Bentley

Joey Coco

CEO, Forte & Tablada / Digi-Twin Global

Illuminate 2025 Atlanta

Public Works Digital Twin Case – New Orleans Hurricane Risk Reduction System Pilot

Presented By: Russell “Joey” Coco, P.E., MBA

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FORTE & TABLADA

INTRODUCTION

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Cell: 225-921-3841
jcoco@forteandtablada.com

INTRODUCTION AND LEARNING OUTCOMES

1. What is a Digital Twin (DT) model?
2. Steps in creating a data-federated Digital Twin model
3. Engineering applications of a Digital Twin model

OUTLINE OF PRESENTATION

- Flood Protection Authority's responsibility and HSDRRS
- Definition of a Digital Twin (DT)
- Engineering & Operational use of a Digital Twin model
- Background of Digital Twin Pilot Study at 17th street canal pump station
- Field coordination and data collection
- Development of base Digital Twin model
- Static & Dynamic data type and their federation
- Engineering application of the DT model
- Key Takeaways & Lessons learned

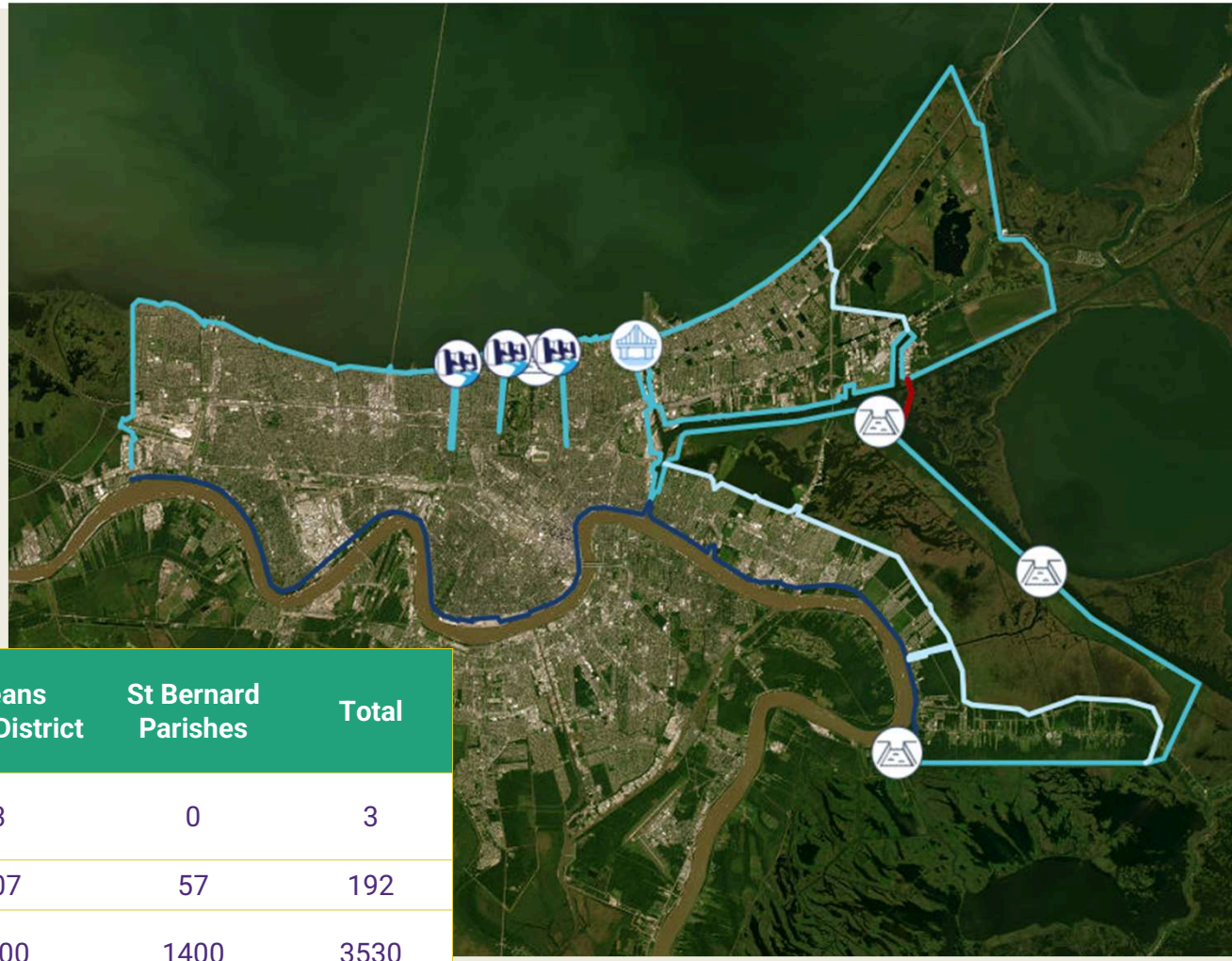
Flood Protection Authority's Responsibility and HSDRRS

Role and Mission of the Flood Protection Authority

Components of the Hurricane Storm Damage Risk Reduction System (HSDRRS)


GREATER NEW ORLEANS HURRICANE AND STORM DAMAGE RISK REDUCTION SYSTEM (HSDRRS)
US Army Corps of Engineers
17th Street Outfall Canal PCCP
Seabrook Floodgate Complex
New Orleans East I-10 Crossing
Bonnabel Pump Station Lakefront Levee
IHNC Surge Barrier Wall
St. Bernard Floodwall
Harvey Canal Floodwall
West Closure Complex
Eastern Tie-In
Lake Pontchartrain
Lake Borgne
Mississippi River
EASTERN NEW ORLEANS
NEW ORLEANS
KENNER
NORCO
DESTREHAN
ST ROSE
AMA
LULING
HARAHAN
WESTWEGO
MARRERO
HARVEY
GRETNA
ALGIERS
ARABI
CHALMETTE
MERAUX
VIOLET
ENGLISH TURN
BRAITHWAITE
CAERNARVON
SEBASTOPOL
KENILWORTH
VERRET
REGGIO
ALLUVIAL CITY
BELLE CHASSE
SCARSDALE
BERTRANDVILLE
IHNC LOCK
ALGIERS LOCK
HARVEY LOCK
GIWW
N

SOUTHEAST LOUISIANA FLOOD PROTECTION AUTHORITY - EAST



Infrastructure Component	East Jefferson Levee Districts	Orleans Levee District	St Bernard Parishes	Total
Permanent Canal Closures & Pumps	0	3	0	3
Levee/Floodwall (miles)*	28	107	57	192
Levee Turn Maintenance Area (acres)	730	1400	1400	3530
Flood Gates (land based)	12	200	32	244
Navigable Floodgates	0	6	2	8

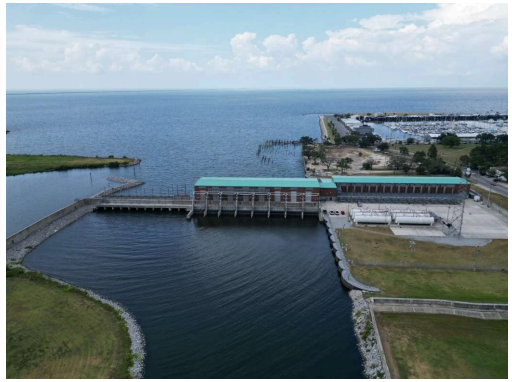
DIGITAL TWIN FOR 17th STREET CANAL PUMP STATION

Definition of an Infrastructure Digital Twin

- **Concept and Evolution of Digital Twins**
  - Virtual representations of physical objects/processes.
  - Evolved from CADD > GIS > BIM > Laser Scanning.
  - Not just a 3D Model

- **Types of Digital Twins in Infrastructure**
  - Categories: component, asset, system twins.

A Digital Twin is a virtual representation of a real-world entity or asset, synchronized with static and dynamic data.



Engineering

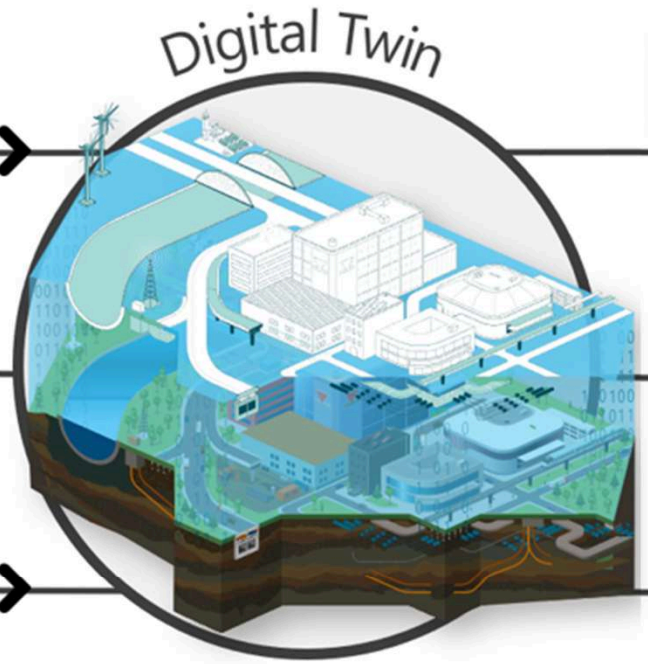
- Specs
- Drawings
- Documents
- Models
- Analyses
- Geotech
- OEM specs

Operations

- IoT feeds
- Sensors
- Drones
- Cameras
- LiDAR
- Point clouds

Information

- Asset tags
- Work orders
- Maintenance records
- Inspection records



3D/XR
Immersive Visualization

4D
Timeline of Change

AI/ML
Analytics Visibility


Bypass Gates (Component)
Pump house (Component)
17th Street Station (Asset)
Generator Room (Component)
Fuel Farm (Component)
SLFPA- E (System) >

