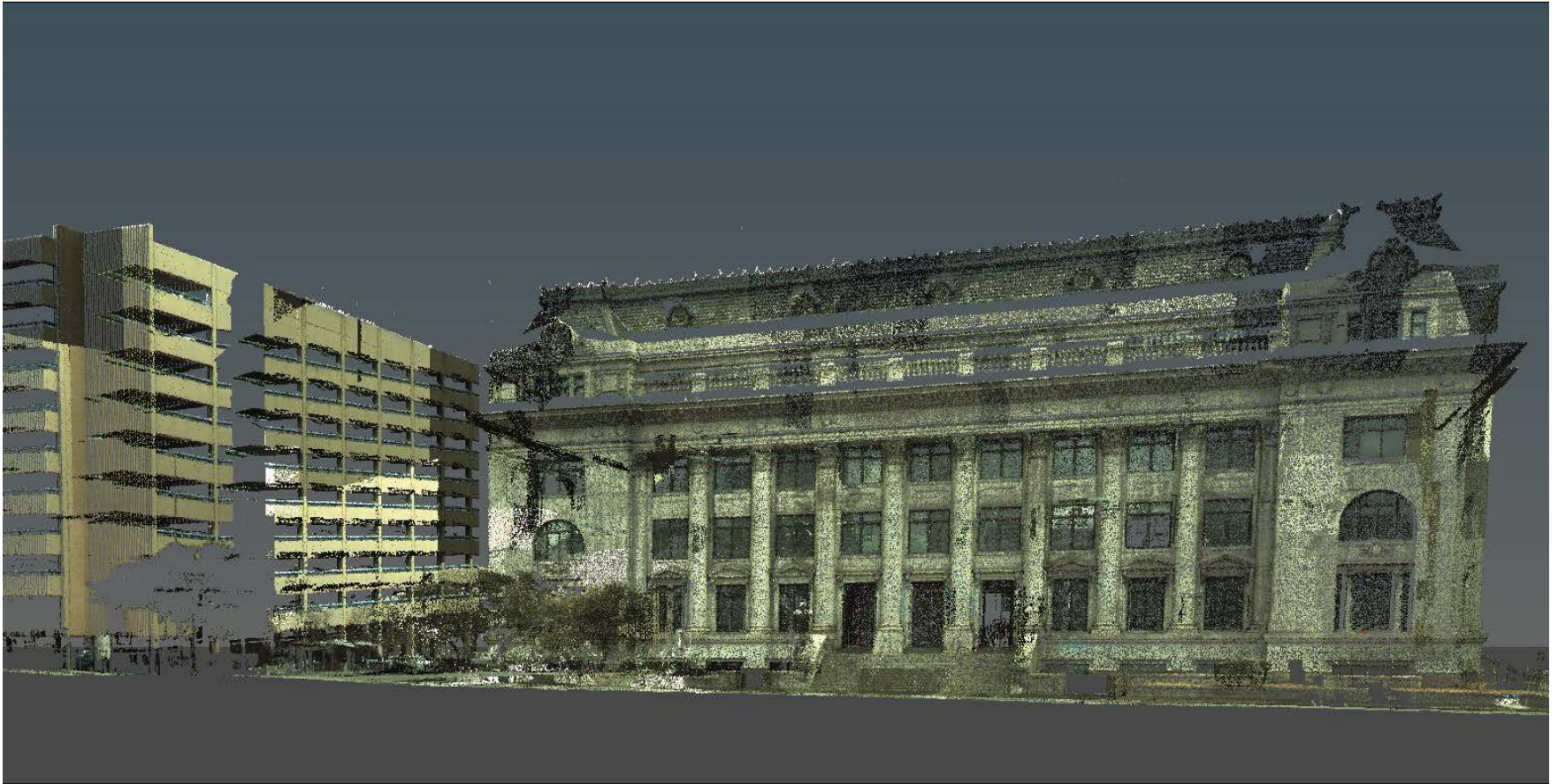
- Poor quality existing drawings

Architectural Applications for LiDAR

- Historic preservation/historical adaptation projects
- Renovations (interior and/or exterior)
- Creating 3D models of existing buildings
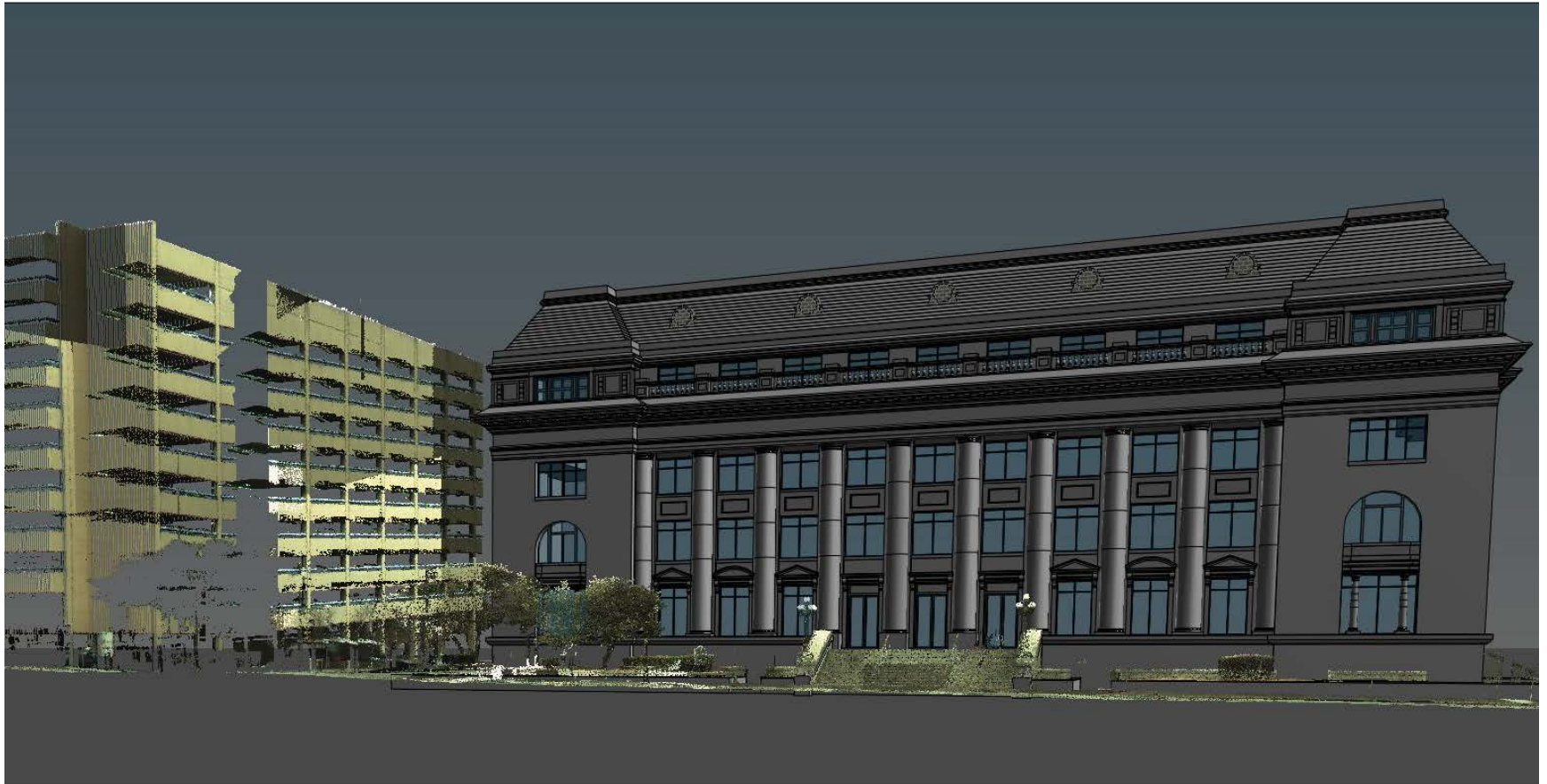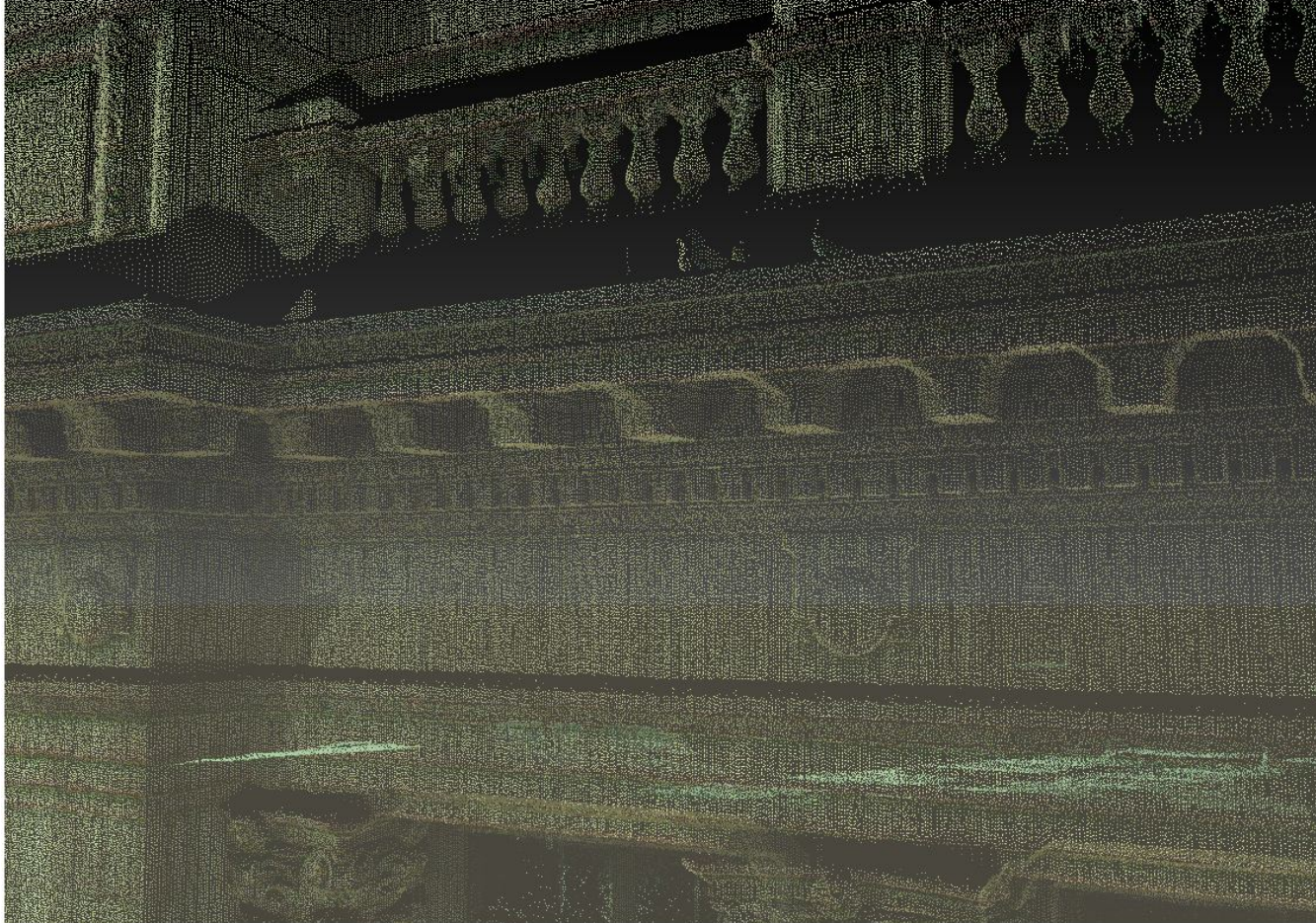- Record 3D models or drawings

