Extracting Consumable Construction intelligence from the Reality Capture Data

Presenter

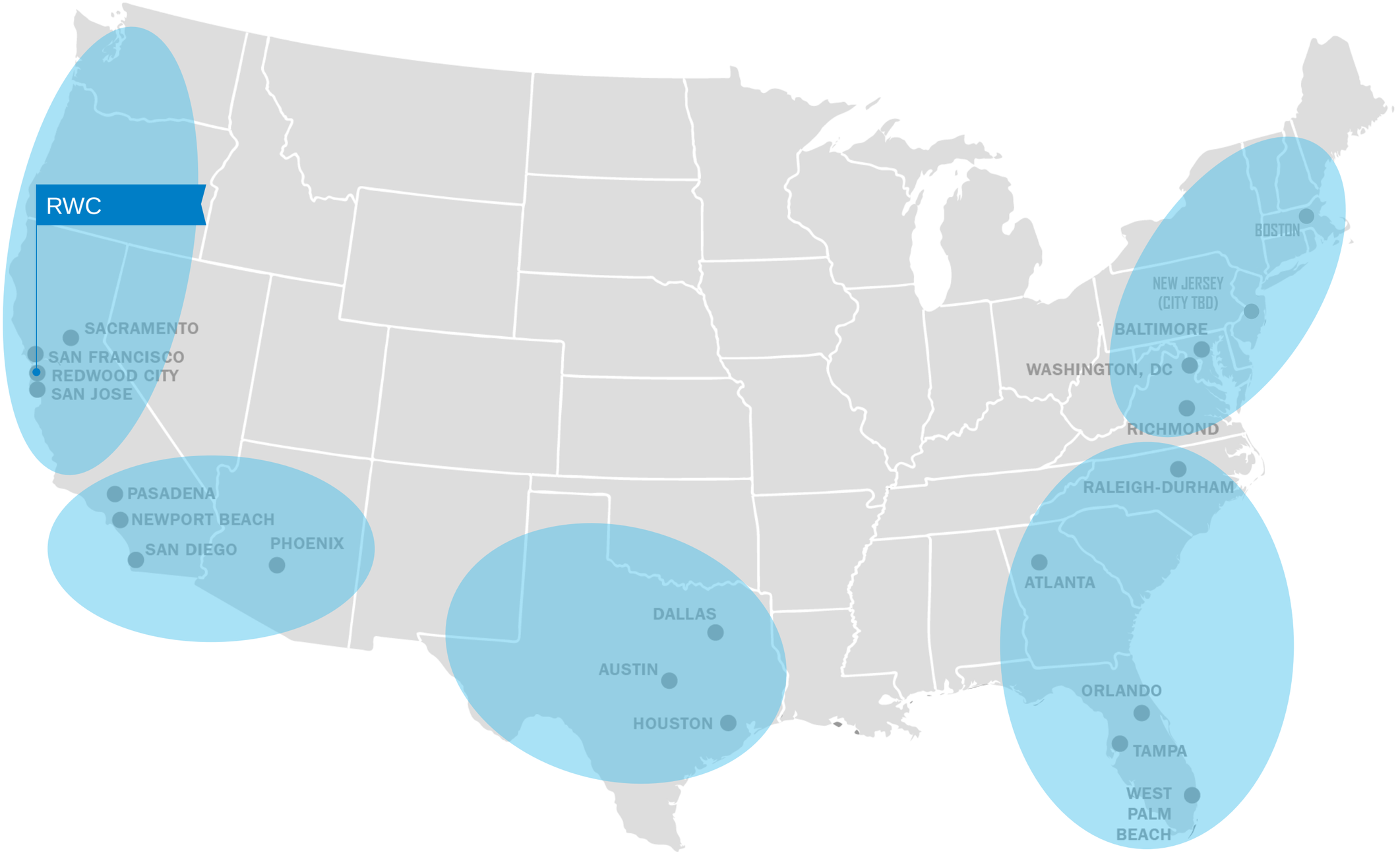
Chidambaram Somu

About me

- Name – Chidambaram Somu
- Location – Phoenix, Arizona
- Company – DPR Construction
- Title – Virtual Construction Manger

Expertise/Interests – BIM, Reality Capture, Facilities Management & Building operations, 4D & 5D

About DPR Construction


RWC
SACRAMENTO
SAN FRANCISCO
REDWOOD CITY
SAN JOSE
PASADENA
NEWPORT BEACH
SAN DIEGO
PHOENIX
DALLAS
AUSTIN
HOUSTON
ATLANTA
ORLANDO
TAMPA
WEST PALM BEACH
RALEIGH-DURHAM
RICHMOND
WASHINGTON, DC
BALTIMORE
NEW JERSEY (CITY TBD)
BOSTON

$4.0B

Annual Volume, 2016

#10

Fortune Magazine's Best Places to Work, 2014

#20

ENR Magazine's Top General Contractor, 2016

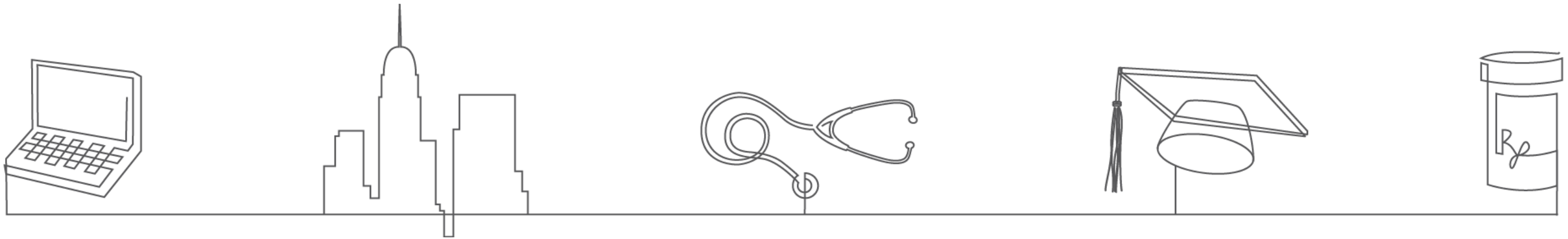
integrity

enjoyment

uniqueness

ever forward

Core Markets



Advanced Technology

Commercial

Healthcare

Higher Education

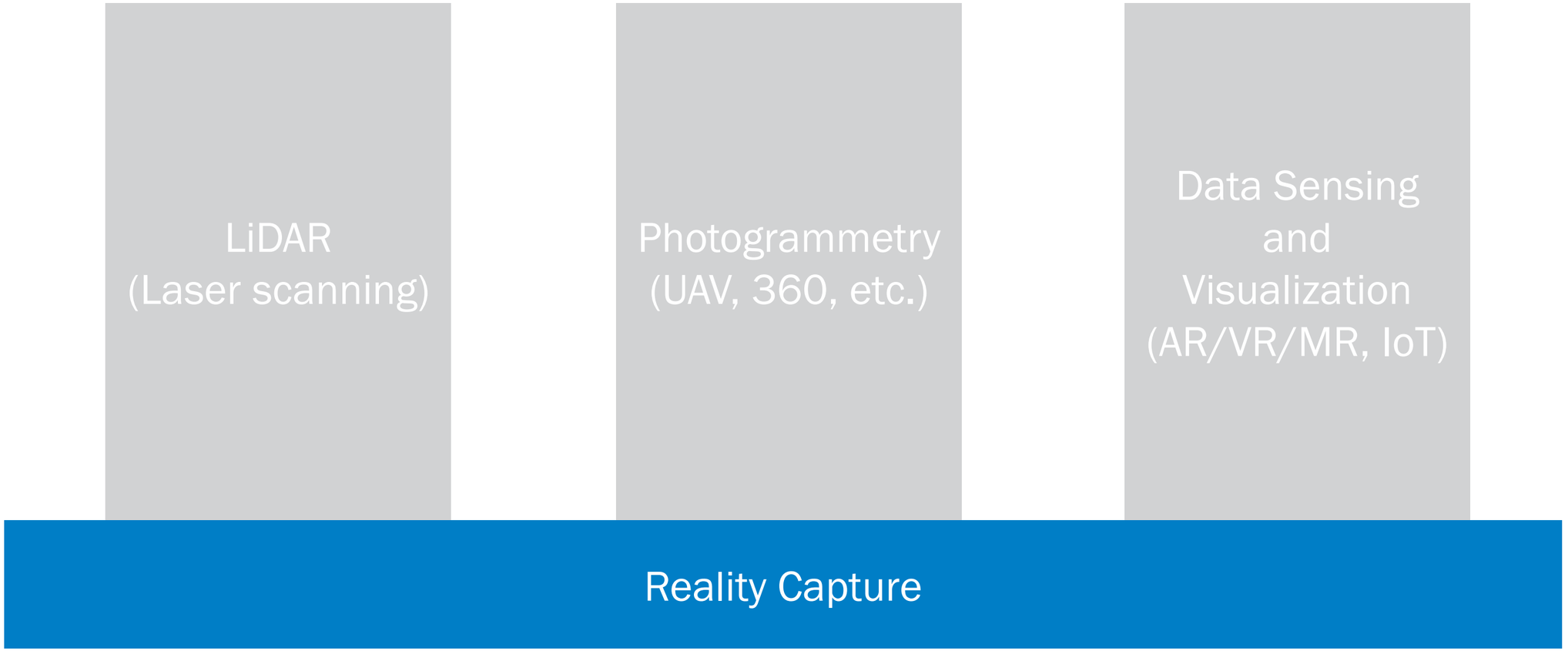
Life Sciences

Reality Capture Intro

What is Reality Capture?