Engineering & Operational Use of a Digital Twin

- **Engineering Applications of Digital Twins**
  - Repository, direct measurability, spatial and conversational tools.
  - Quick start-up on new projects using old information.
- **Operational Benefits of Digital Twins**
  - Simulated training with multiple role/user profiles and stakeholder participation.
  - Real-time monitoring, predictive maintenance, and comparative analysis.
- **Integration of Digital Twin with Existing Systems**
  - Integrate with IoT devices, inventory databases, and asset management tools
  - SCADA and Controls – Robust Integration

Steps and Objectives of the Pilot Study

1. Field Data Capture → 2. Field Data Processing

2. Field Data Processing → 3. Base Model and Content Federation

3. Base Model and Content Federation → 4. Engineering Applications (Clash Detection Simulation)

4. Engineering Applications (Clash Detection Simulation) → 1. Field Data Capture

Field Data Capture

Skydio

Trimble

R2SONIC

RIEGL

dji

FARO

Field Data Processing

PHOTOGRAMMETRY

DJI M350 W/ P1 CAMERA, SKYDIO 2+

4	IMAGES OBTAINED 22,763	450GB	10GB
LOCATIONS CAPTURED		OF PROJECT FILES	OF UPLOADED DATA

LIDAR

3	SCANS OBTAINED 442	335GB	15GB
FARO S350'S		OF RAW DATA & PROJECT FILES	OF EXPORTED POINT CLOUDS

EXTERIOR, PUMP ROOM, BASEMENT, & GENERATOR ROOM CAPTURED

CONTROL NETWORK

TRIMBLE S9 TOTAL STATION
TRIMBLE R12 GPS
LEICA LS15

32 CONTROL POINTS

EXISTING USACE NETWORK UTILIZED

DATUM LA SOUTH ZONE 1702 NAD83 (2011)
EPOCH (2010.00) GEOID 18

Metashape

Bentley®

HYPACK a xylem brand

FARO SCENE

QT Modeler

ContextCapture

Field Data Processing

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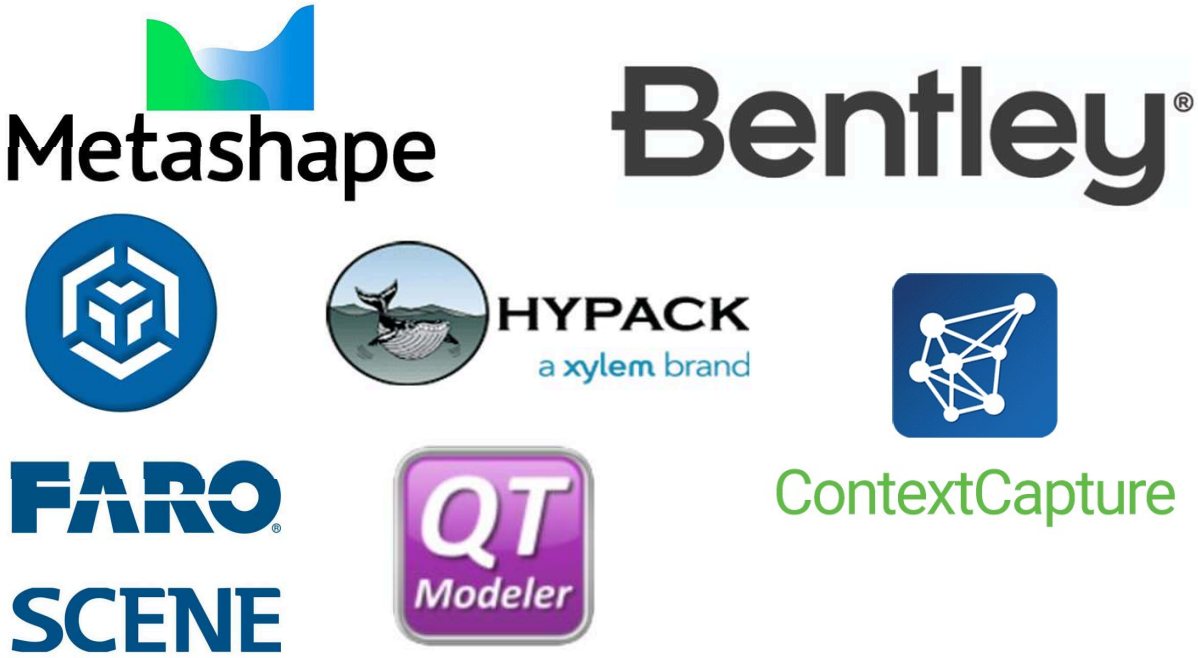
Field Data Processing