Historic Structure
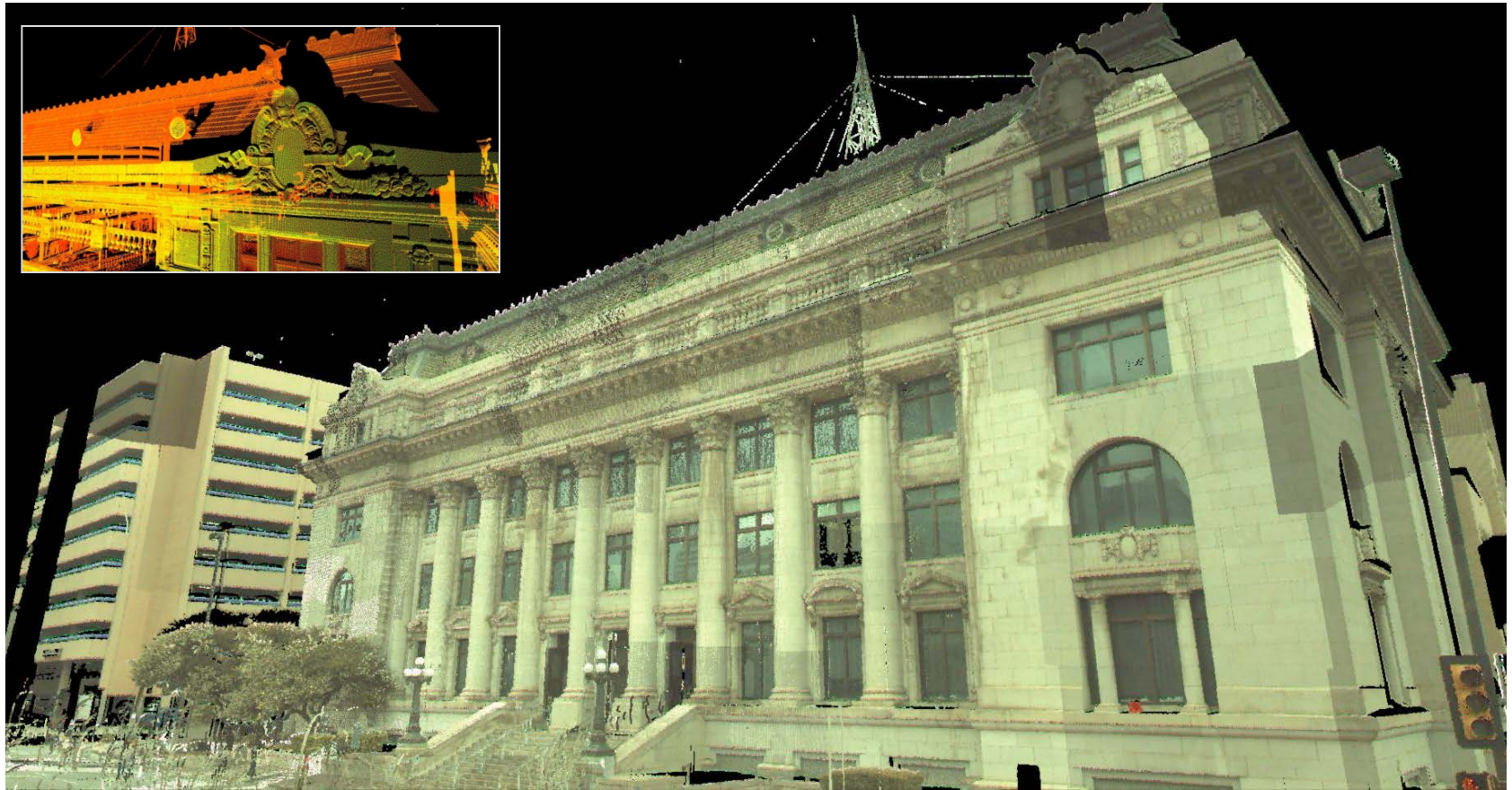
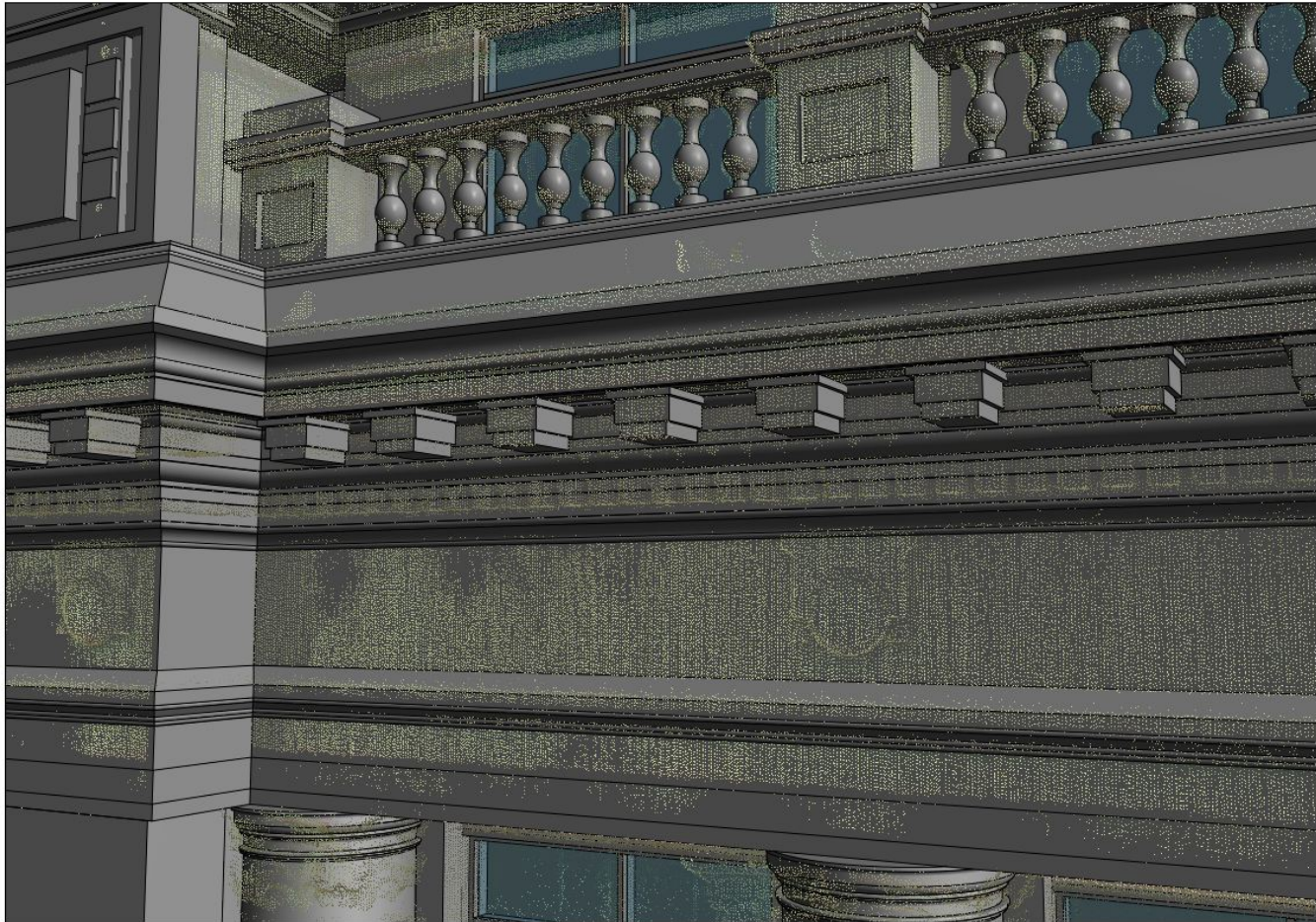# Going from LiDAR to BIM