Reality capture is a process of capturing as it is conditions

Reality Capture – What does it include?

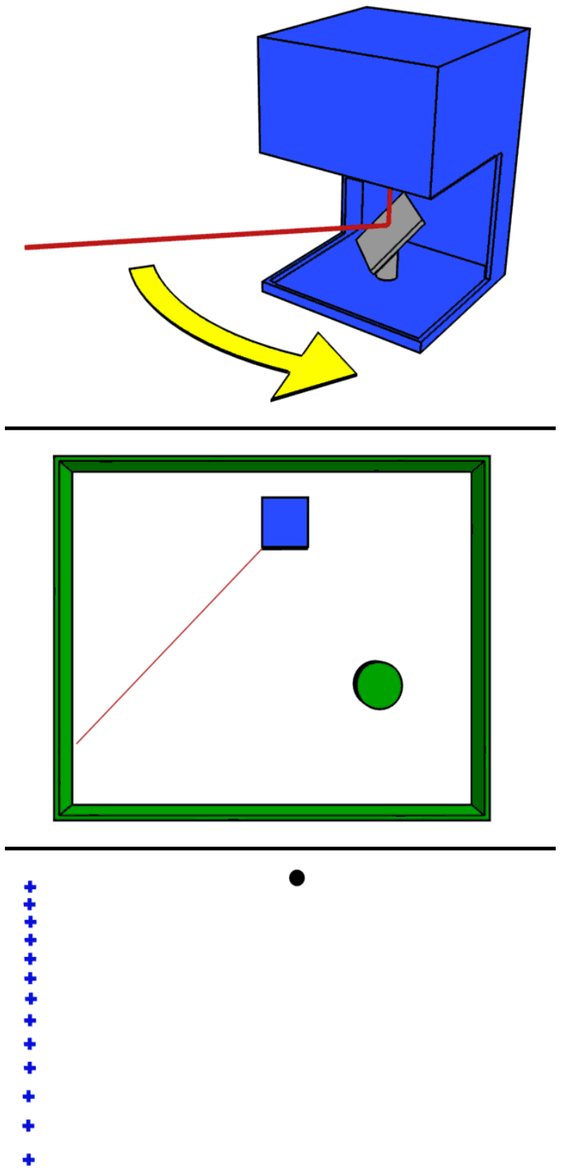


Reality Capture – Modes of Data Capture?

Data can be from any single source or combination of sources

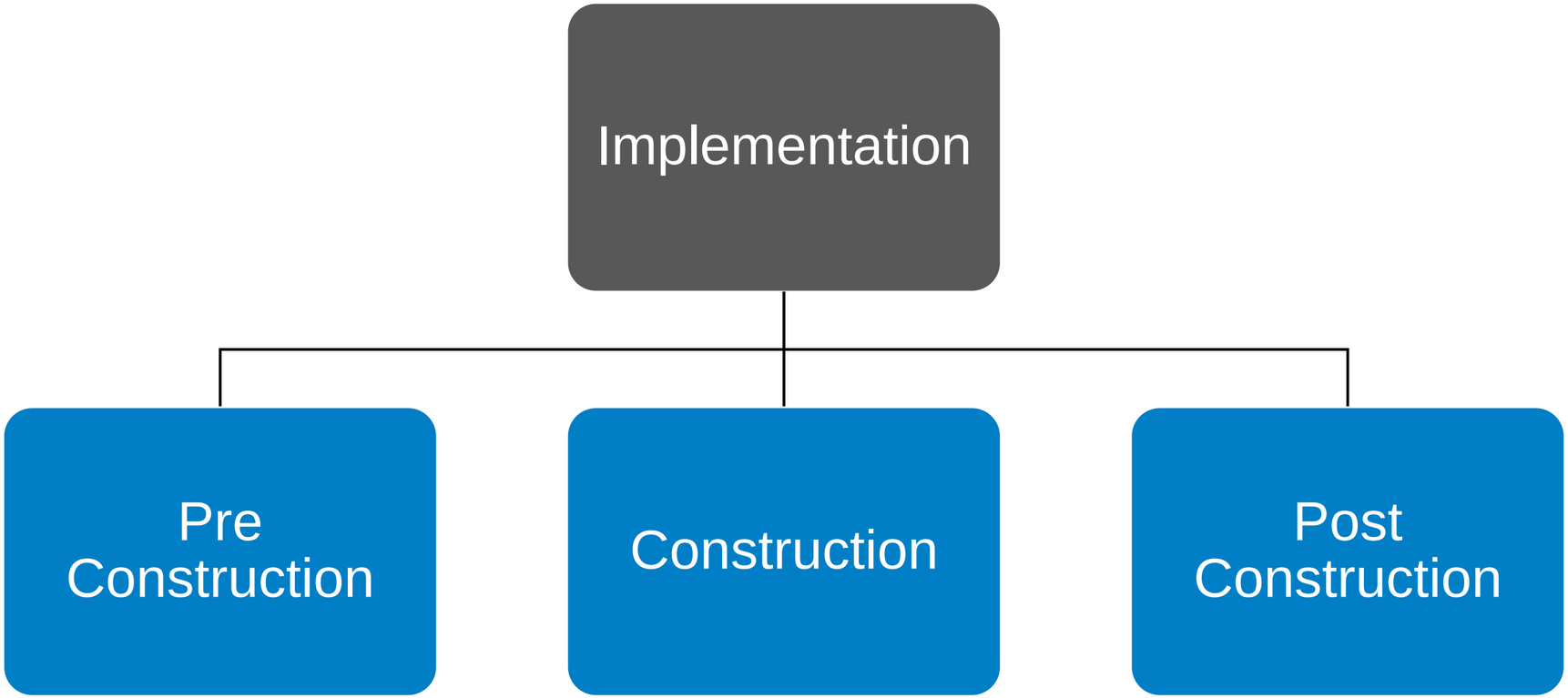
LiDAR

- Measures distance to a target by illuminating that target with a pulsed laser light, and measuring the reflected pulses with a sensor