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EPOCH (2010.00) GEOID 18

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Bentley®

HYPACK a xylem brand

FARO SCENE

QT Modeler

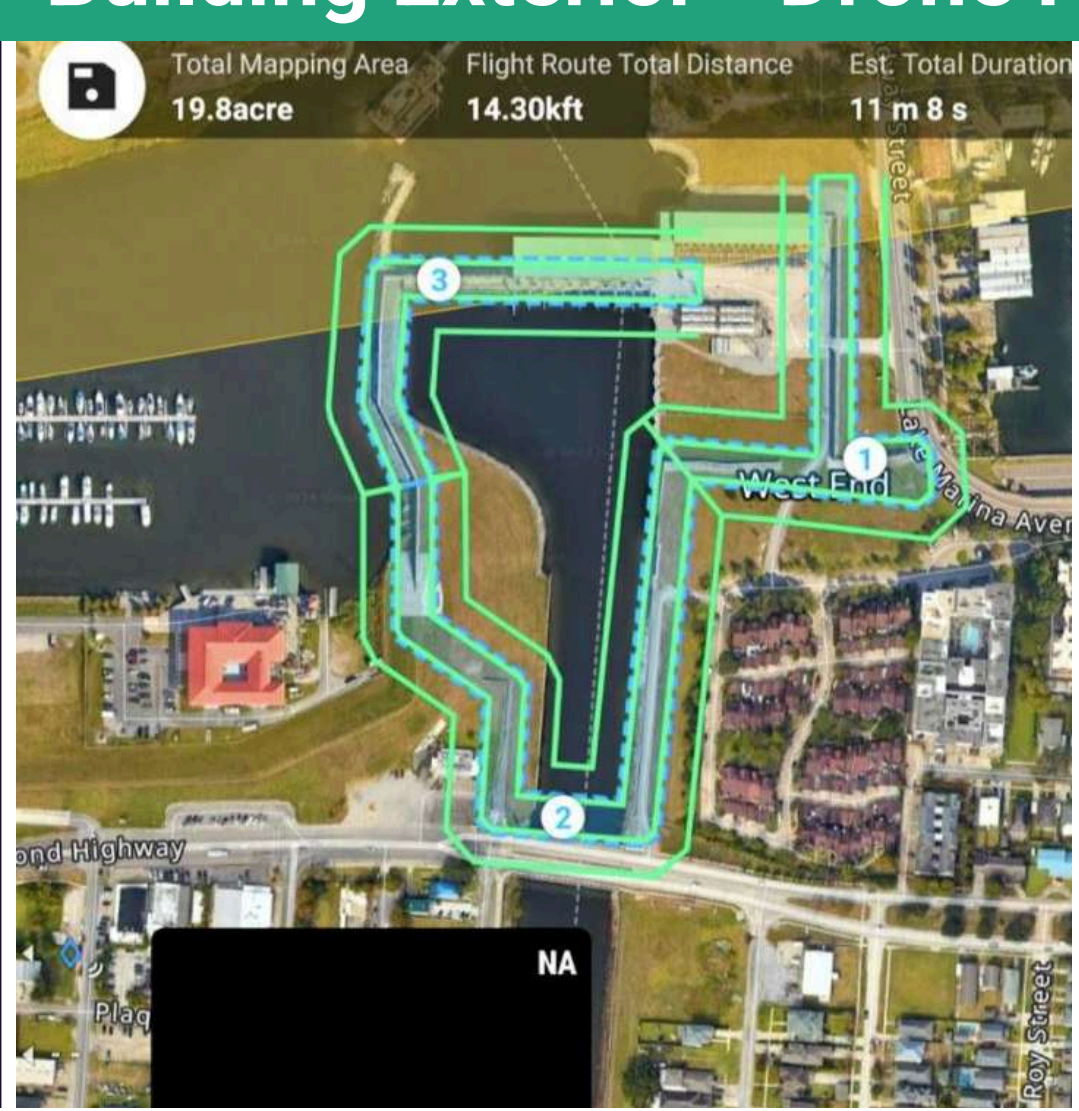
ContextCapture

Field Data Capture

Exterior Drone Photogrammetry

DJI M350 with Zenmuse P1 camera

Building Exterior - Drone Photogrammetry

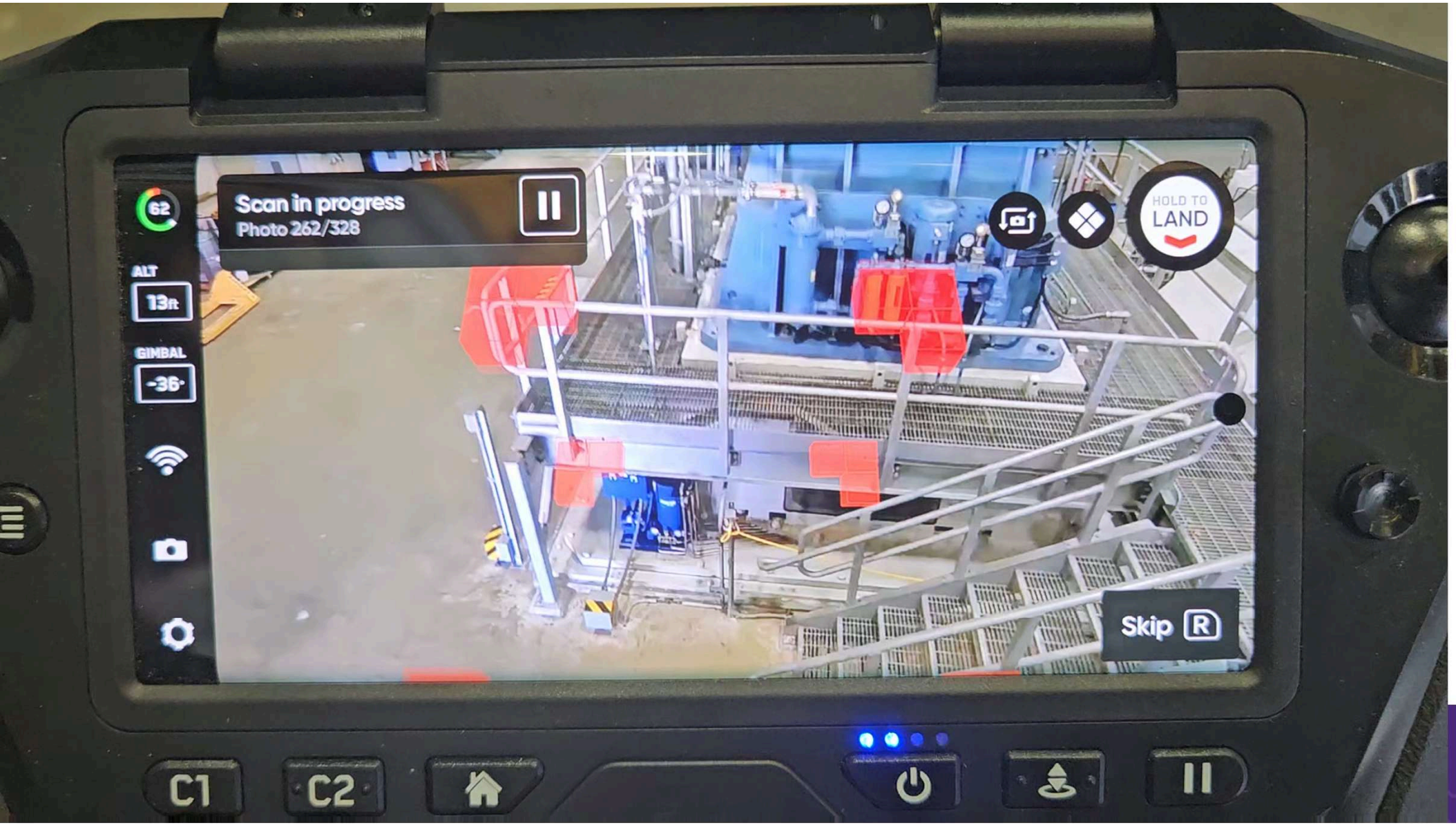


Field Data Capture

Interior Drone Photogrammetry

Skydio 2+


ABB
ABB
2

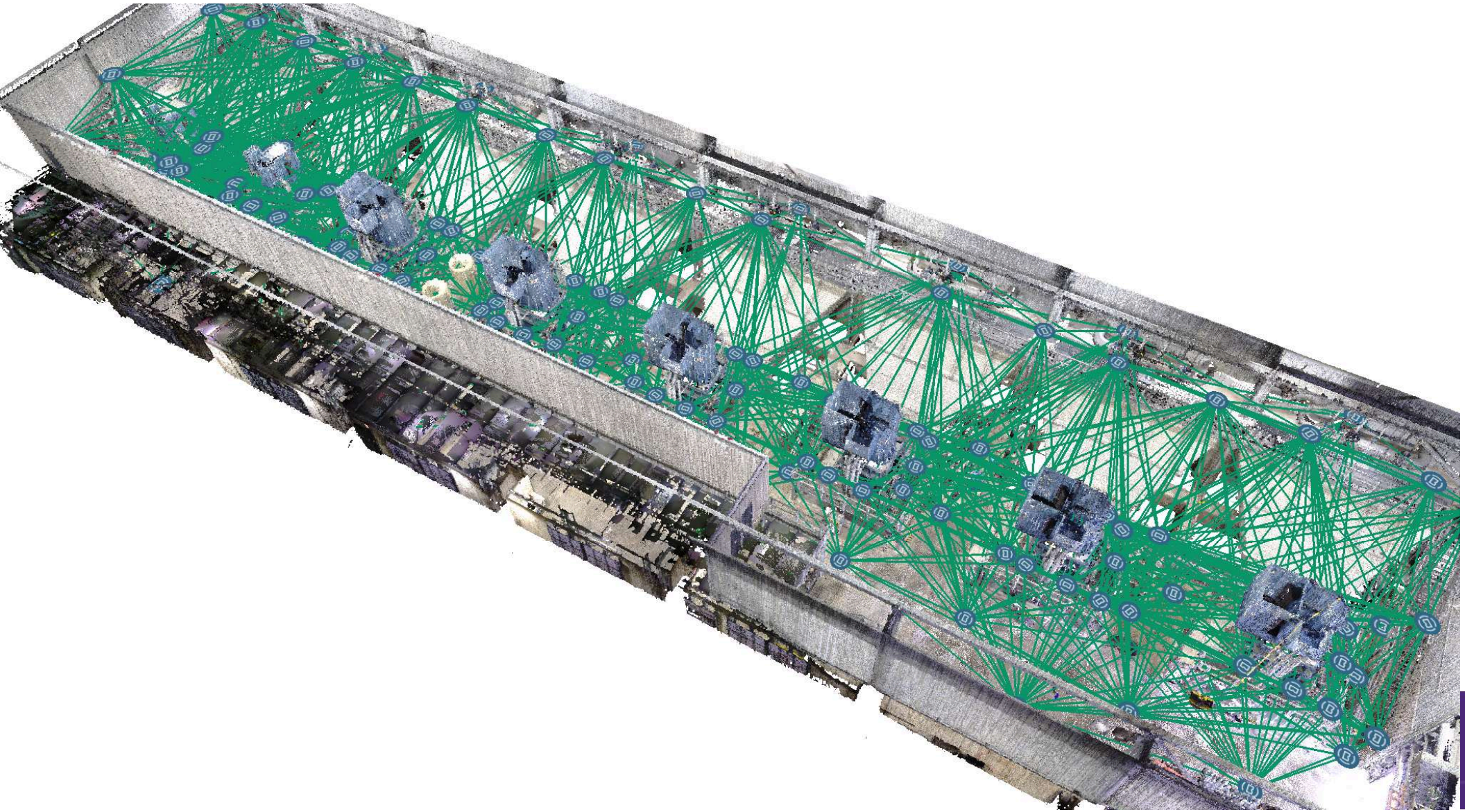

62
ALT
13ft
GIMBAL
-36°
Scan in progress
Photo 262/328
HOLD TO
LAND
Skip R
C1
C2


X
Y
CAT
CAT

Field Data Capture

Laser Scanning

Faro Focus S 330

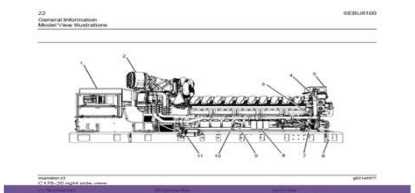


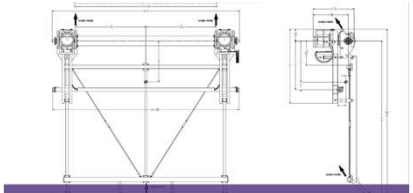
Static and Dynamic Data Type and Federation

- **Types of Static & Dynamic Data in Digital Twins**
  - Plans, Specs, Shop Drawings, Construction Photos, CADD Linework, Survey Data, Maintenance Records, O&M Manuals (PDF, dgn, dwg, pod, shp, kmz)
- **Federation of Static & Dynamic Data**
  - Broad to Focused: Systemwide > Asset > Element
  - Example, Entire FPA System > 17th Street Station > CAT Generator #2
- **Benefits of Federated Static & Dynamic Data**
  - Everything in one place instead of thousands of folders across stakeholders