Going from LiDAR to BIM

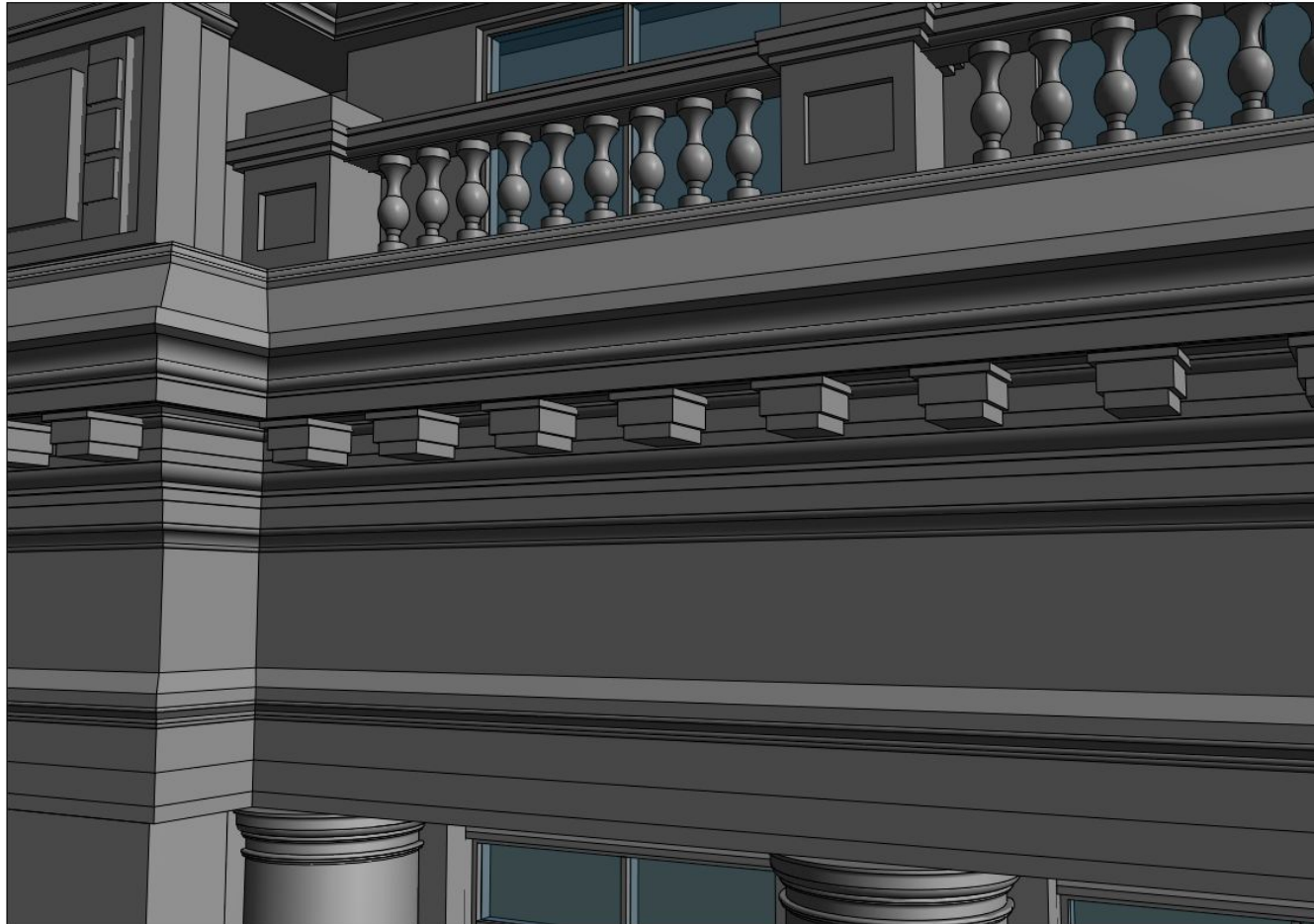# Going from LiDAR to BIM: Capturing Detailed Information from a Distance

Scan

Going from LiDAR to BIM: Capturing Detailed Information from a Distance
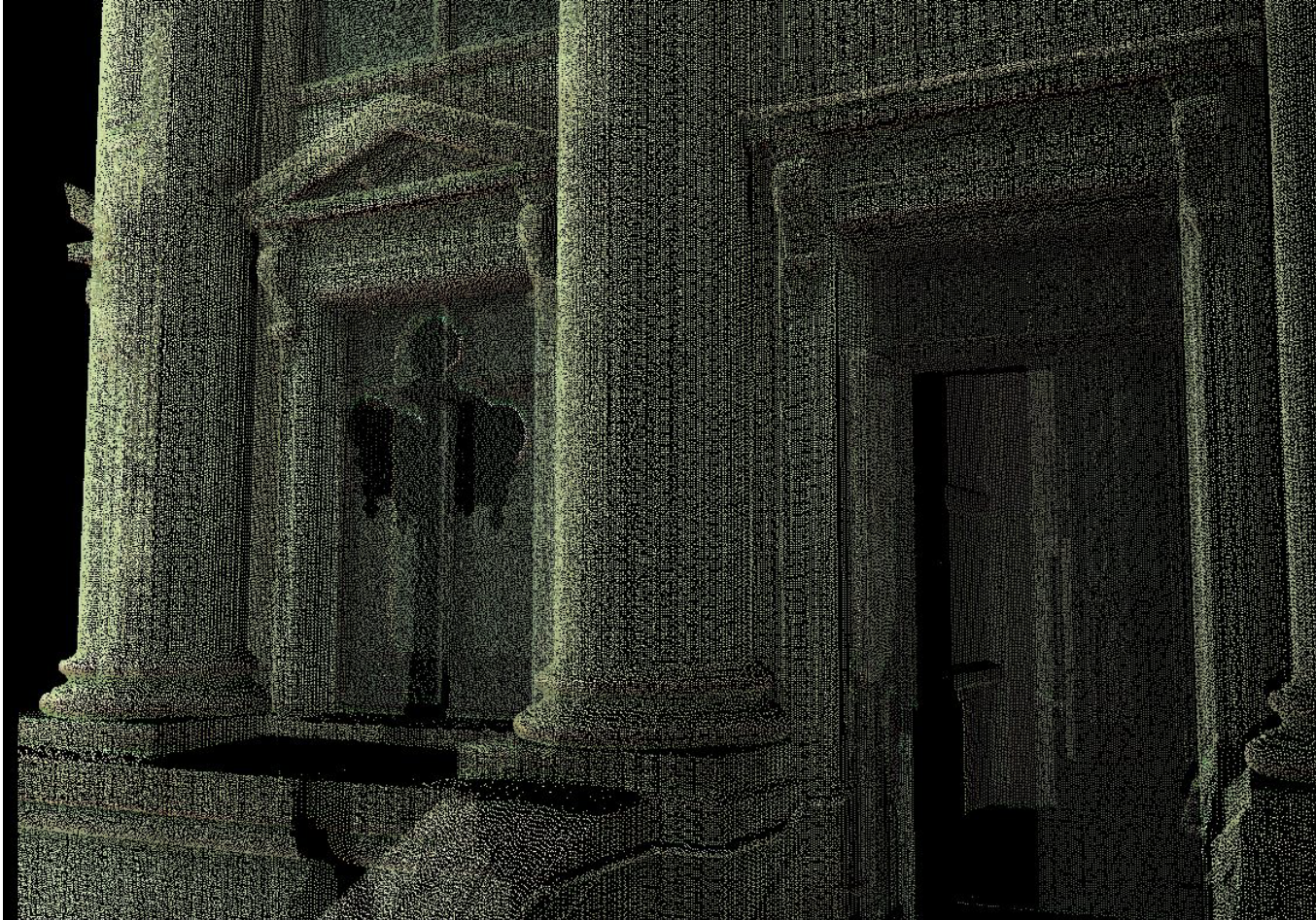