Photogrammetry

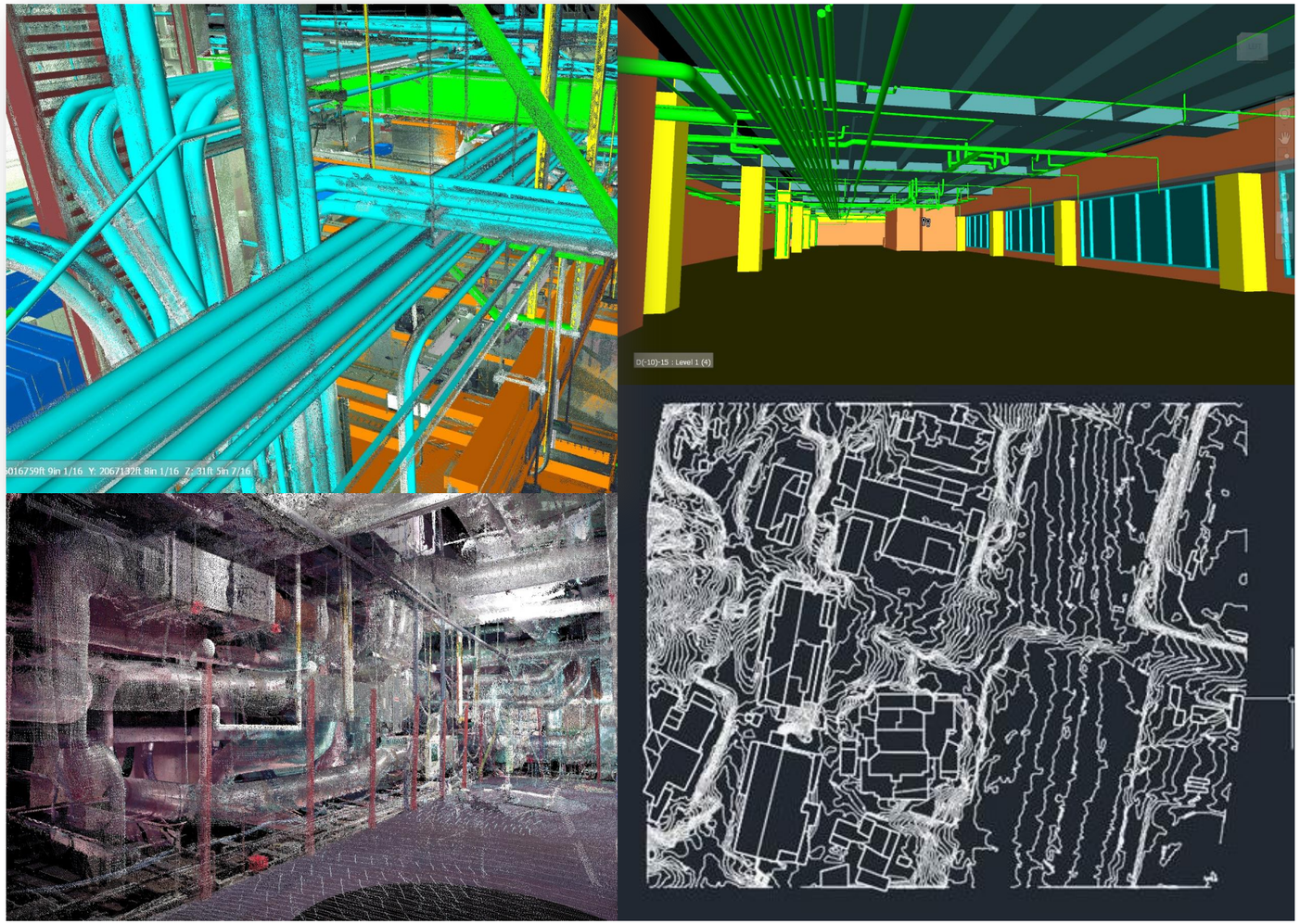
Reality Capture – Implementation Phases



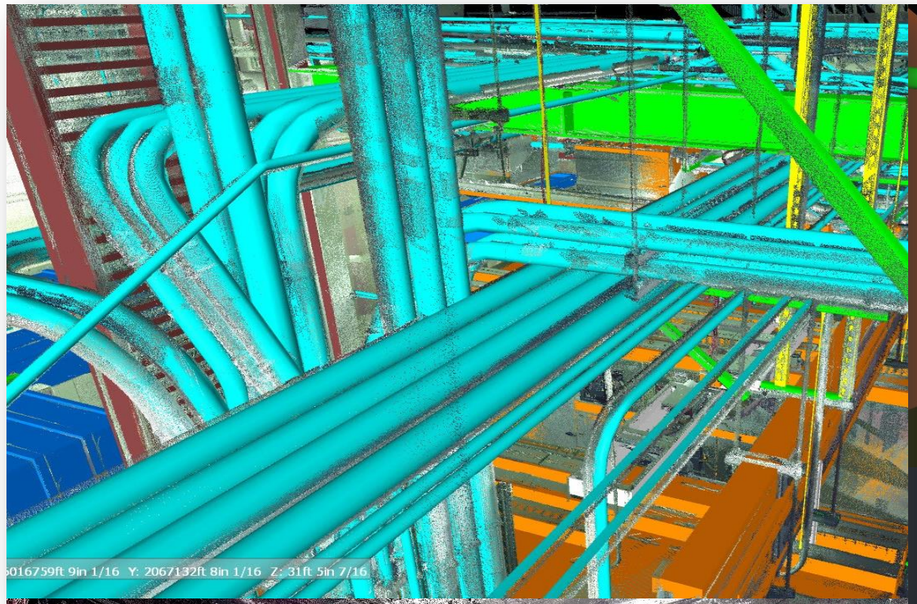
Preconstruction Use Cases

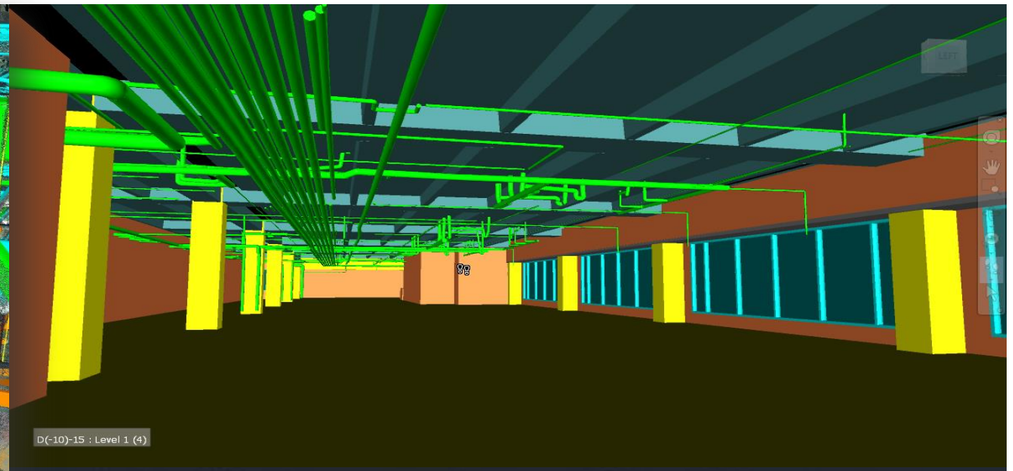
Reality Capture – Preconstruction Use Cases

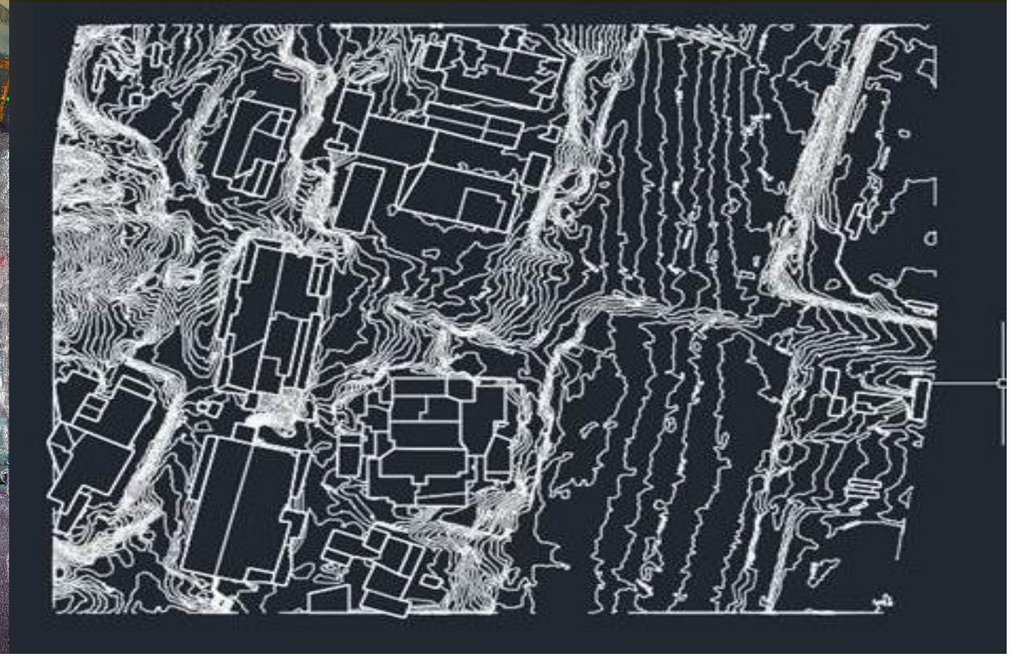
- Exact Building for
  - Documentation
  - Design Coordination
  - Quantification
- Supplement Survey
  - Site Selection
  - Contour mapping
  - Cut/Fill Analysis