Static and Dynamic Content


Construction Phase


CAT C175 Model


Climber Screen Diagram


Cofferdam


Pump Station Model

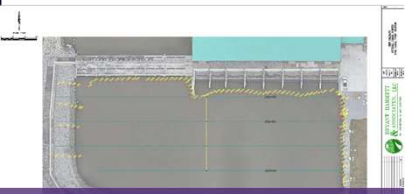

Pump Station Model

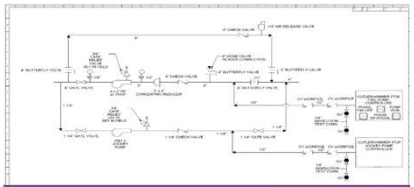

Metairie Canal Bathymetric

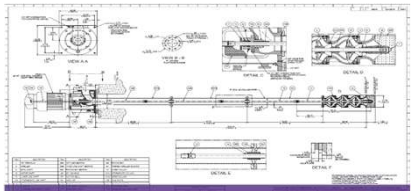

Bathymetric Survey

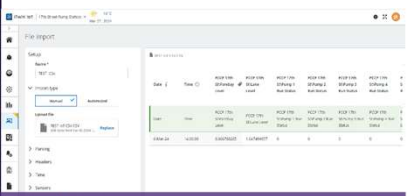

Canal & Outfall Cross Sections


Canal & Outfall Bathymetric

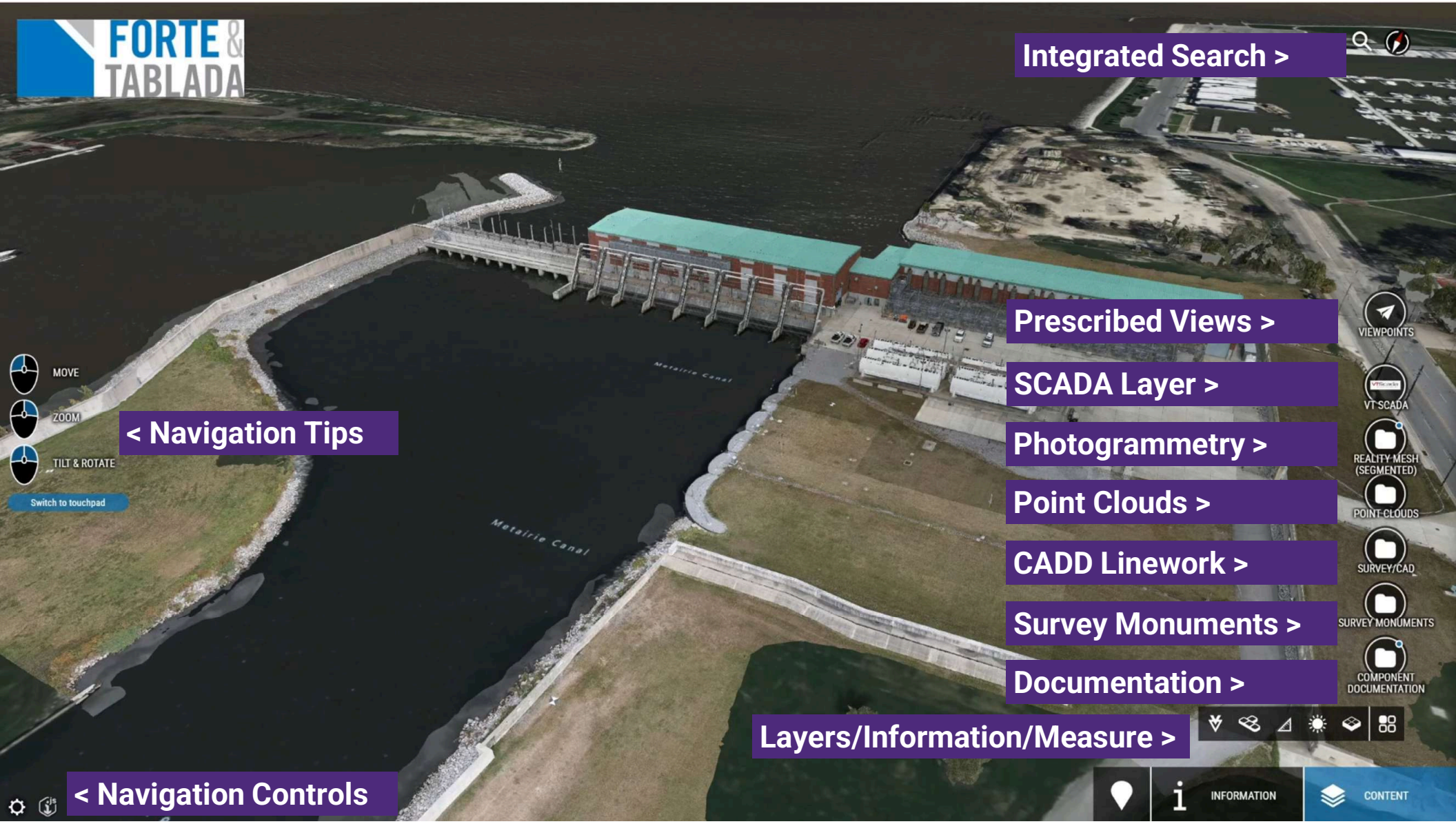

Intake Survey


CAT C175 Circuit Diagram

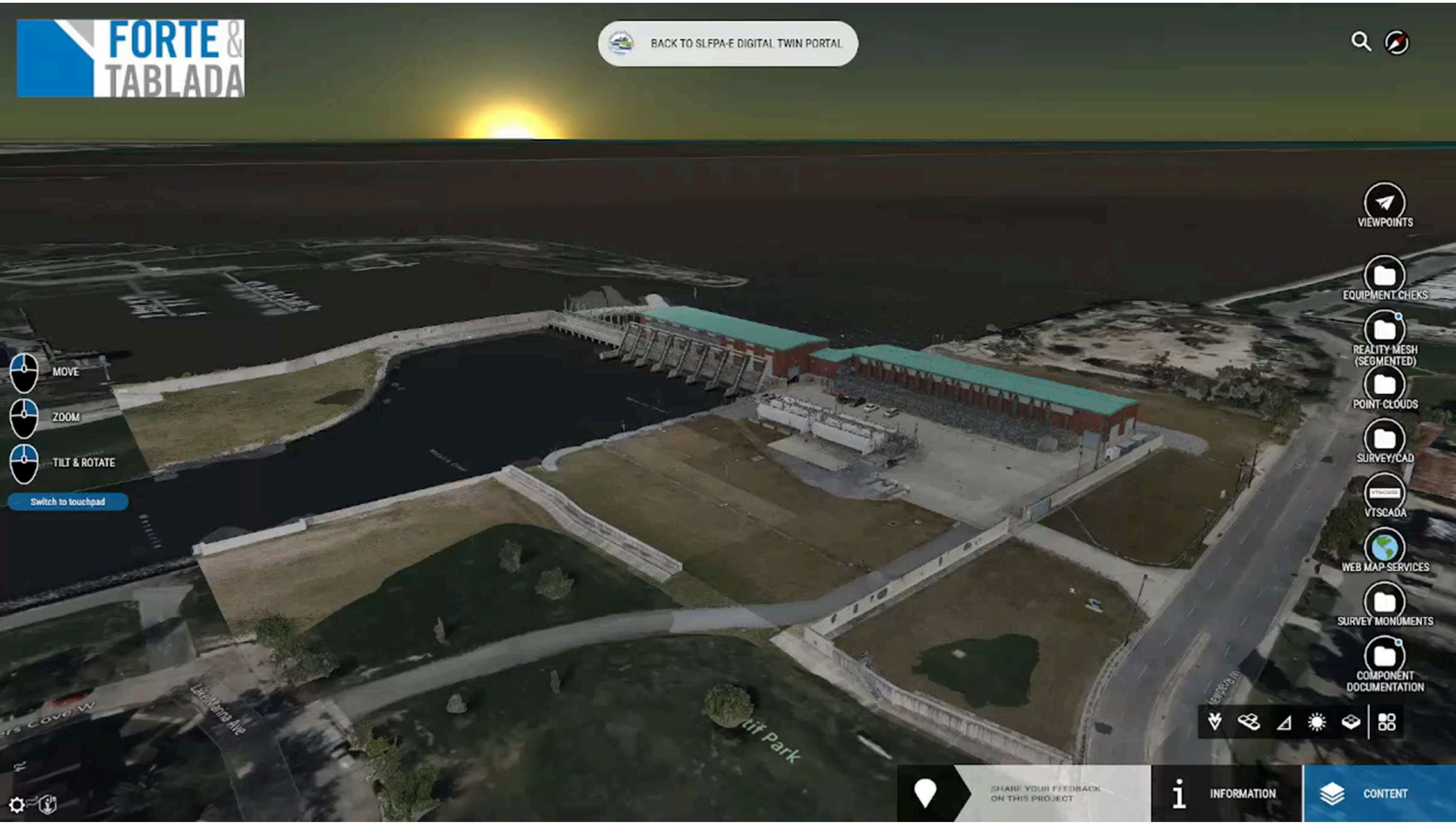

Patterson Pump Assembly


VTScada to iTwin IoT

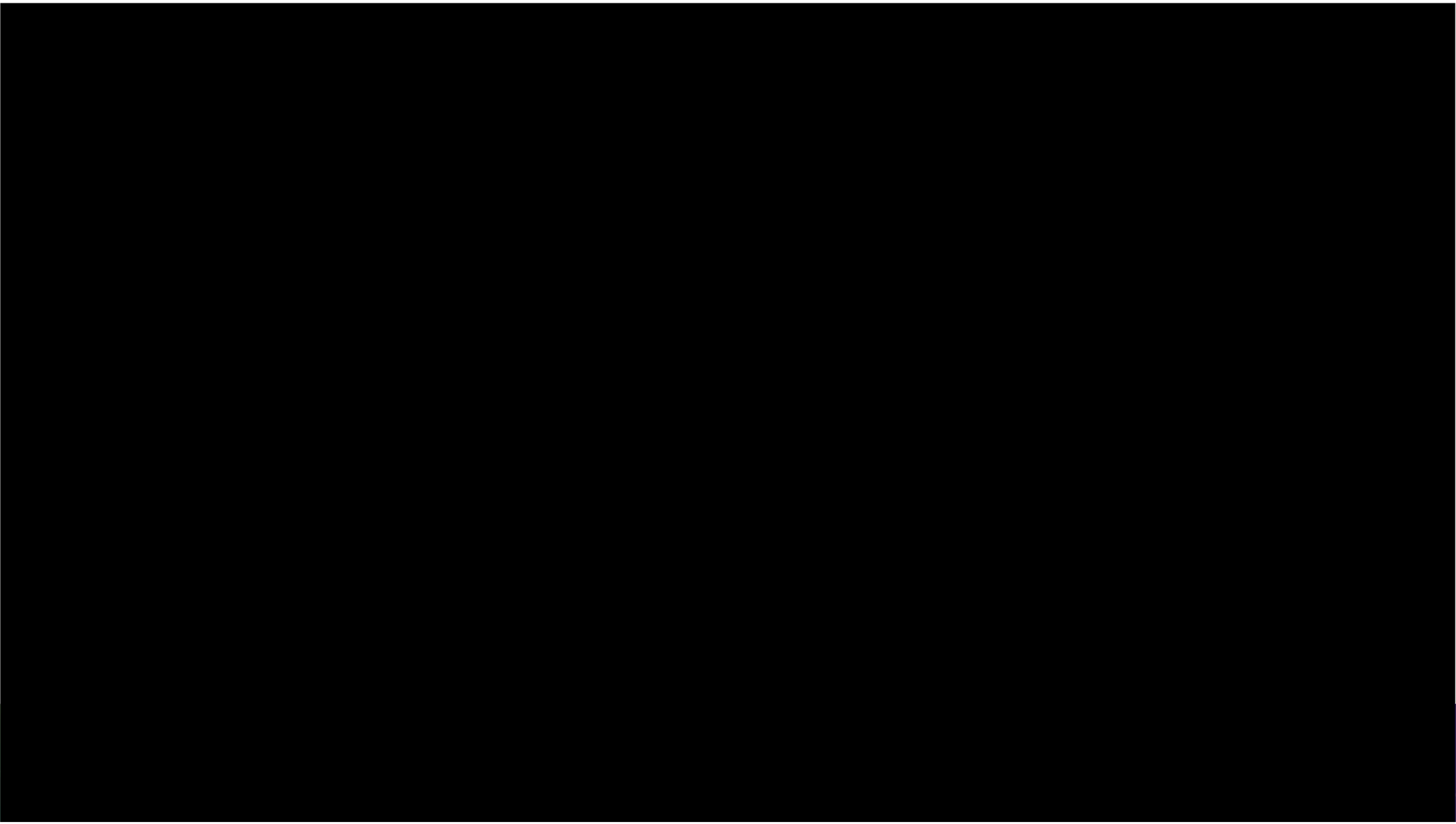
Base Model Development


FORTE & TABLADA
Integrated Search >
Prescribed Views >
SCADA Layer >
Photogrammetry >
Point Clouds >
CADD Linework >
Survey Monuments >
Documentation >
Layers/Information/Measure >
< Navigation Tips
< Navigation Controls
MOVE
ZOOM
TILT & ROTATE
Switch to touchpad
VIEWPOINTS
VT SCADA
REALITY MESH (SEGMENTED)
POINT CLOUDS
SURVEY/CAD
SURVEY MONUMENTS
COMPONENT DOCUMENTATION
INFORMATION
CONTENT
Metairie Canal