Model from scan

Going from LiDAR to BIM: Capturing Detailed Information from a Distance

Model

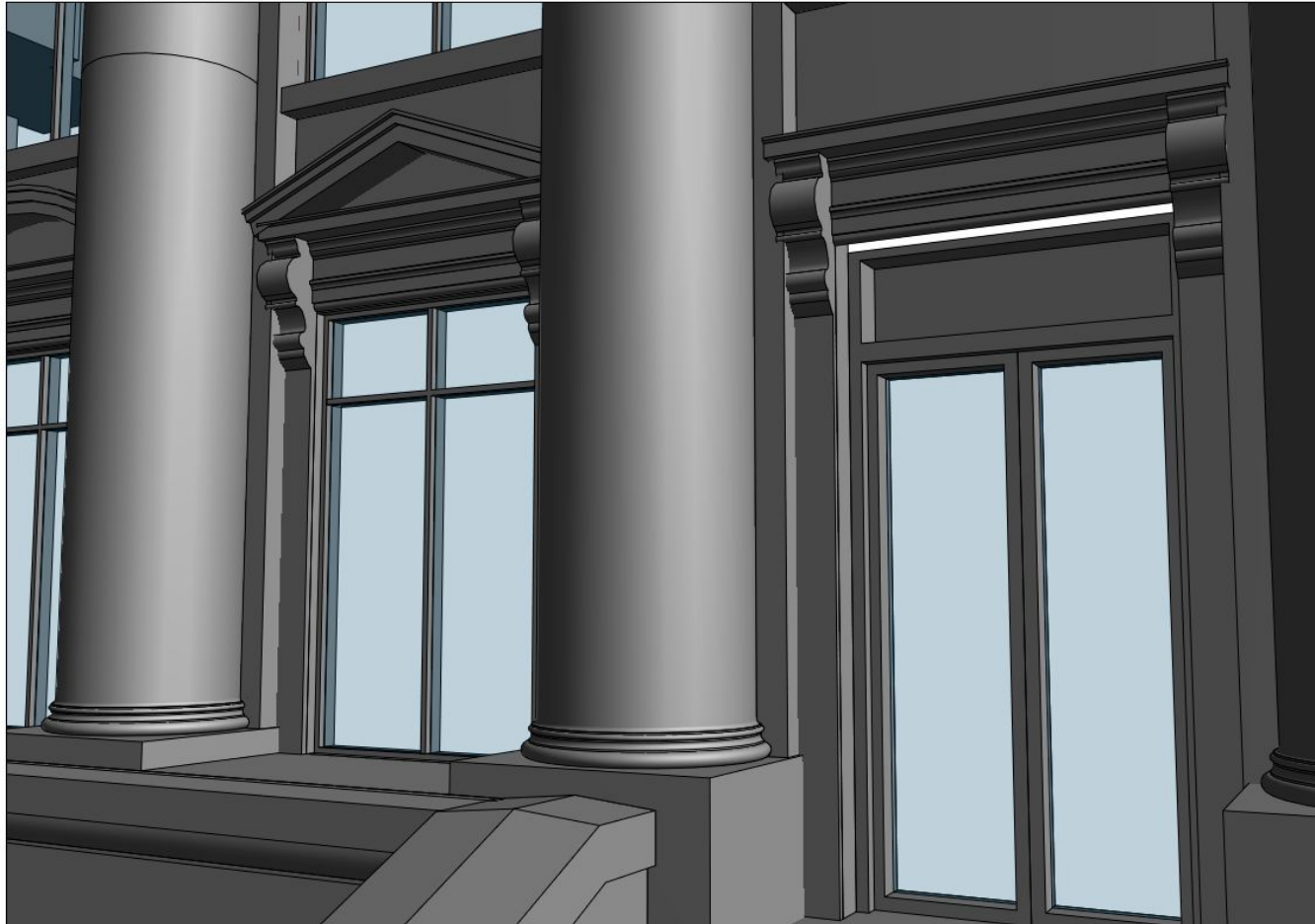# Going from LiDAR to BIM: Quickly Capturing Intricate Detail

Scan

Going from LiDAR to BIM: Quickly Capturing Intricate Detail
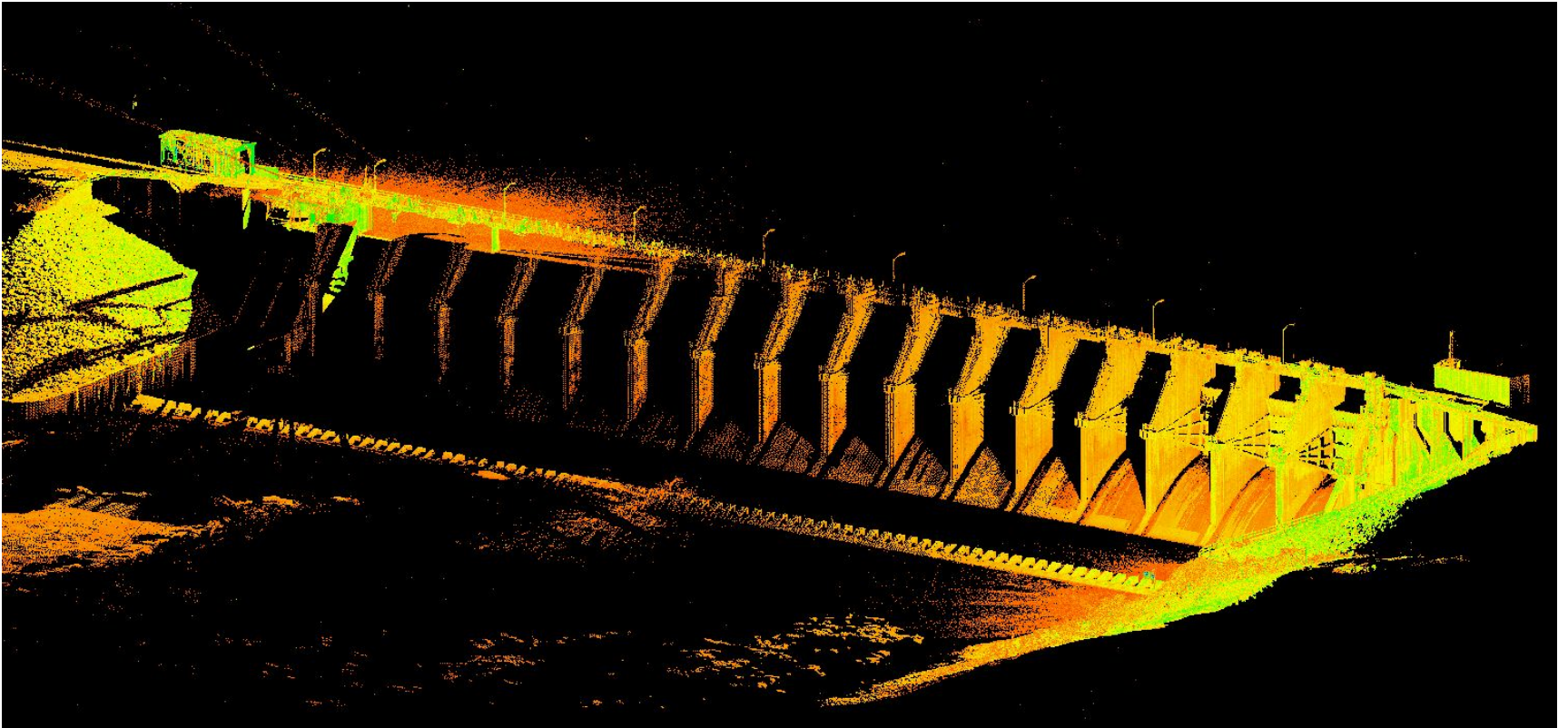

Model from scan

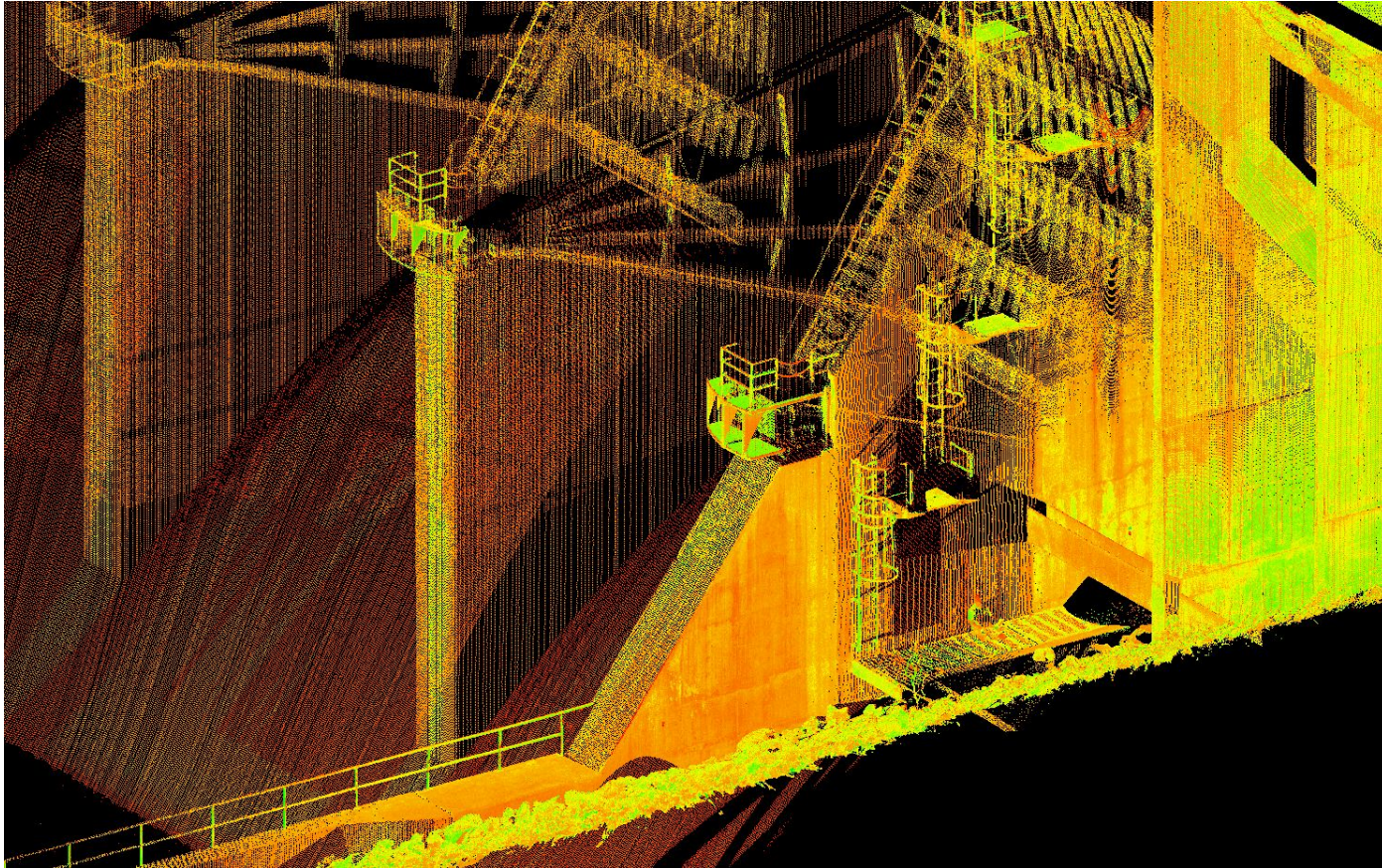# Going from LiDAR to BIM: Quickly Capturing Intricate Detail