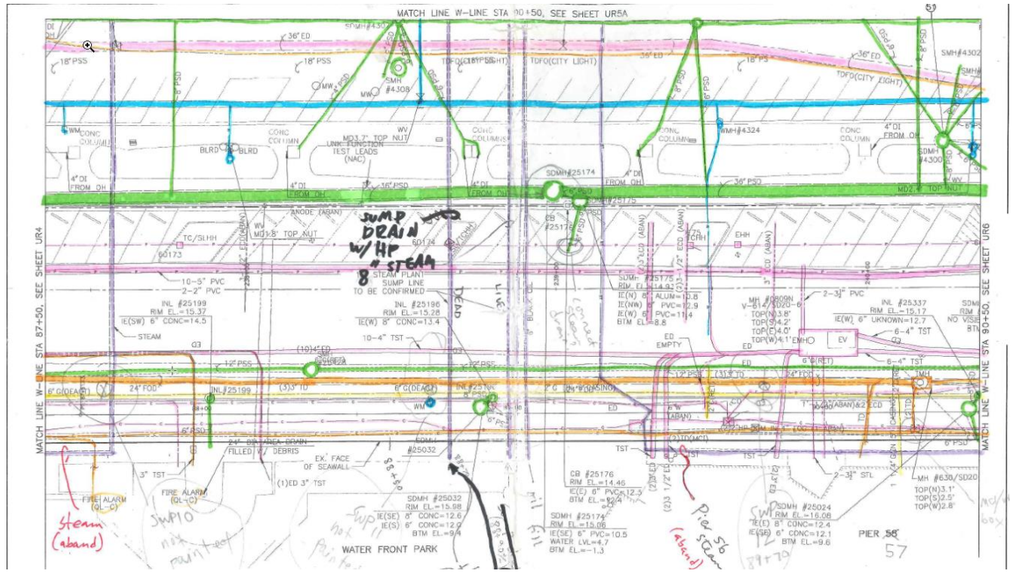
Exact Builting



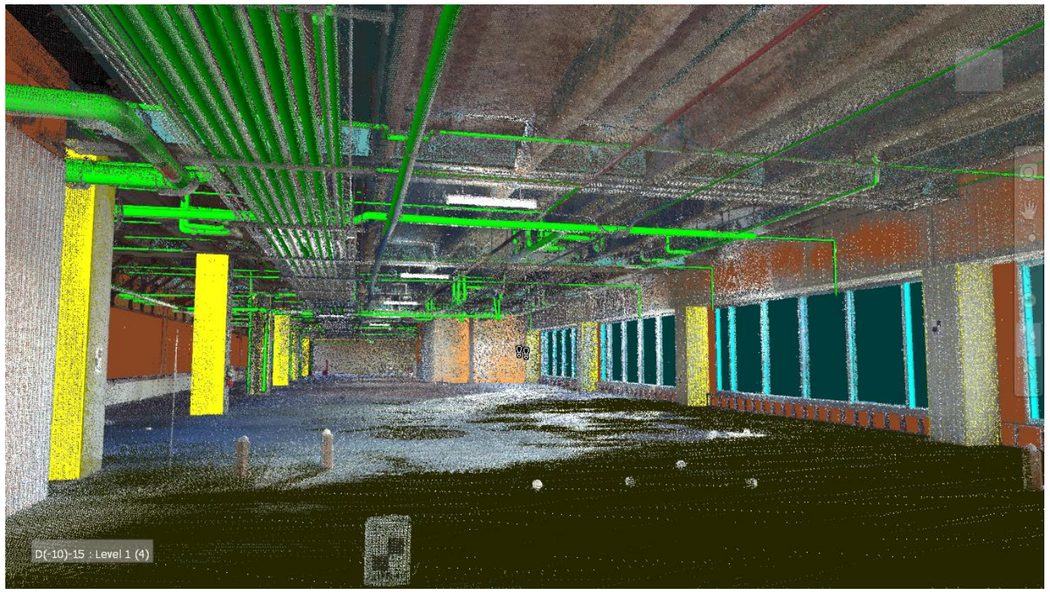


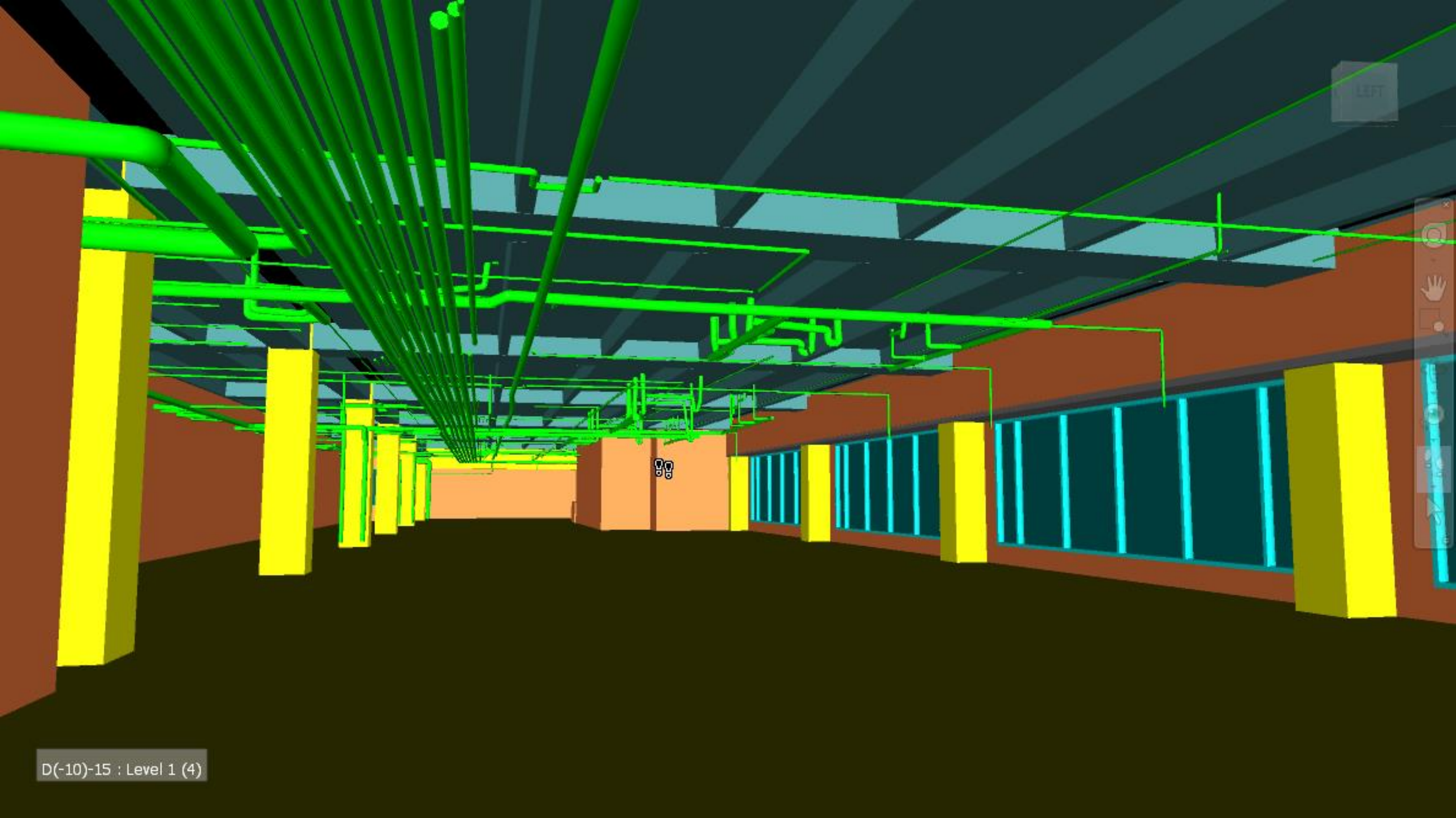


As-builts vs Exact-Builts



vs




LEFT
D(-10)-15 : Level 1 (4)