Exterior Base Model


FORTE & TABLADA
BACK TO SLFPA-E DIGITAL TWIN PORTAL
VIEWPOINTS
EQUIPMENT CHEKS
REALITY MESH (SEGMENTED)
POINT CLOUDS
SURVEY/CAD
VTSCADA
WEB MAP SERVICES
SURVEY MONUMENTS
COMPONENT DOCUMENTATION
MOVE
ZOOM
TILT & ROTATE
Switch to touchpad
Lake Marina Ave
tif Park
SHARE YOUR FEEDBACK ON THIS PROJECT
INFORMATION
CONTENT

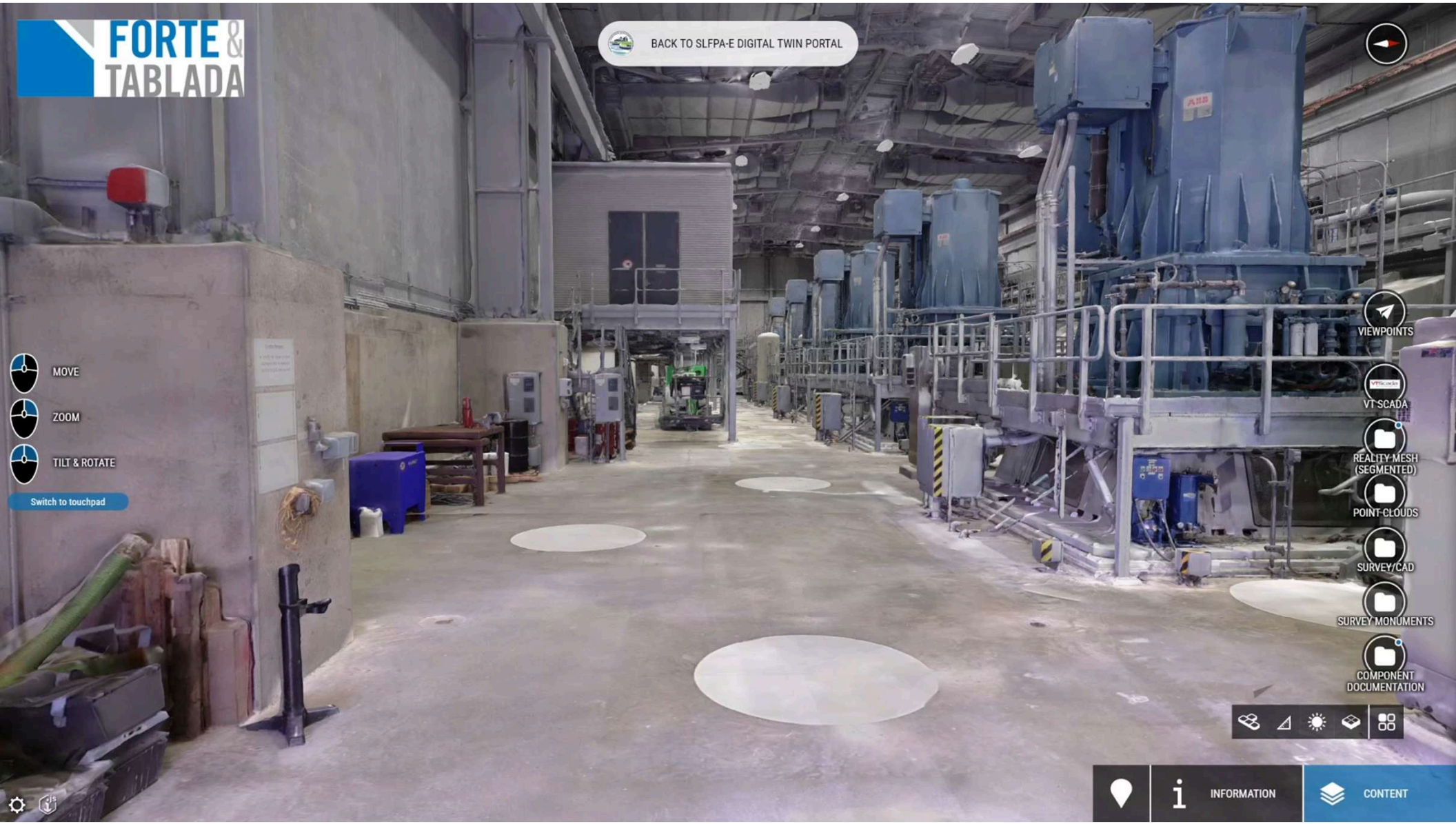
Interior Base Model



Engineering Applications of the DT model

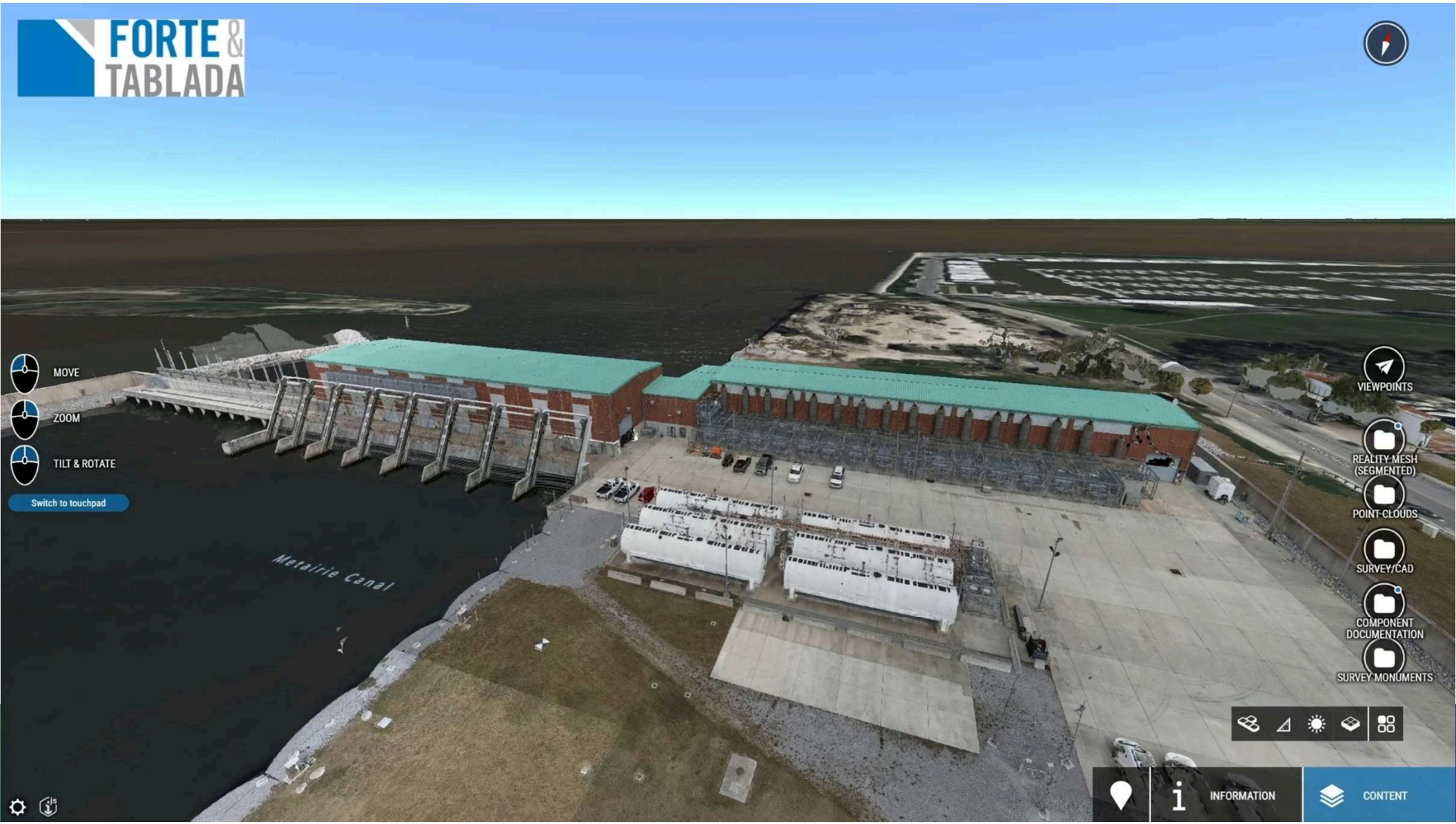
- **Direct Use of Static Content**
  - Easy access to manuals and reports
  - Direct query of base model (elevations, basic measurements)
- **Direct Use of Dynamic Content**
  - SCADA
  - Water level readings
- **Indirect Use of Model Content**
  - Native Data Analysis (Cadd, Point Clouds, Surveys)
  - Clash Detection, Time-Based Change, Detailed Extraction