Model

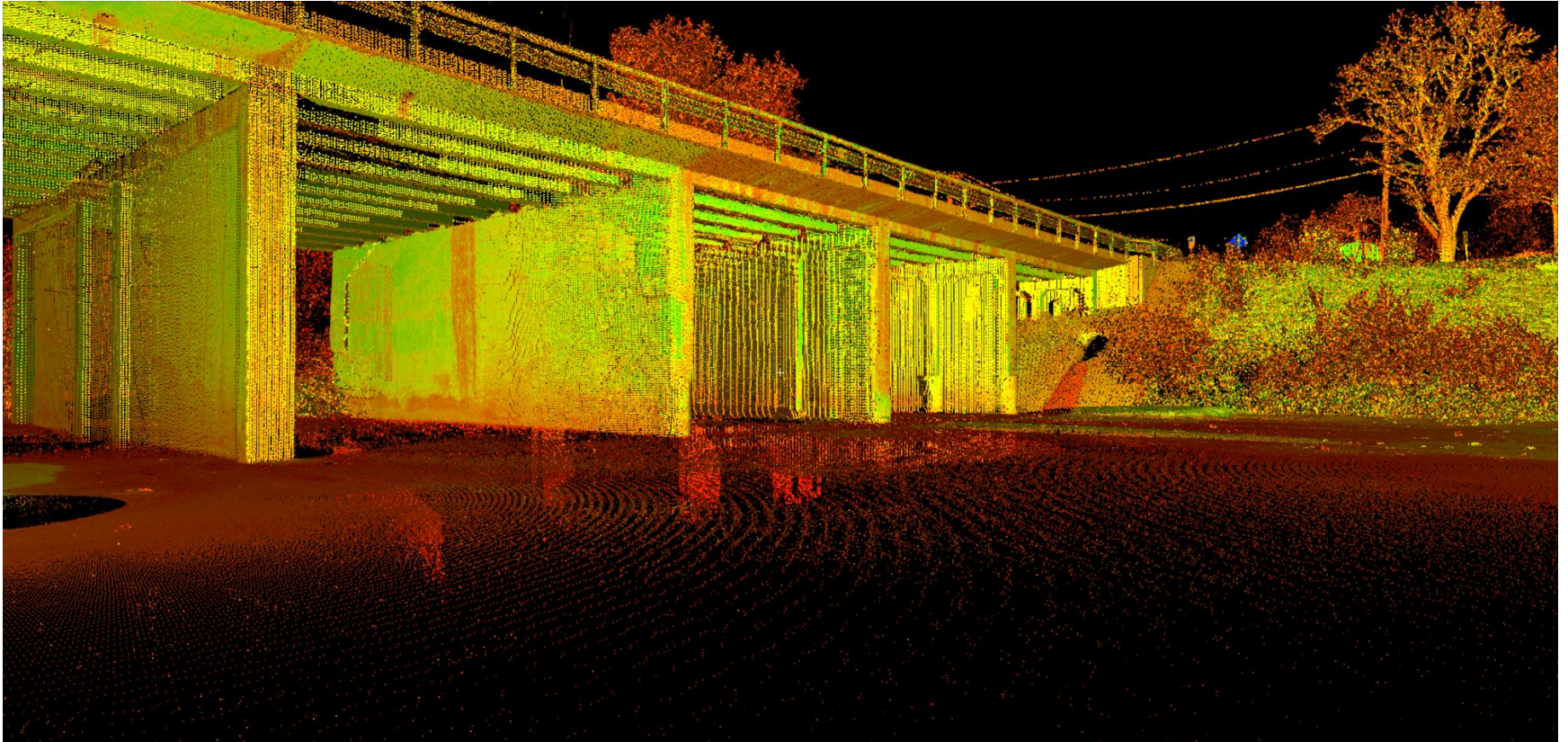# LiDAR Captures Vast Amounts of Data Safely and Quickly

Limitation: LiDAR cannot scan below the water surface

LiDAR Captures Vast Amounts of Data Safely and Quickly

Rip-rap slope adjacent to spillway scanned without walking across rocks.

LiDAR: A Safer Way to Measure

The majority of a bridge can be documented from the banks rather than from a boat or scaffolding.

Benefits of using LiDAR

- Millions of highly accurate points ready to be modeled (relative accuracy is ¼ in at 500 ft)
- Measuring from safer areas of the facility
- Reduction in return fields trips for additional measurements
- Point cloud data can be imported and modeled in 3D software

Mobile Apps

Tablet Tasks

- Observation Reports

- Condition Assessments

- Video Conference/Mobile Meetings

- Presentations/Client Meetings

- Reference Material

Applications

- PDF Annotation
- Photo Annotation
- Photo to PDF Conversion
- SD Card w/ Wireless Transfer
- Word Processor
- Cloud-based Document Editor

- Data Presentation Tool
- Online Meeting & Conference Calls
- File Sharing/Access
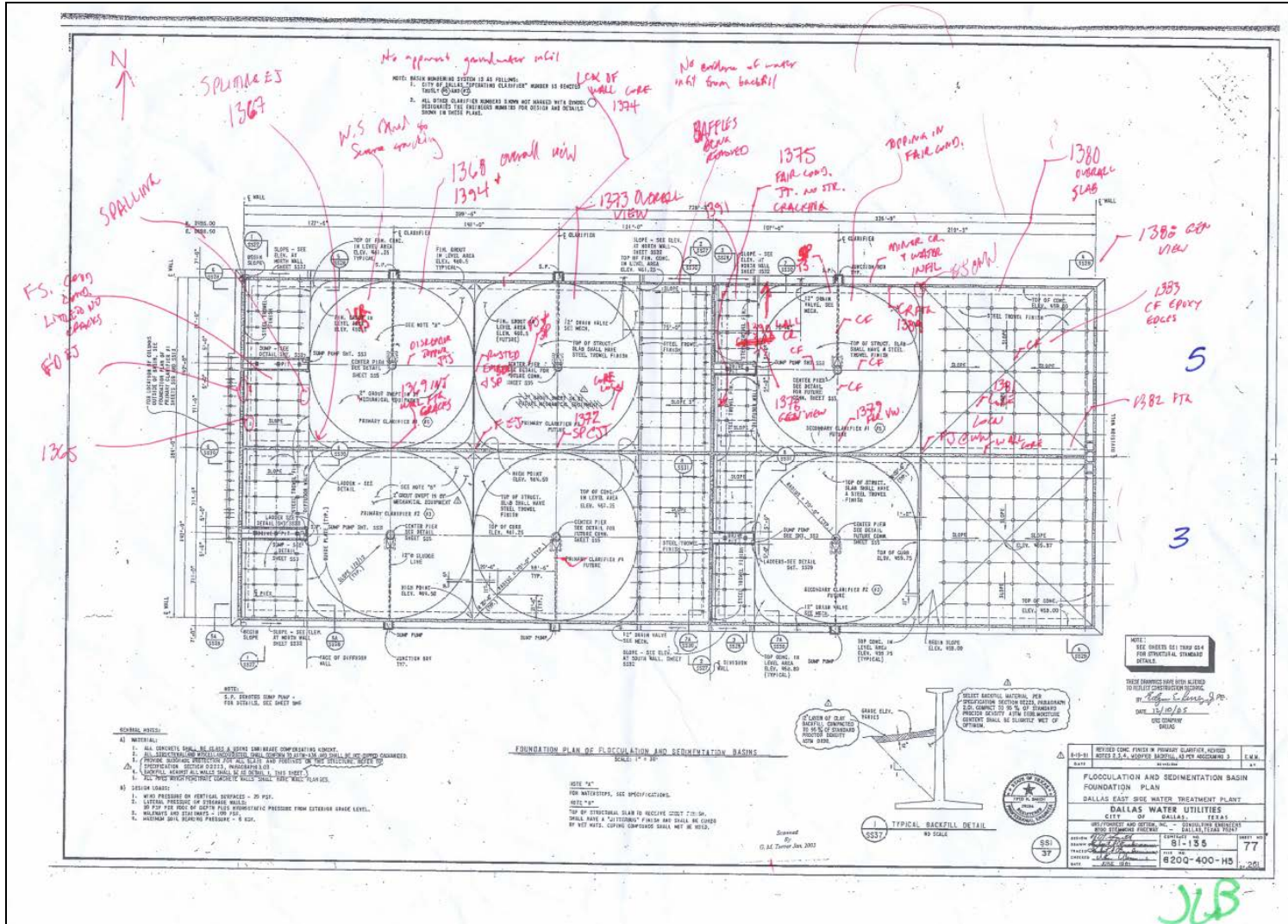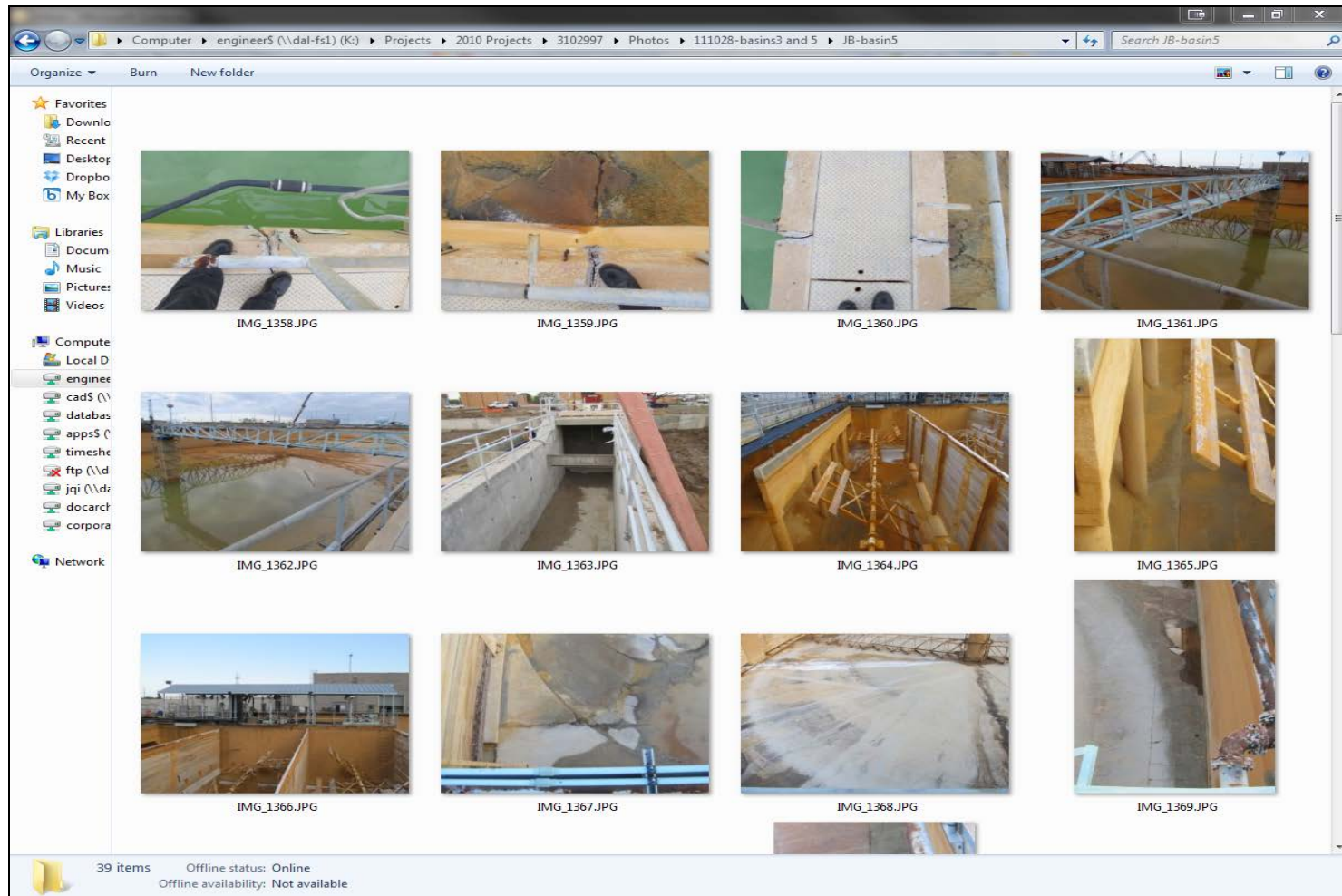- Remote Desktop/VPN Connection
- 2D & 3D Model Viewer
- Model Visualization