Site selection and survey supplement

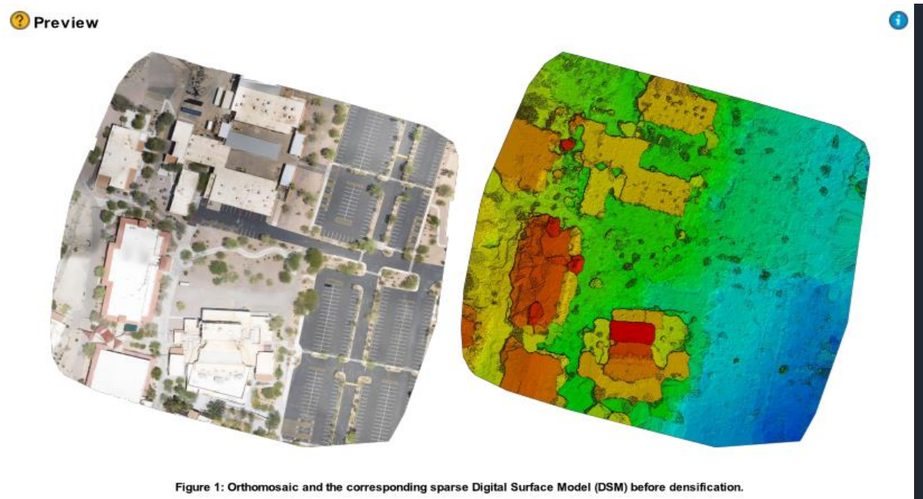
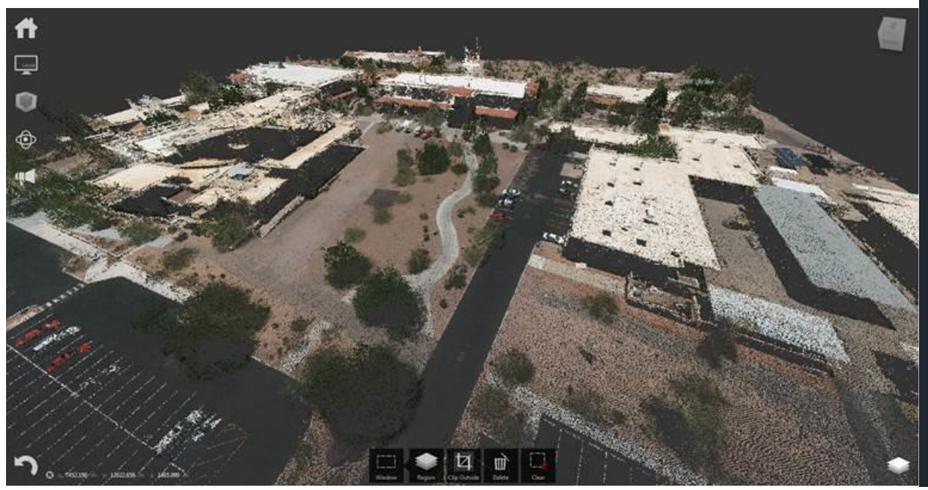
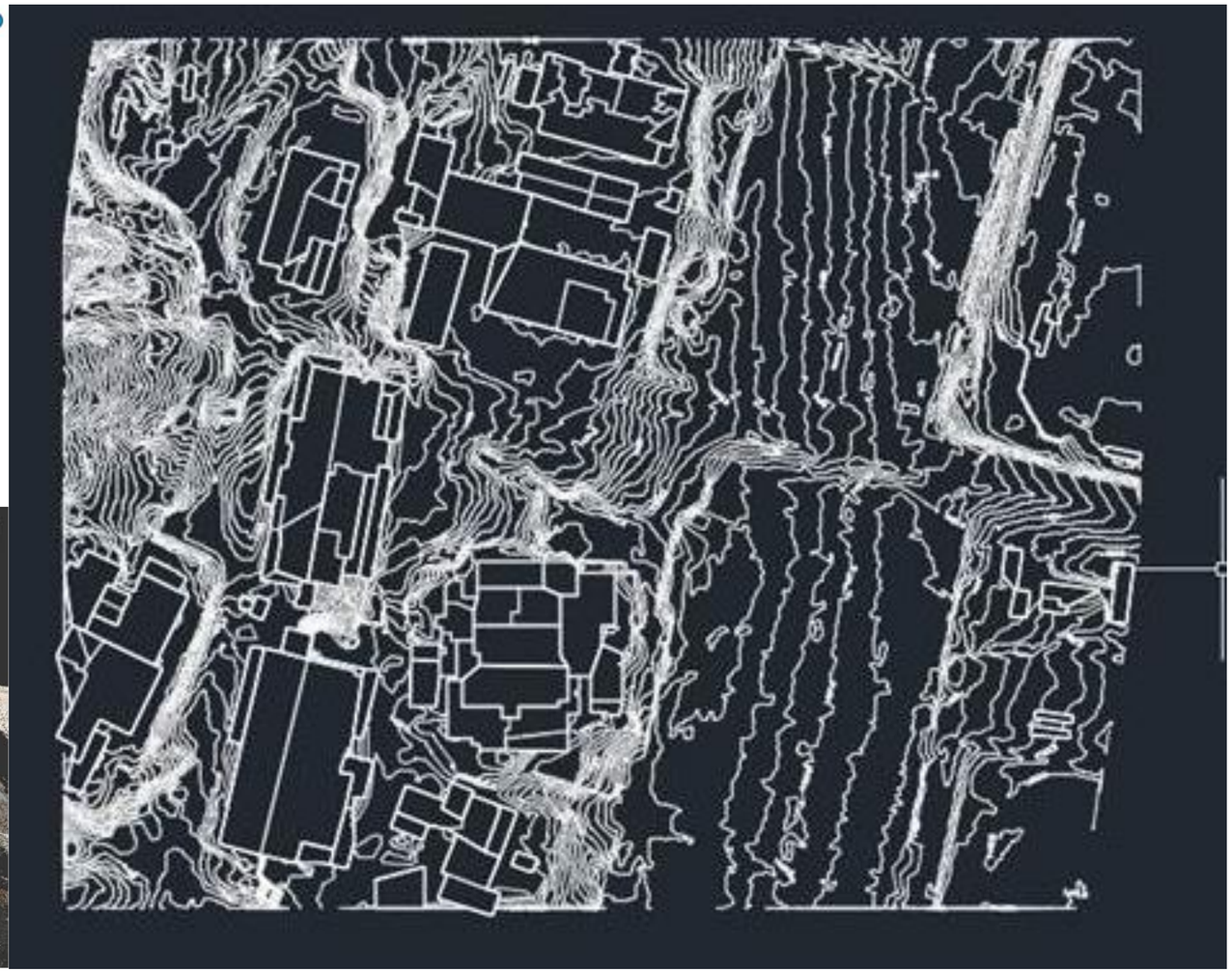
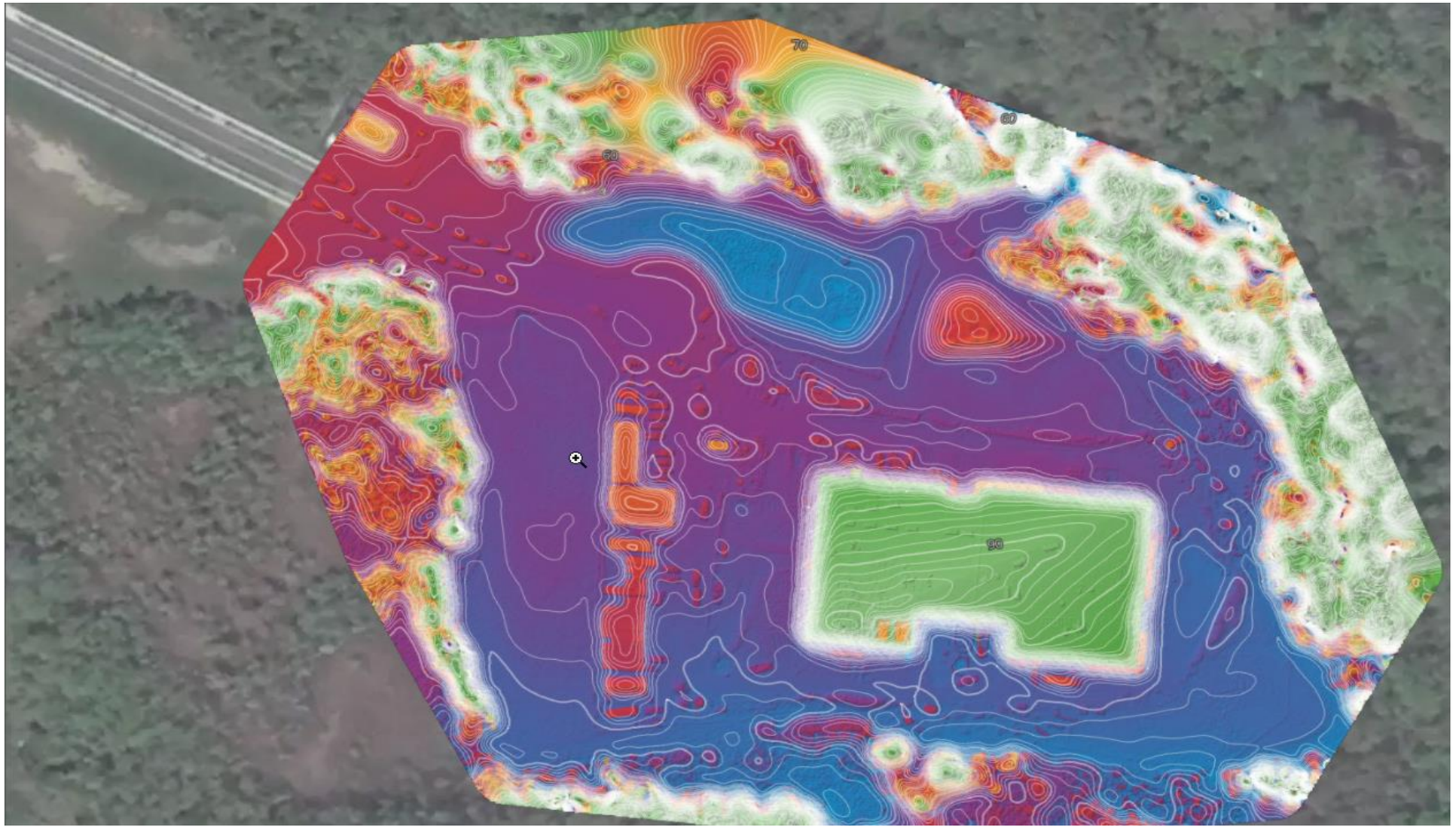