Static Content Federation – Components


FORTE & TABLADA
BACK TO SLFPA-E DIGITAL TWIN PORTAL
MOVE
ZOOM
TILT & ROTATE
Switch to touchpad
VIEWPOINTS
VT SCADA
REALITY MESH (SEGMENTED)
POINT CLOUDS
SURVEY/CAD
SURVEY MONUMENTS
COMPONENT DOCUMENTATION
INFORMATION
CONTENT


FORTE & TABLADA
BACK TO SLFPA-E DIGITAL TWIN PORTAL
MOVE
ZOOM
TILT & ROTATE
Switch to touchpad
VIEWPOINTS
EQUIPMENT CHEKS
REALITY MESH (SEGMENTED)
POINT CLOUDS
SURVEY/CAD
VTSCADA
WEB MAP SERVICES
SURVEY MONUMENTS
COMPONENT DOCUMENTATION
HAVE QUESTIONS OR SUGGESTIONS?
INFORMATION
CONTENT
Lake Marina Ave

Static Content Federation – CADD Assets


FORTE & TABLADA
MOVE
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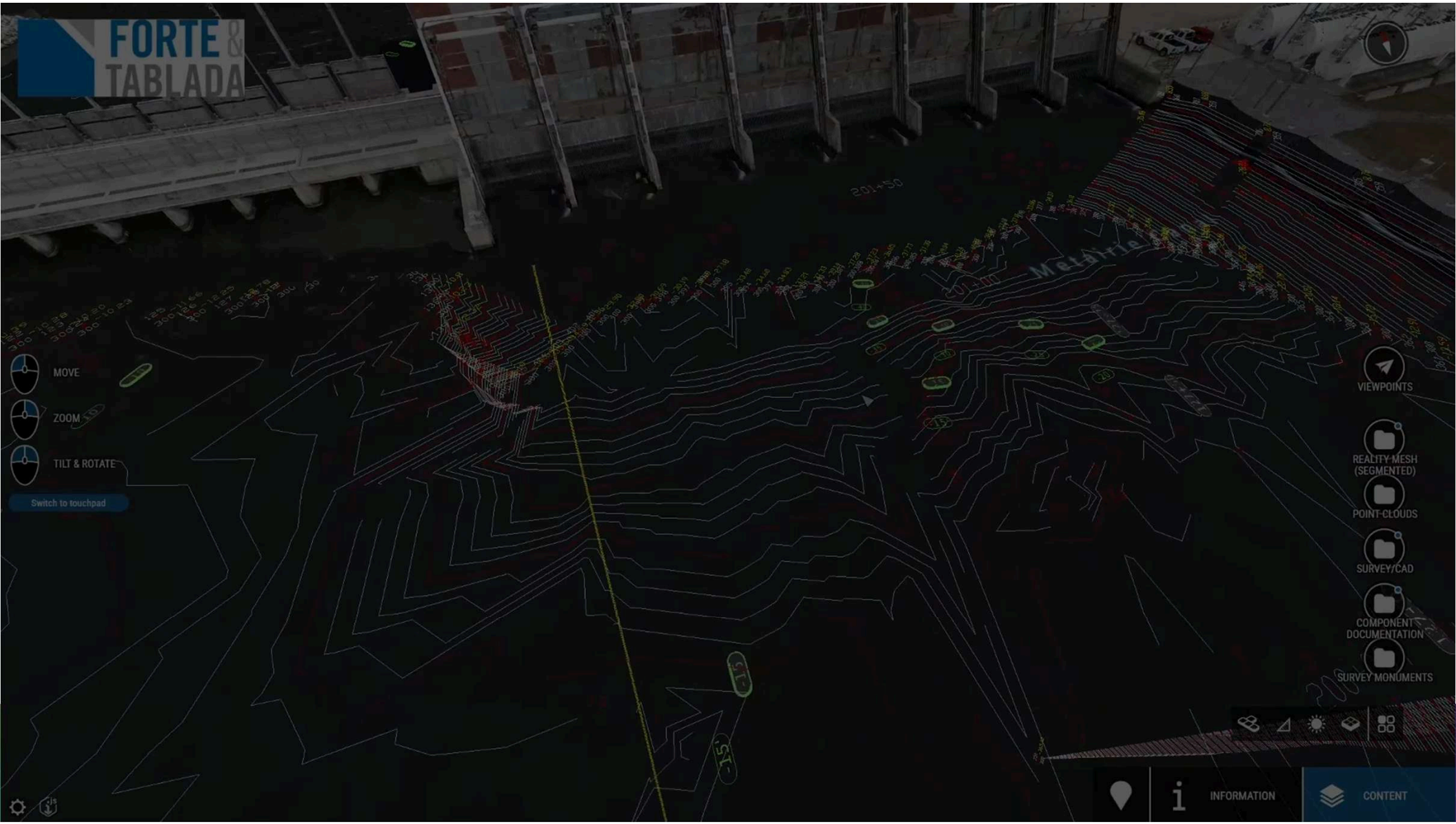
Switch to touchpad
Metairie Canal
VIEWPOINTS
REALITY MESH (SEGMENTED)
POINT CLOUDS
SURVEY/CAD
COMPONENT DOCUMENTATION
SURVEY MONUMENTS
INFORMATION
CONTENT

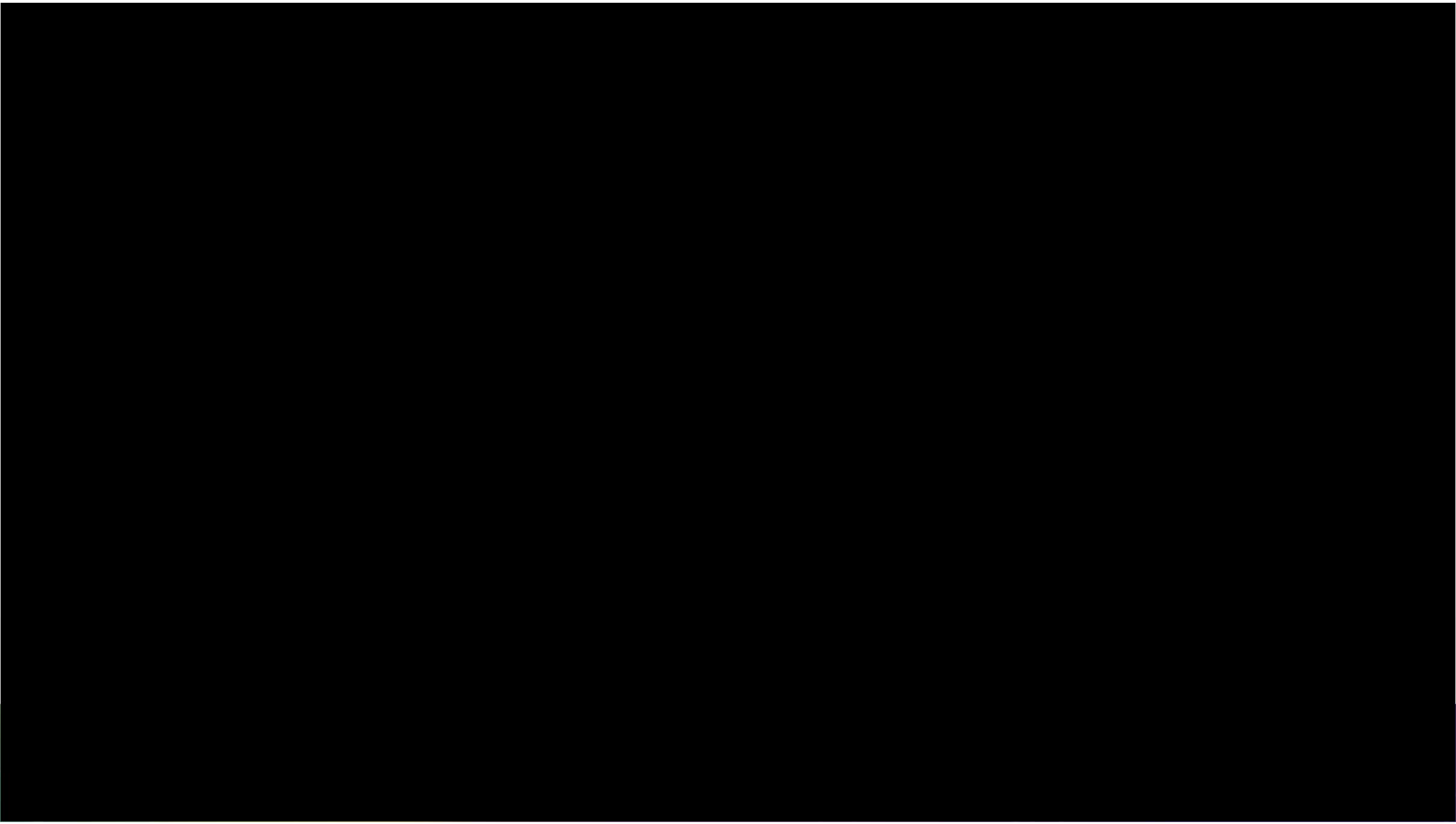
Static Content Federation – Point Data


FORTE & TABLADA
MOVE
ZOOM
TILT & ROTATE
Switch to touchpad
VIEWPOINTS
REALITY MESH (SEGMENTED)
POINT CLOUDS
SURVEY/CAD
COMPONENT DOCUMENTATION
SURVEY MONUMENTS
INFORMATION
CONTENT

Static Content – Directory Integration

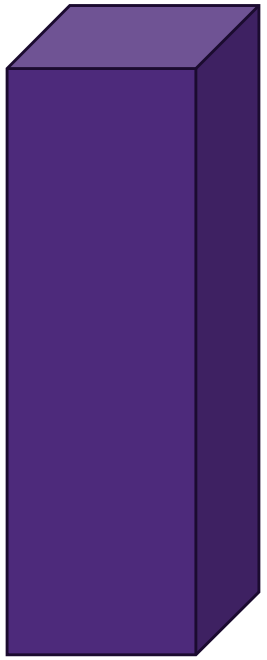
Dynamic Content Federation – Controls (IOT)