PDF Annotation

- Allows markup of PDF, word processor and data presentation files
- Photo, video, audio, comments, markups
- Cloud-based file sharing compatible
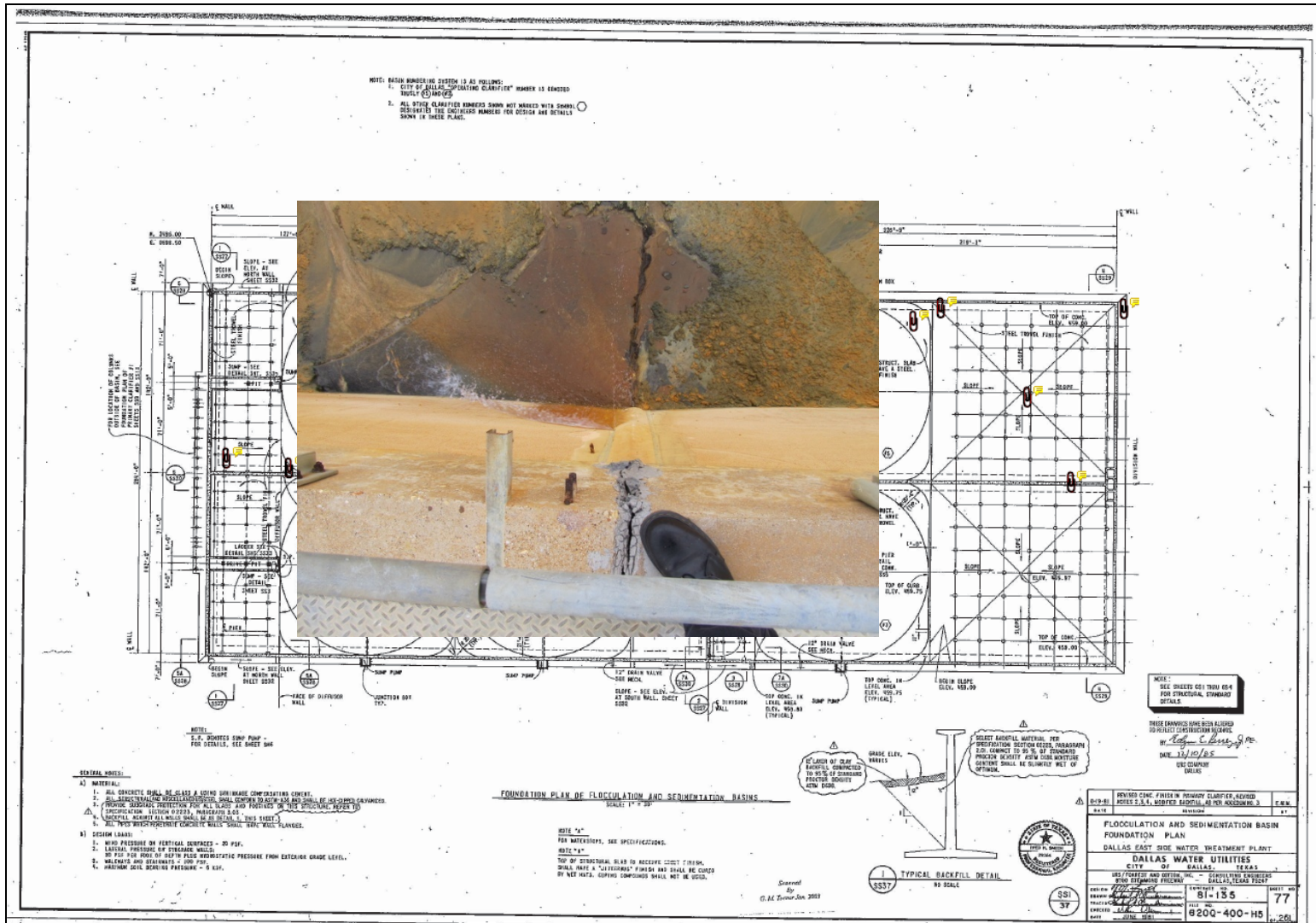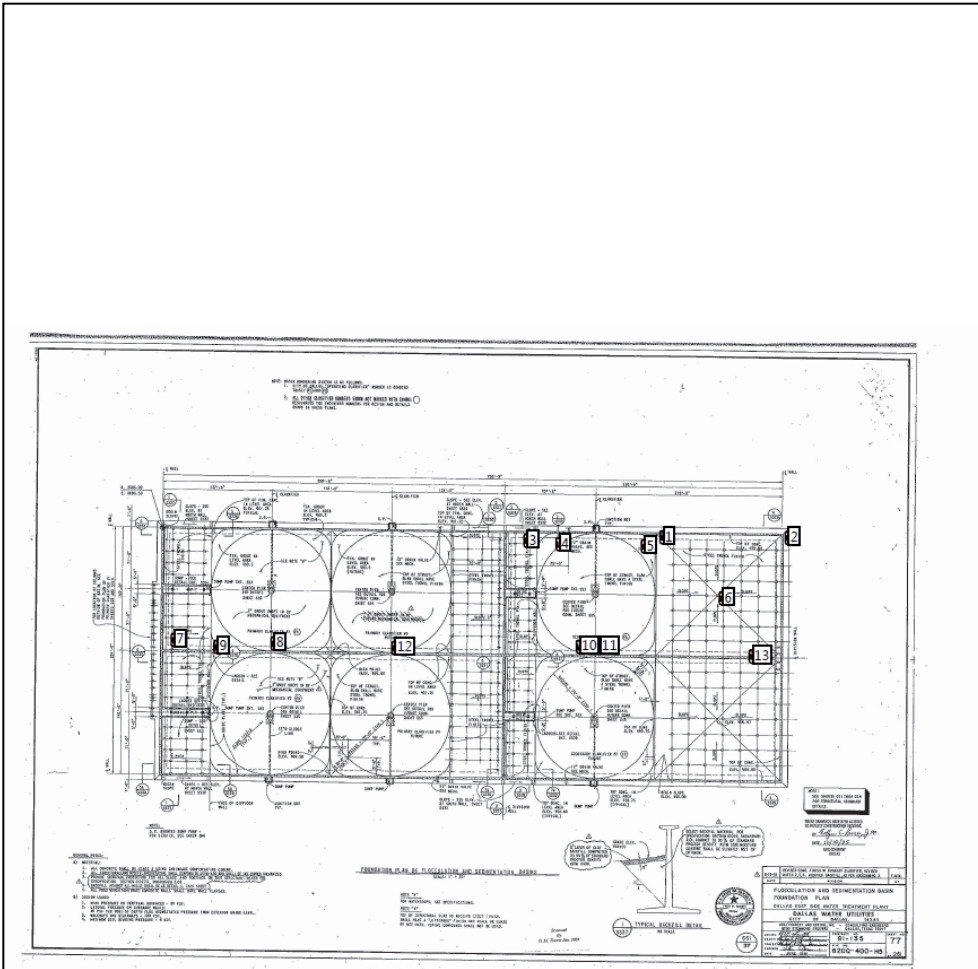- Email files of 8 MB or less