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

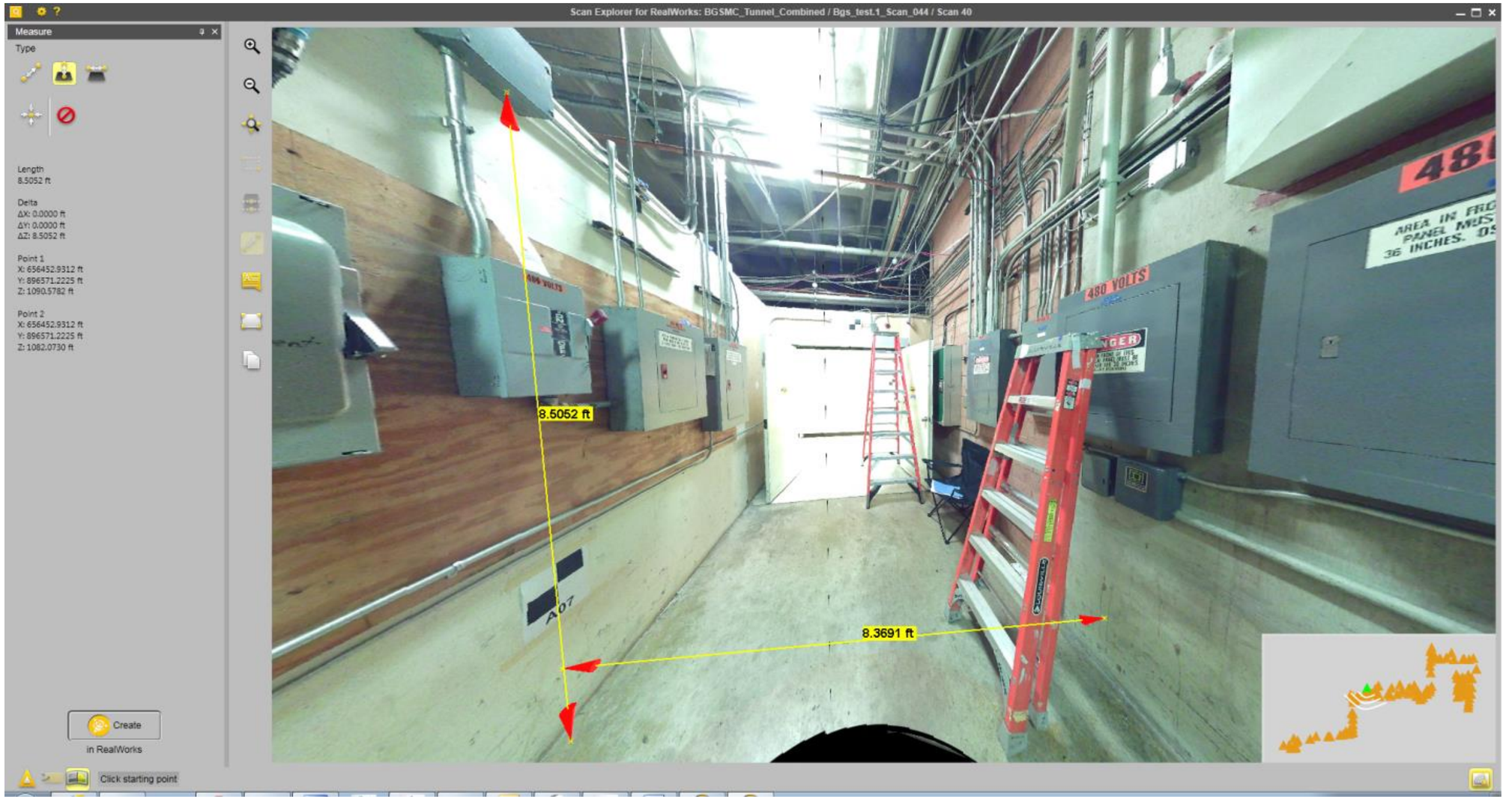




Site selection and survey supplement

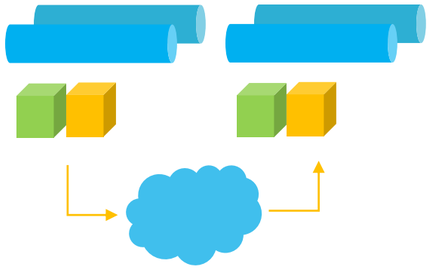


Documentation and Coordination

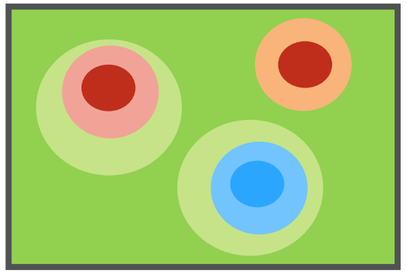


Construction Use Cases

Construction Use Cases



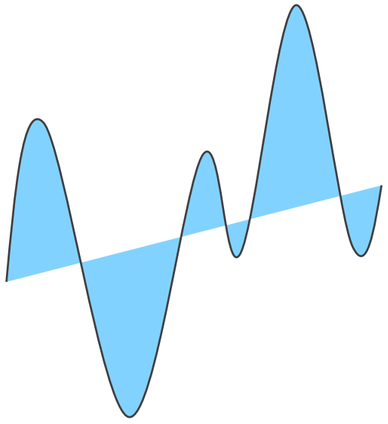
Verify Field installs
Check as-builts
Prefabrication