Engineering Applicatons – Detailed Measurements



Engineering Applicatons – Clash Detection

Rectifier Box



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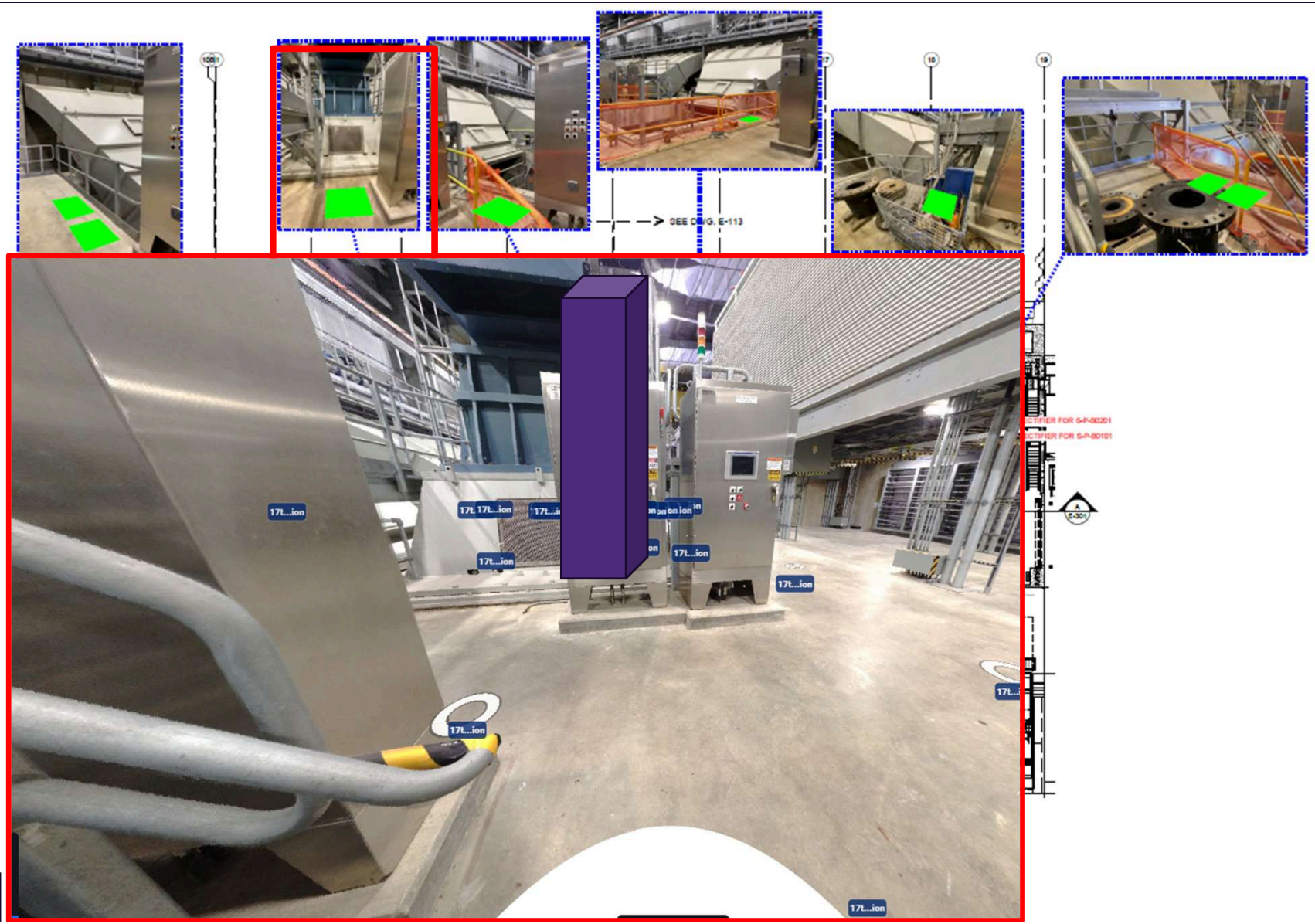

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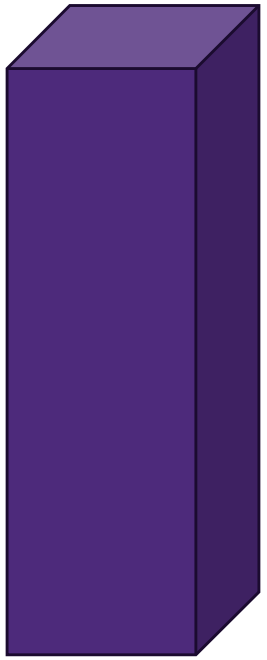

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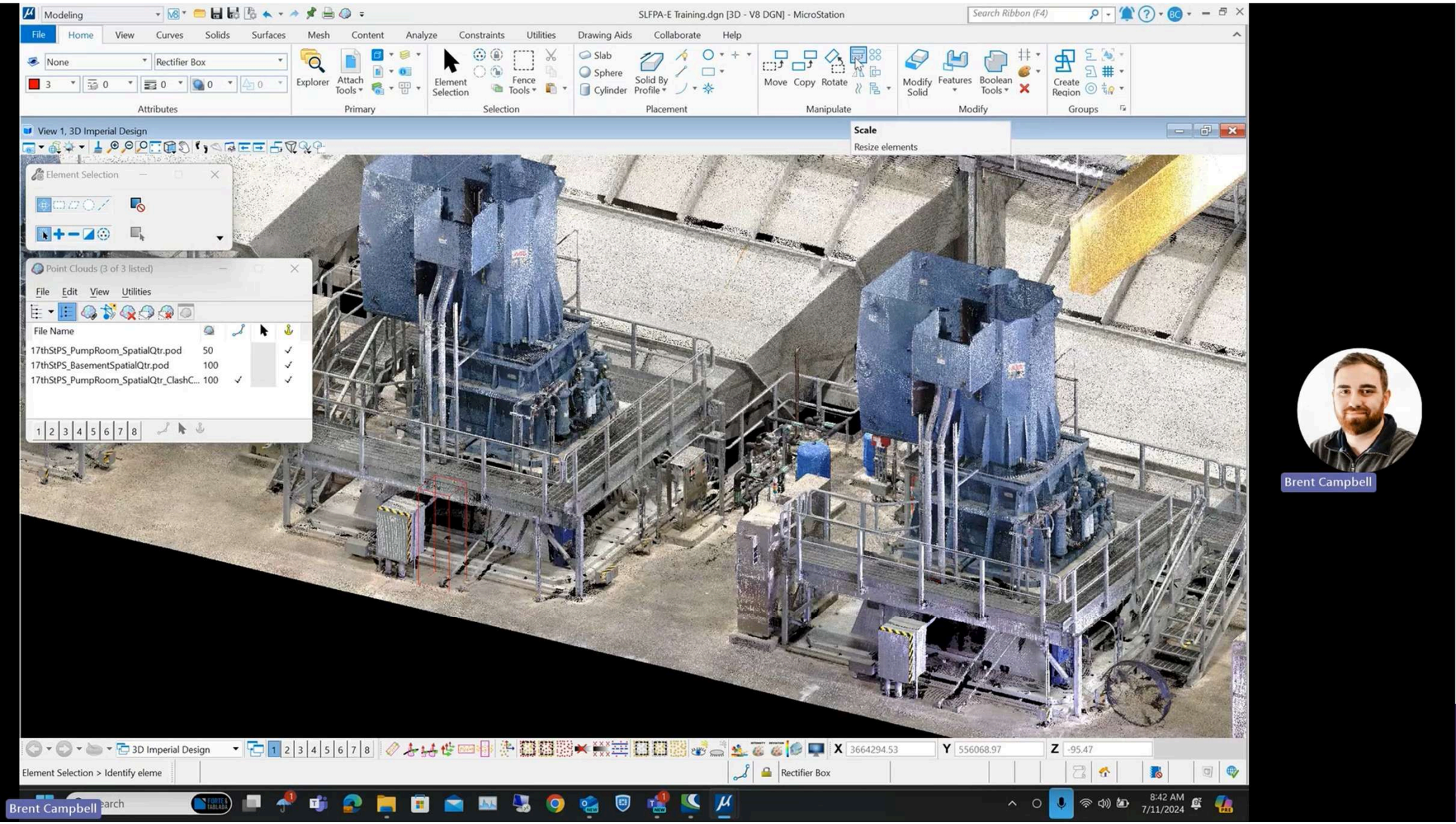

Modeling
SLFPA-E Training.dgn [3D - V8 DGN] - MicroStation
Search Ribbon (F4)
File
Home
View
Curves
Solids
Surfaces
Mesh
Content
Analyze
Constraints
Utilities
Drawing Aids
Collaborate
Help
None
Rectifier Box
Attributes
Explorer
Attach Tools
Primary
Element Selection
Fence Tools
Selection
Slab
Sphere
Cylinder
Solid By Profile
Placement
Move
Copy
Rotate
Manipulate
Modify Solid
Features
Boolean Tools
Modify
Create Region
Groups
View 1, 3D Imperial Design
Scale
Resize elements
Element Selection
Point Clouds (3 of 3 listed)
File Edit View Utilities
File Name
17thStPS_PumpRoom_SpatialQtr.pod 50
17thStPS_BasementSpatialQtr.pod 100
17thStPS_PumpRoom_SpatialQtr_ClashC... 100
1 2 3 4 5 6 7 8
3D Imperial Design
X 3664294.53
Y 556068.97
Z -95.47
Element Selection > Identify eleme
Rectifier Box
Brent Campbell
8:42 AM
7/11/2024
Brent Campbell

Future Applications

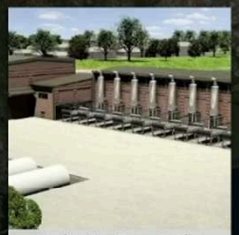
1. Data Federation of the Surge Barrier – all manuals and documents in one electronic and virtual place (organized, indexed, and easily accessible)
2. Comparison of sediment erosion/accumulation over time
3. Clash detection (gate opening versus sediment accumulation)
4. Pile movement trendline (real time)
5. Live camera feed (real time)
6. Comparison of settlement of wall over time
7. Maintenance deadline trigger alarms (real time)
8. Water level trigger alarms (real time)
9. Other engineering measurements using Microstation

Future Applications

SLFPA-E DIGITAL TWIN PROJECTS

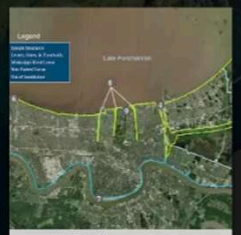
SLFPA-E Digital Twin Project Portal prepared by Forte & Tablada Inc.