PDF Annotation Example - Before

PDF Annotation Example - Before

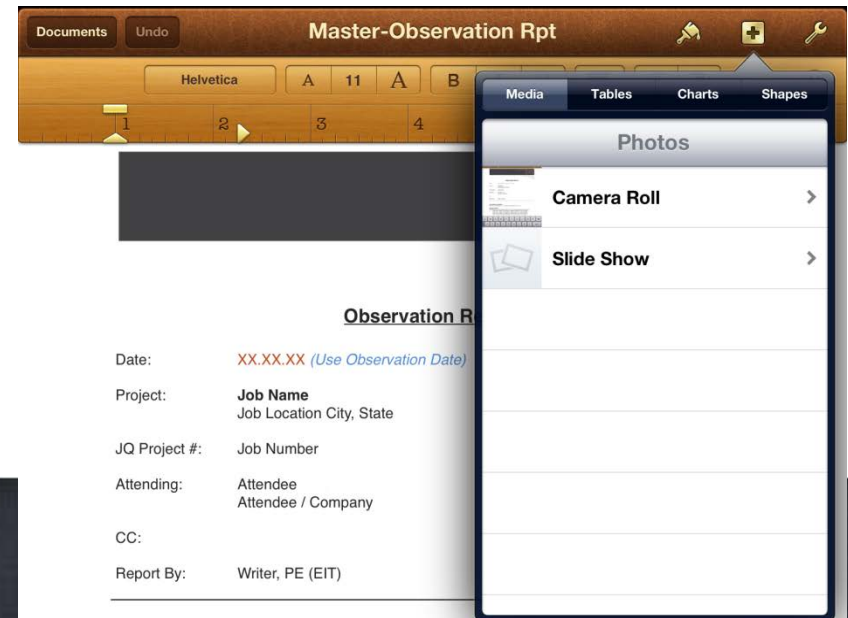# PDF Annotation Example - After

PDF Annotation Example - After

Word Processor

- Create new documents
- Preload standard forms
- Email, .doc, .pdf export

Photo Markup - Before

Photo Markup - After

Photo to PDF Conversion
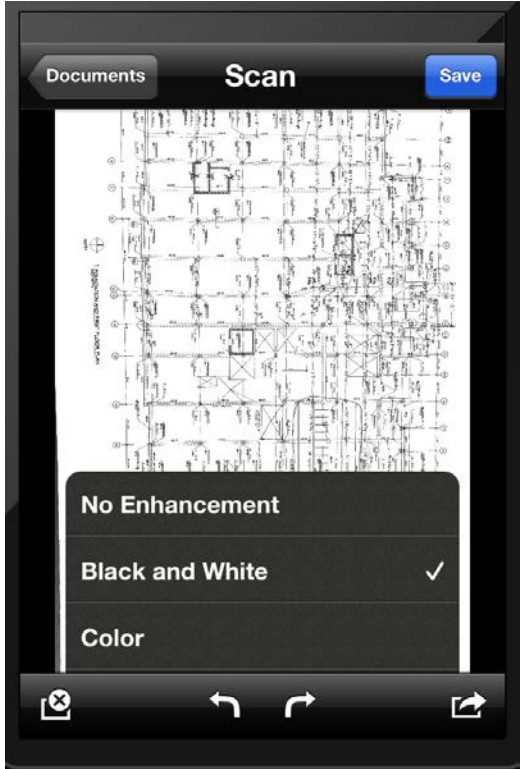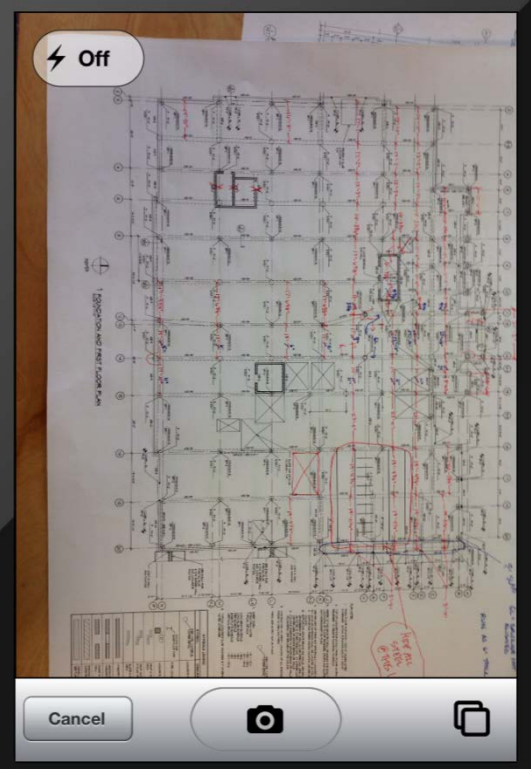
SD Card with Wireless Transfer

- SD card with built-in Wi-Fi

- Photos from existing cameras instantly uploaded to tablet

- If Wi-Fi not available, app turns tablet data plan into Wi-Fi for photo transfer only

- Greatly decreases camera and tablet battery life

Cloud-based Document Editor

☐ Access and modify files from file sharing accounts in PC-based processors

☐ Edit word processor, spreadsheet and data presentation files

☐ Must have internet connection, preferably Wi-Fi

Data Presentation Tool

- Upload data presentation to account

- Connect tablet to TV/projector

- Touch slide on tablet screen for digital laser pointer

- Use smart phone as remote

- Data presentation also possible via PDF viewer app

Online Meeting and Conference Calls

- Field correspondence, attend online meetings, and conference calls over Wi-Fi or data plan
- Host meetings (Wi-Fi preferred)
  - File sharing
  - View web browser
  - Markup on whiteboard
- Free account to account phone calls
- Paid version
  - Unlimited calls to US and Canada
  - Group video calls
  - Group screen share

File Sharing/Access
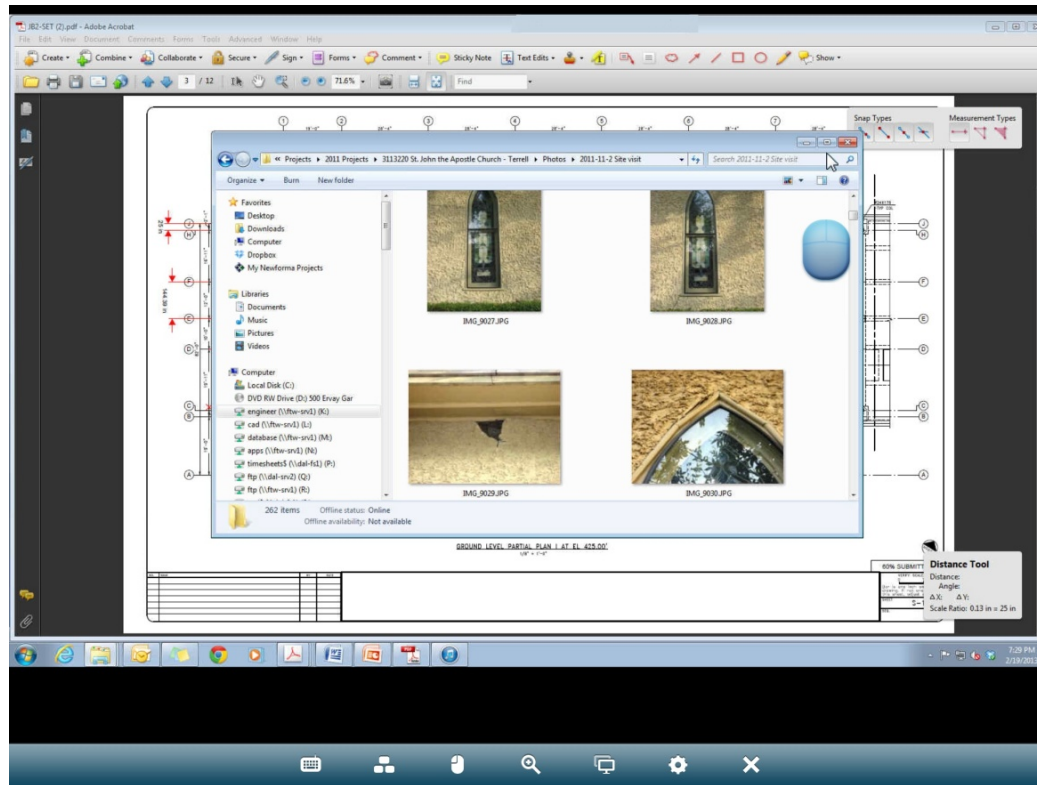
- Add file to file sharing folder on computer; accessible via app or website