Floor Flatness
Floor Levelness
ASTM 1155

Quality Control
- Concrete
- MEP Openings
- Edge of Slab
- Prefab Skin

Camber Analysis



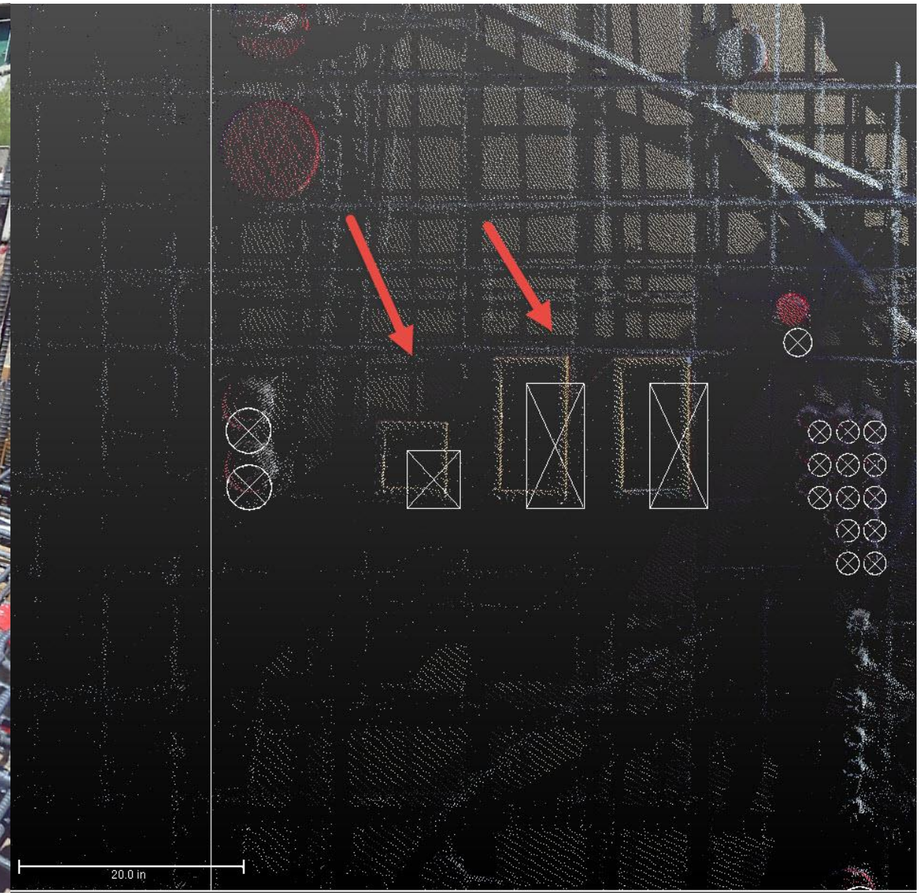
Site Analysis

Safety

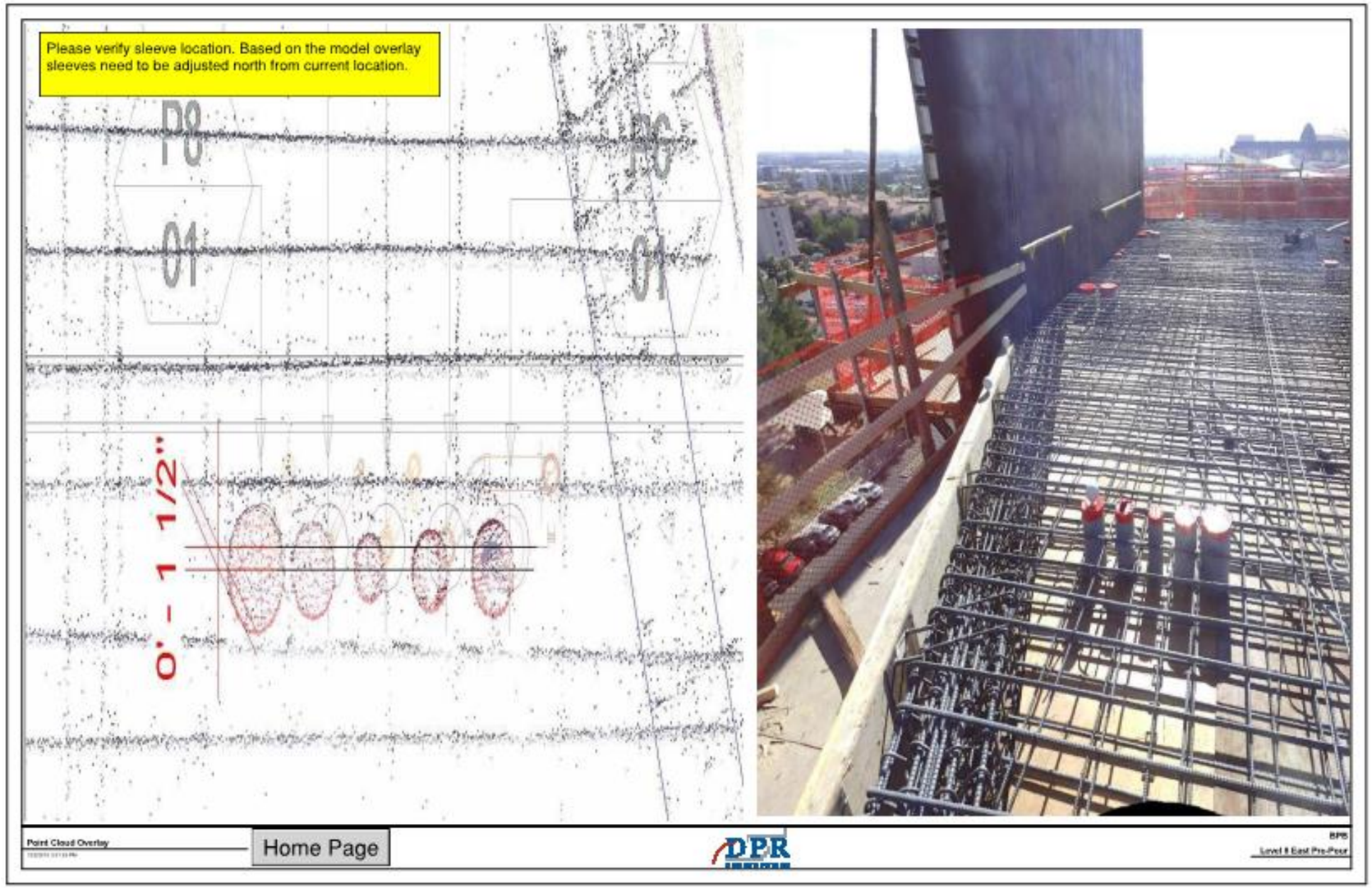
Progress Tracking

Prepour QA/QC - Verify Field Installs

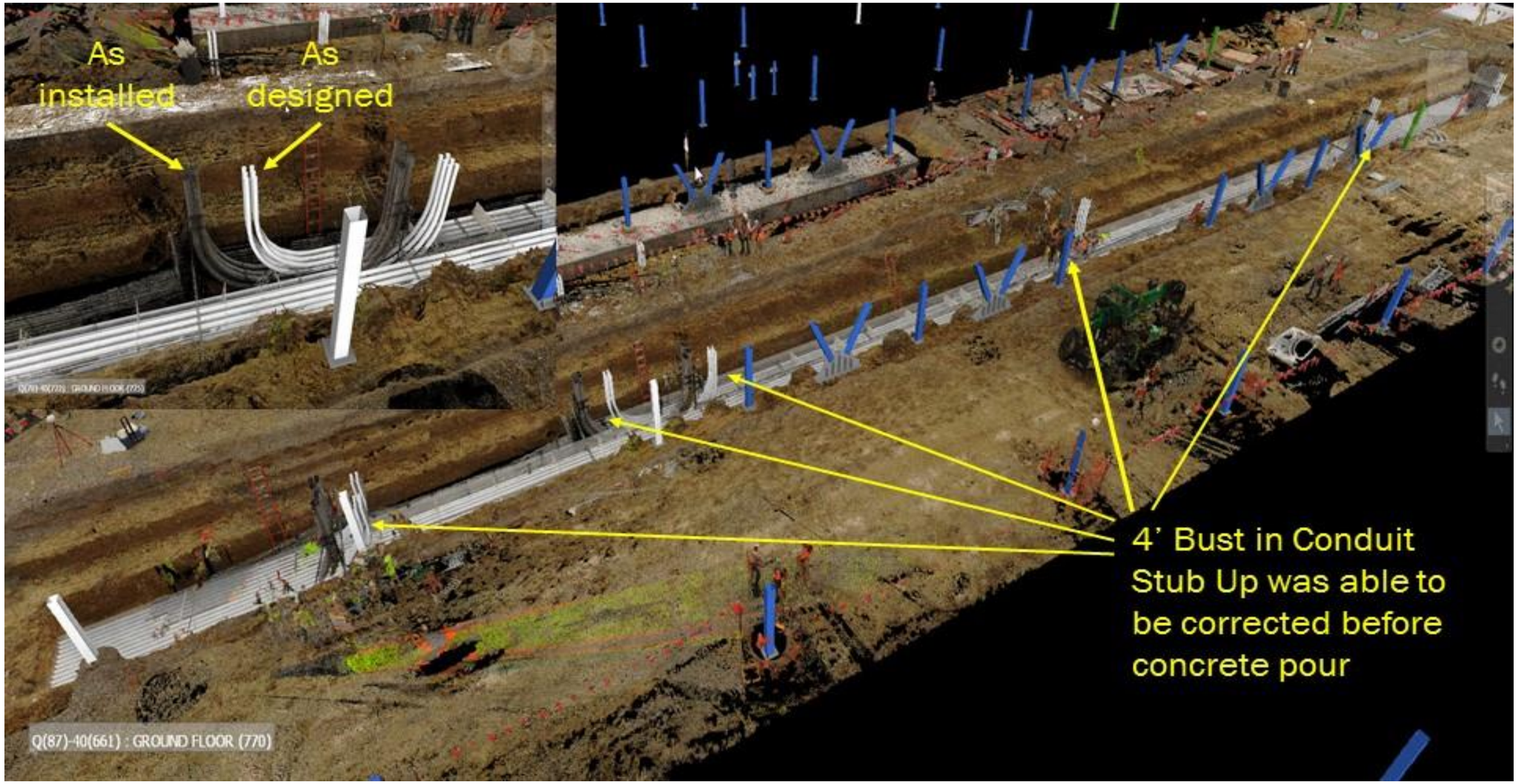
- Verify MEP sleeves, Openings, block outs, shafts, embeds, etc.



Prepour QA/QC - Verify Field Installs



QA/QC - Verify Field Installs



Statistical Analysis

- Implementation of laser scan concrete pre-pour QA/QC process can save approximately 85 Cents/Square Feet on rework caused by field errors.
- For 100,000 SF - $85,000 Approx.

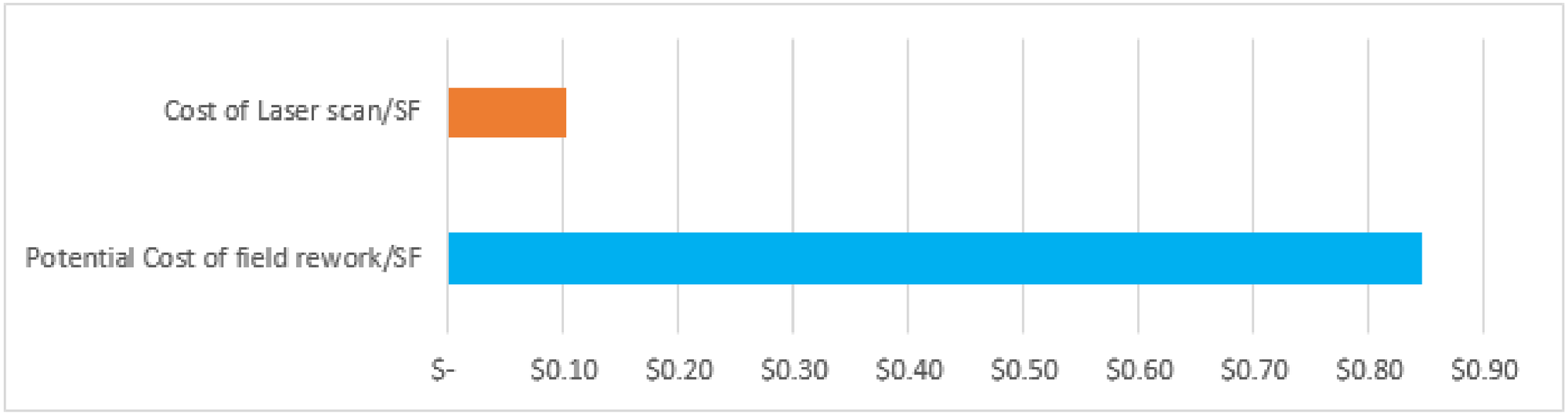
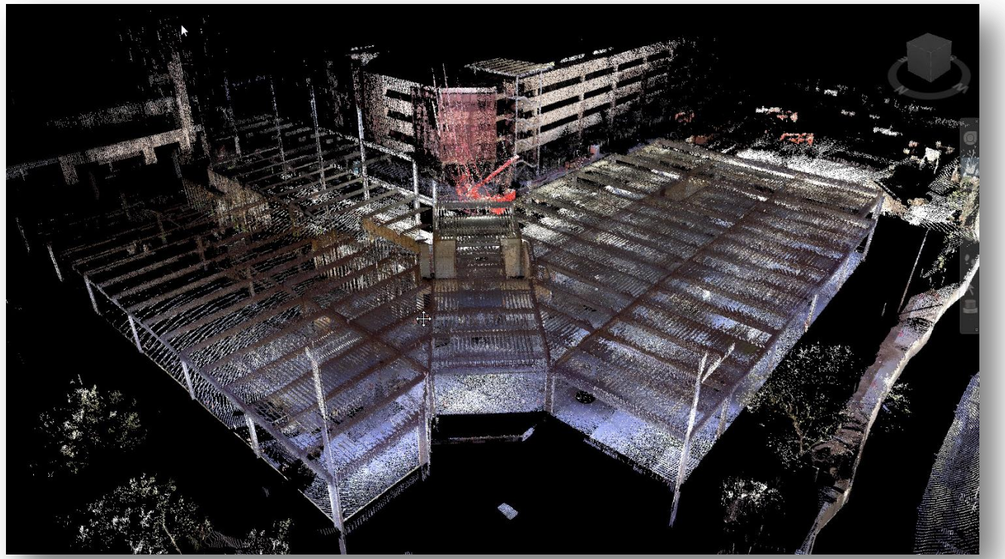
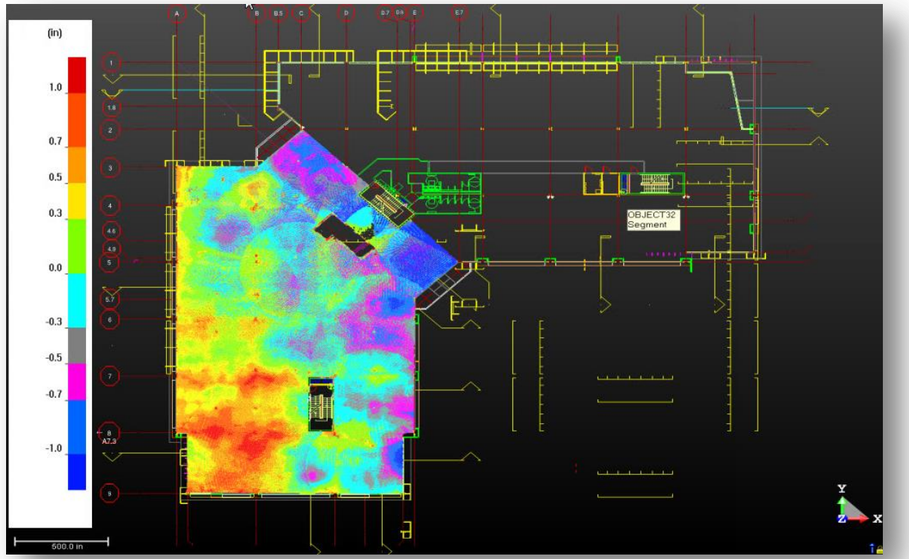