17th Street Pump Station



London Ave. Pump Station

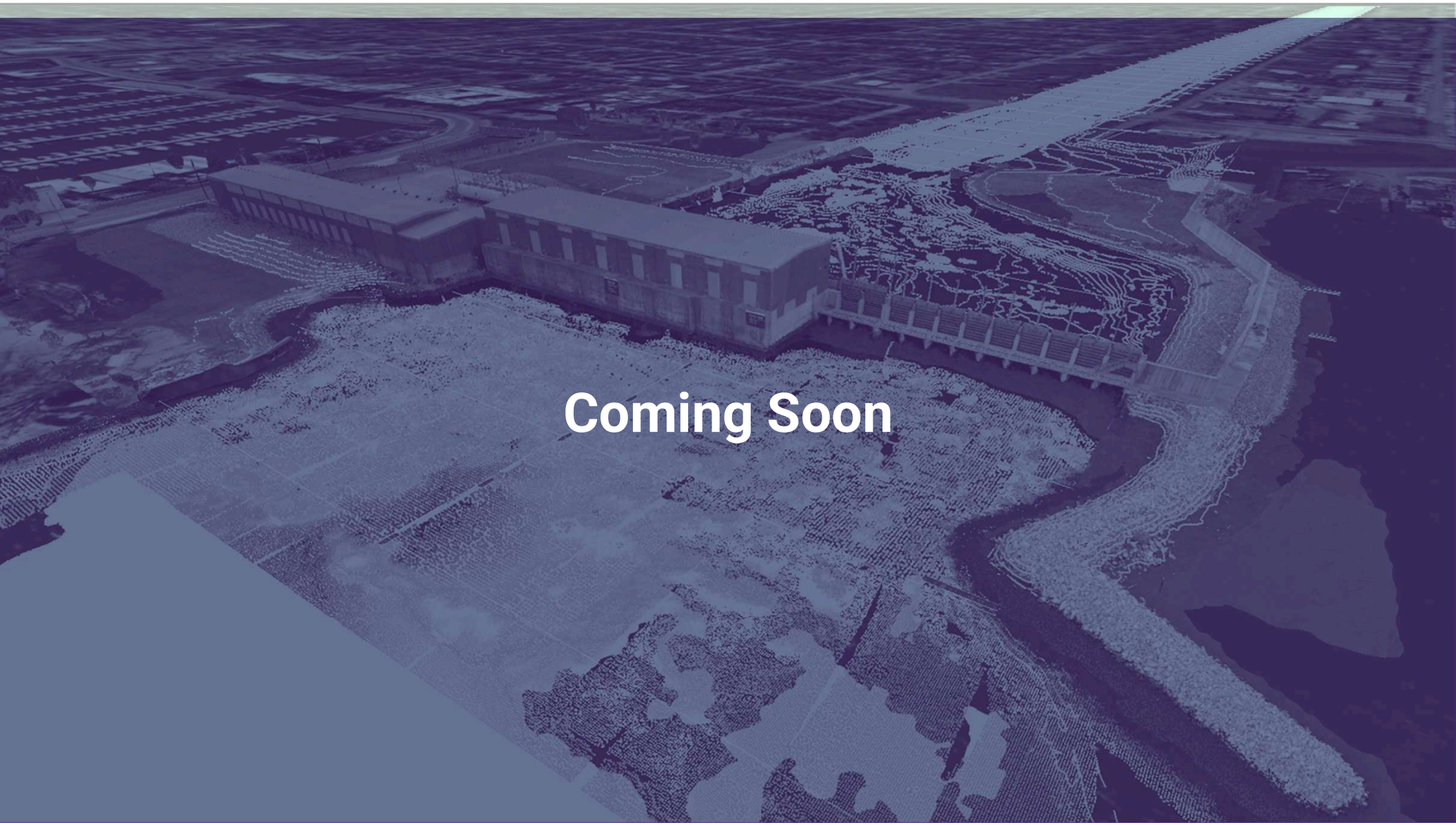
Orleans Ave. Pump Station

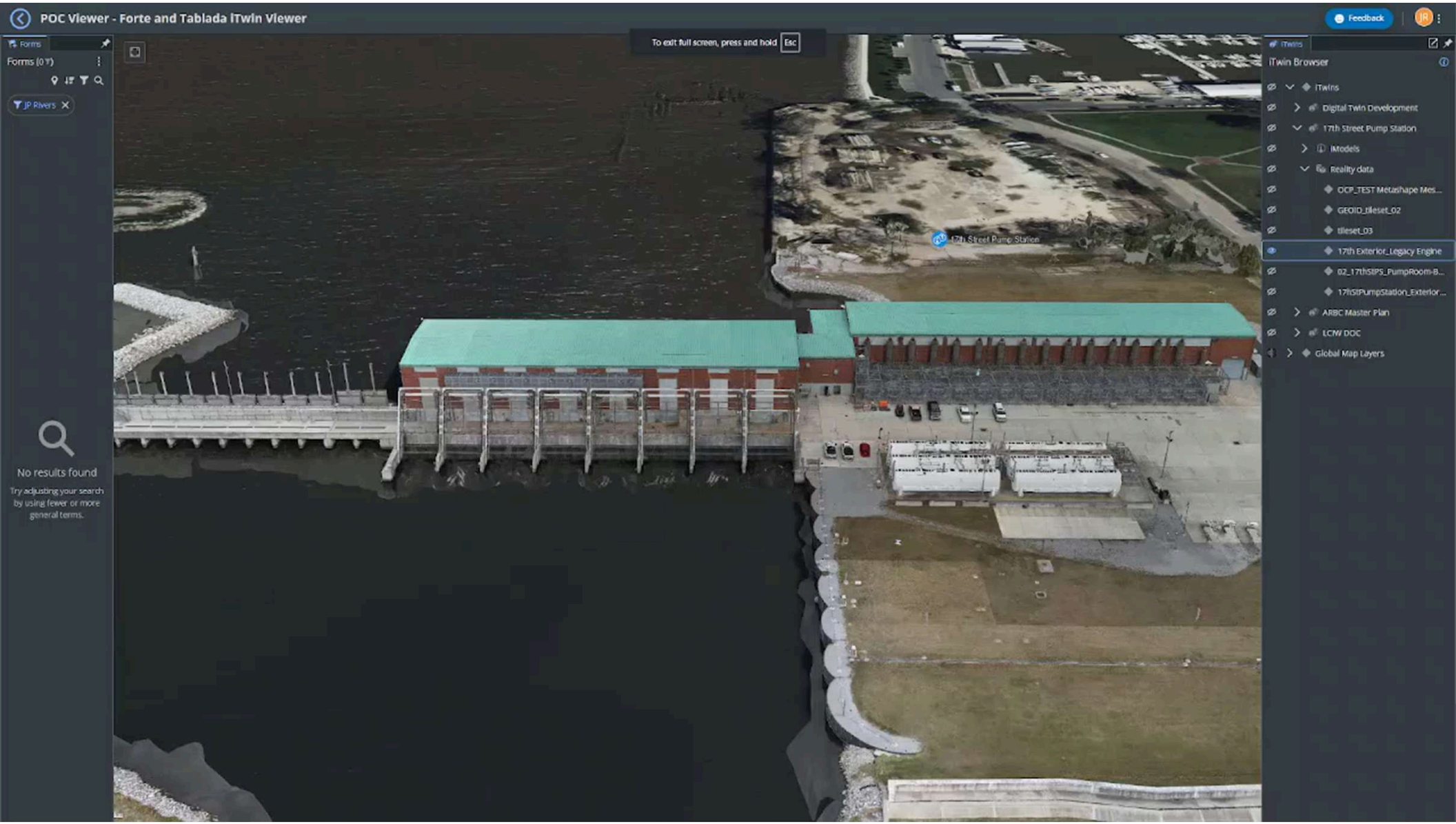


SLFPA-E Levee System

Culvert Inspections Project

GIWW Surge Barrier


Coming Soon


POC Viewer - Forte and Tablada iTwin Viewer
Feedback
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Forms
Forms (0 ▼)
JP Rivers
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iTwins
iTwin Browser
iTwins
Digital Twin Development
17th Street Pump Station
iModels
Reality data
OCP_TEST Metashape Mes...
GEOID_tileset_02
tileset_03
17th Exterior_Legacy Engine
02_17thStPS_PumpRoom-B...
17thStPumpStation_Exterior...
ARBC Master Plan
LCW DOC
Global Map Layers
17th Street Pump Station

Key Takeaways & Lessons learned

Key Takeaways and Lessons from the Pilot Study

Realize that value is widespread, unique to role or stakeholder

Define success and desired outcome early, remain focused on goals

Understand Digital Twin is a way of business, Digital Twin is not a "project"

Acknowledge that it takes a diverse and integrated team

Consider that software is emerging, tools are many

Key Benefits

Organized Documentation

- Digital storage of operating manuals, maintenance records, and inspection reports for easy access and data integrity.

Remote Access

- Access critical data anywhere, at any time, enabling fast decision-making during emergencies.

Live Data Display

- Monitor real-time system health, structural integrity, and water levels via a visual model.

Historical Analysis

- Compare data over time to spot trends in system performance and enhance long-term maintenance planning.

AI-Powered Alert

- Use Artificial Intelligence to create automatic alarms, detecting issues early to prevent failures.

Streamlined Reporting

- Easily generate reports for inspections and asset management improvements.

Training and Outreach

- A vital tool for onboarding new employees and educating communities on the system’s importance.

THANK YOU!

Digital Twinning of New Orleans Flood Risk Reduction Infrastructure

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