- Photos auto-upload from camera roll on tablet or smart phone

- File-sharing folder can be on hard-drive or network drive, depending on app

File Sharing/Access
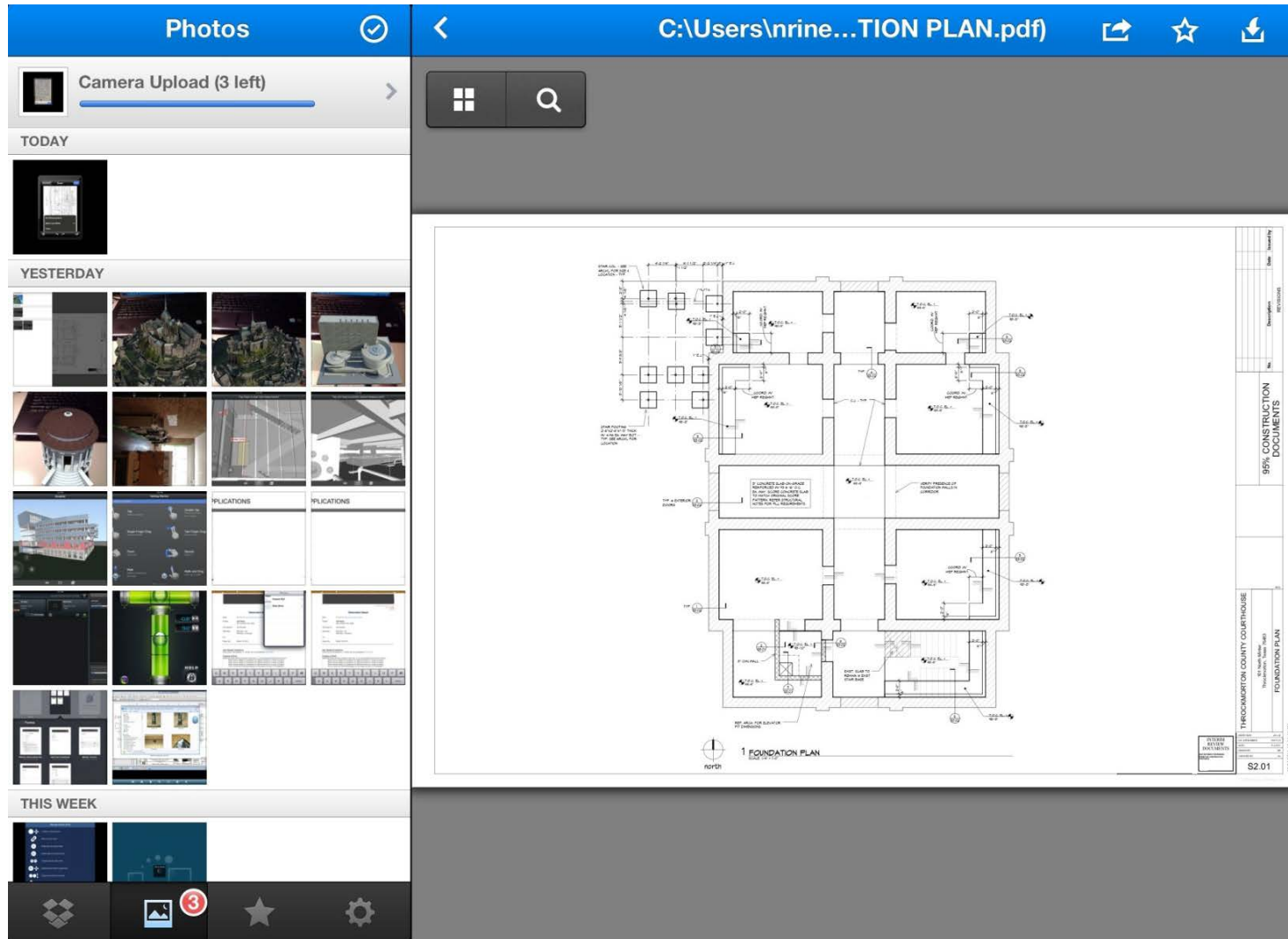
Remote Desktop/VPN Connection

- Free version allows remote access to desktop
- Paid version allows videos, remote sound, remote-to-local printing, file sharing

2D & 3D Model Viewer

- ☐ View and markup 2D and 3D models

- ☐ Upload model files to website

- ☐ Model markups tracked for easier coordination

- ☐ Need internet connectivity (Wi-Fi or data plan)

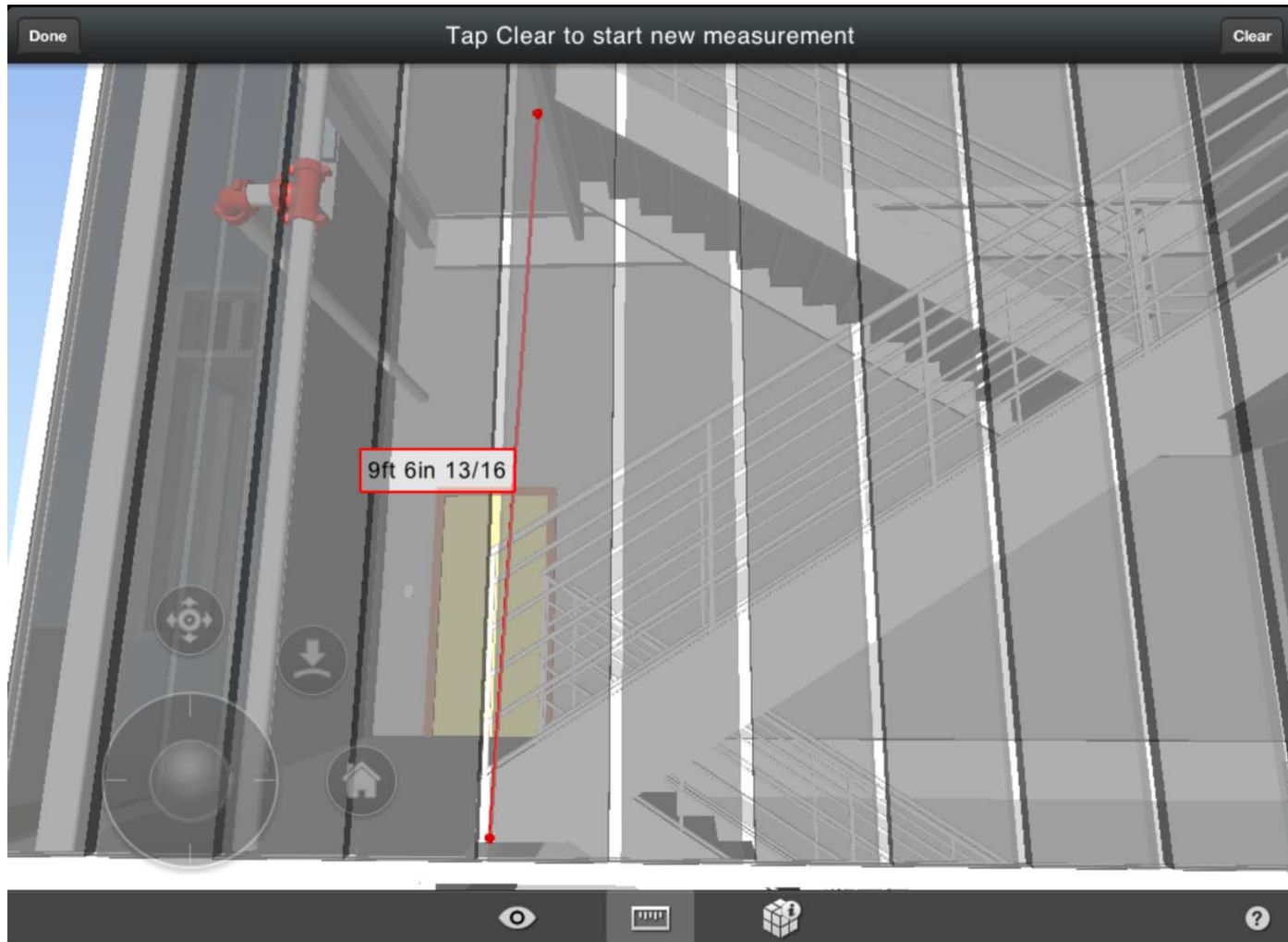# 2D & 3D Model Viewer

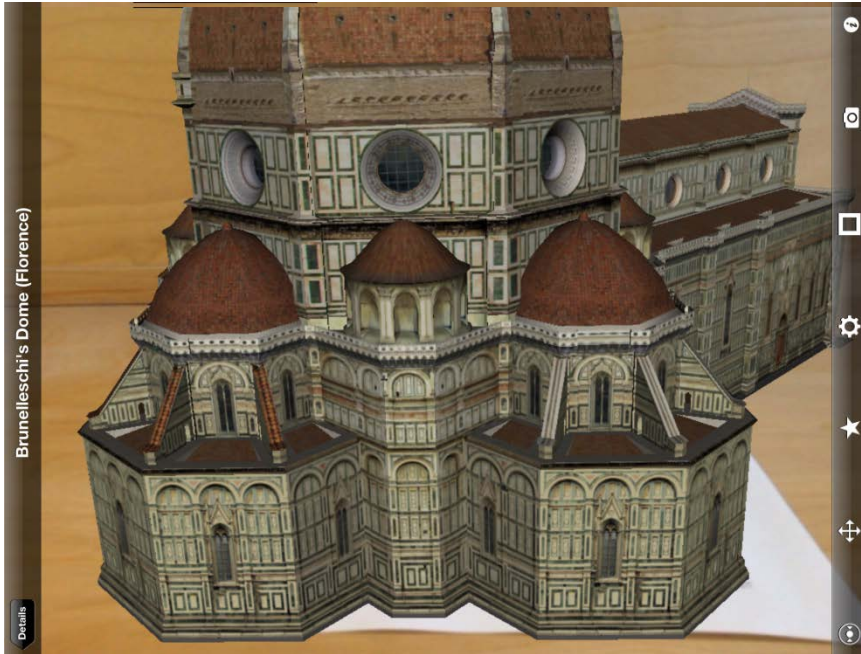# 2D & 3D Model Viewer

2D & 3D Model Viewer

Model Visualization

- Create model visualization file from Building Information Modeling (BIM) file
- Geolocate models
- Free viewer app
- Paid version for model creator

Model Visualization

Questions?