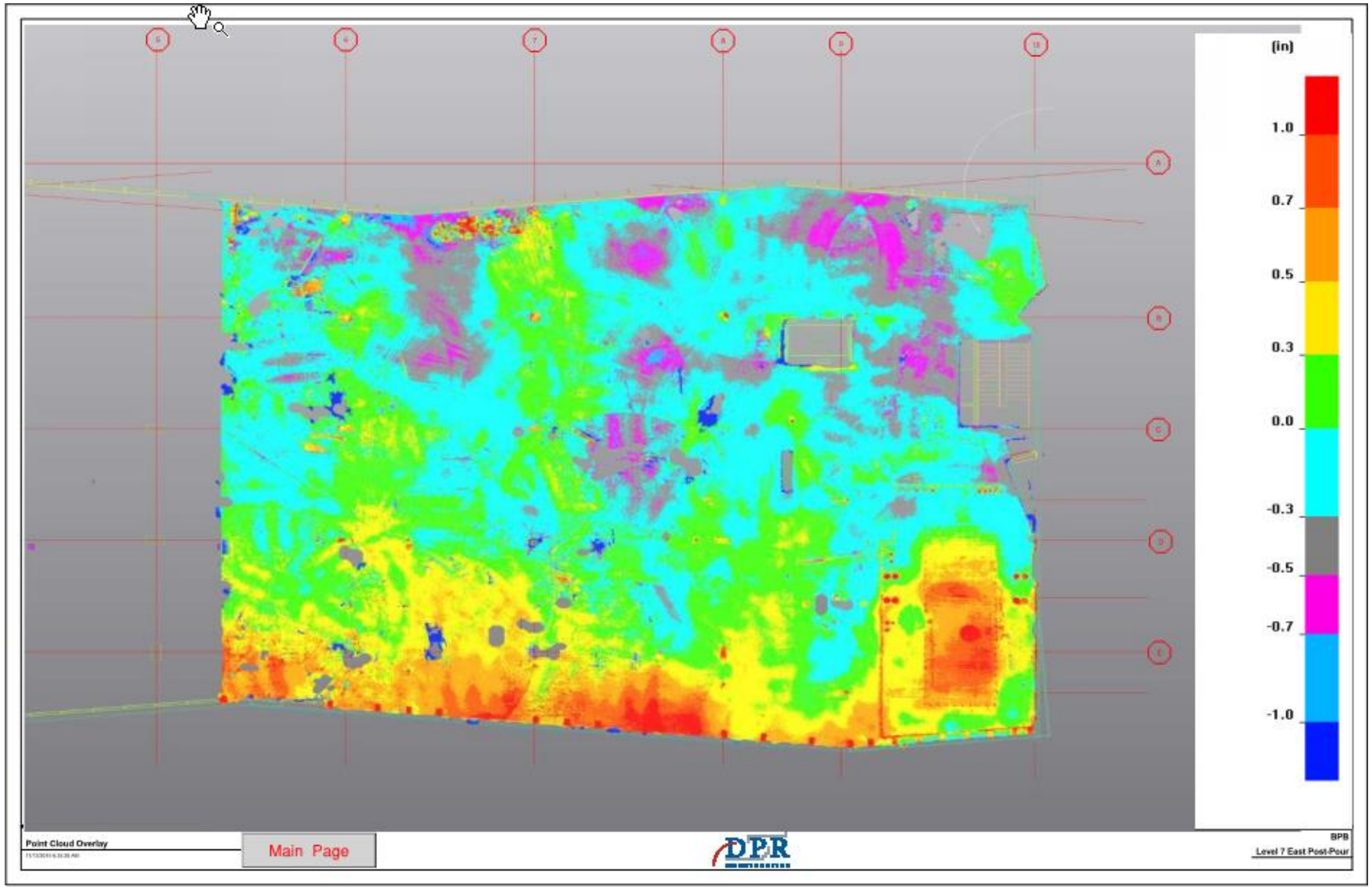
Figure 3 Cost of laser scan vs potential cost of rework saved by laser scan

Floor Flatness and Floor Levelness

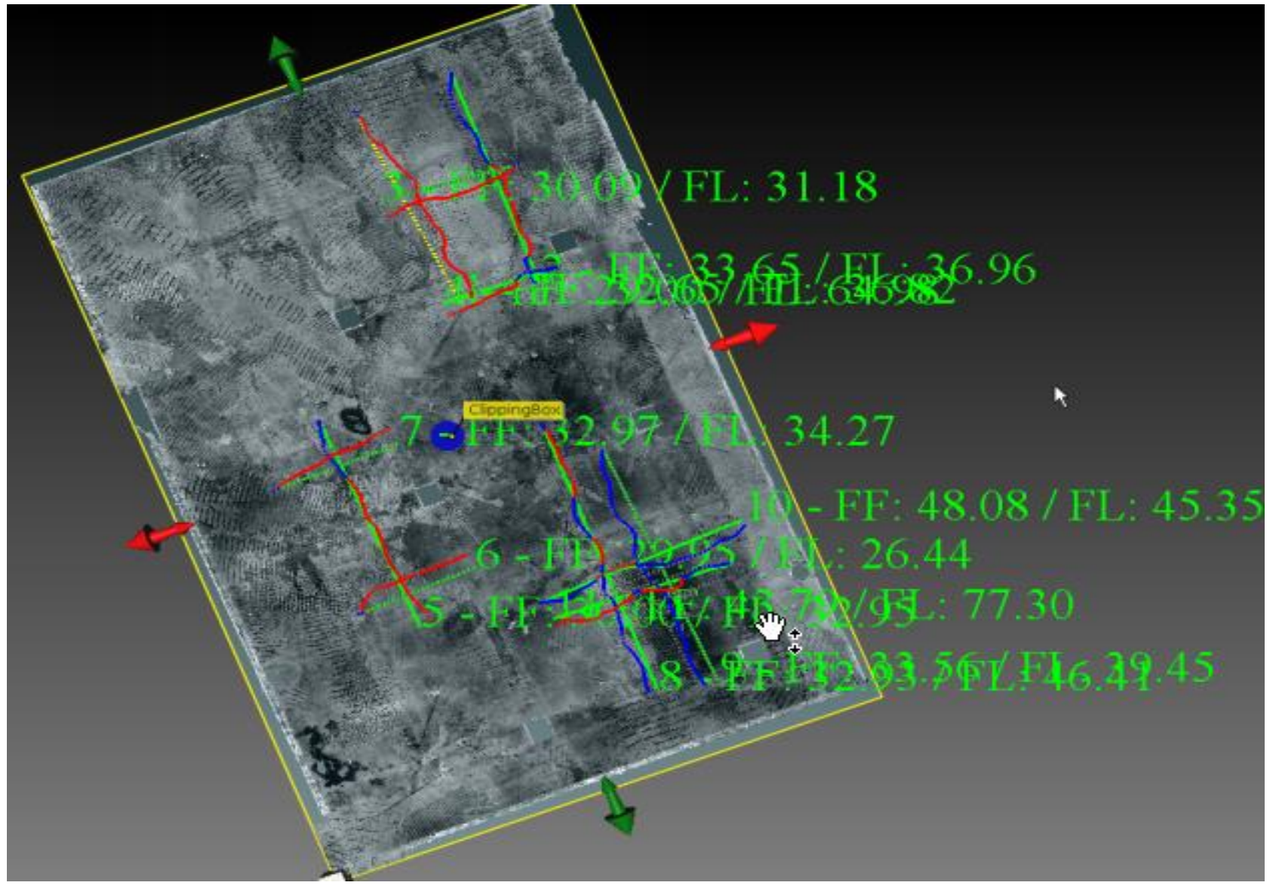




Floor Flatness and Floor Levelness

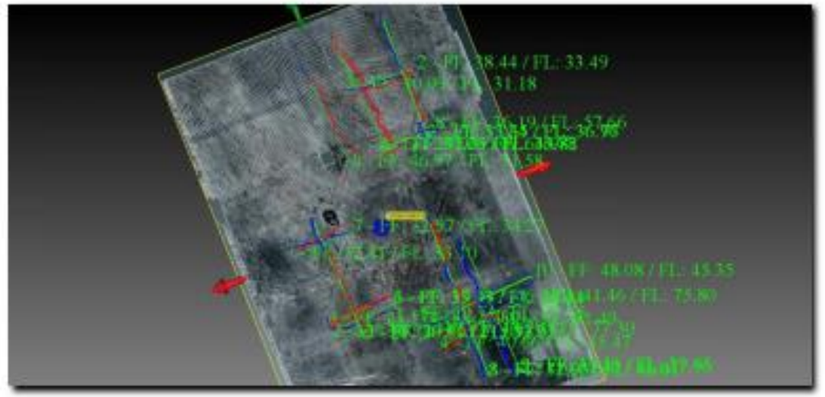


Floor Flatness and Floor Levelness – ASTM 1155



Floor Flatness / Floor Levelness Inspection Results

Per ASTM 1155 Specifications



Inspection Information

Project	BSRL_CGRI
Location	Tucson
Pour Date	March 17th, 2017
Scan Date	March 17th, 2017
Measured Area	

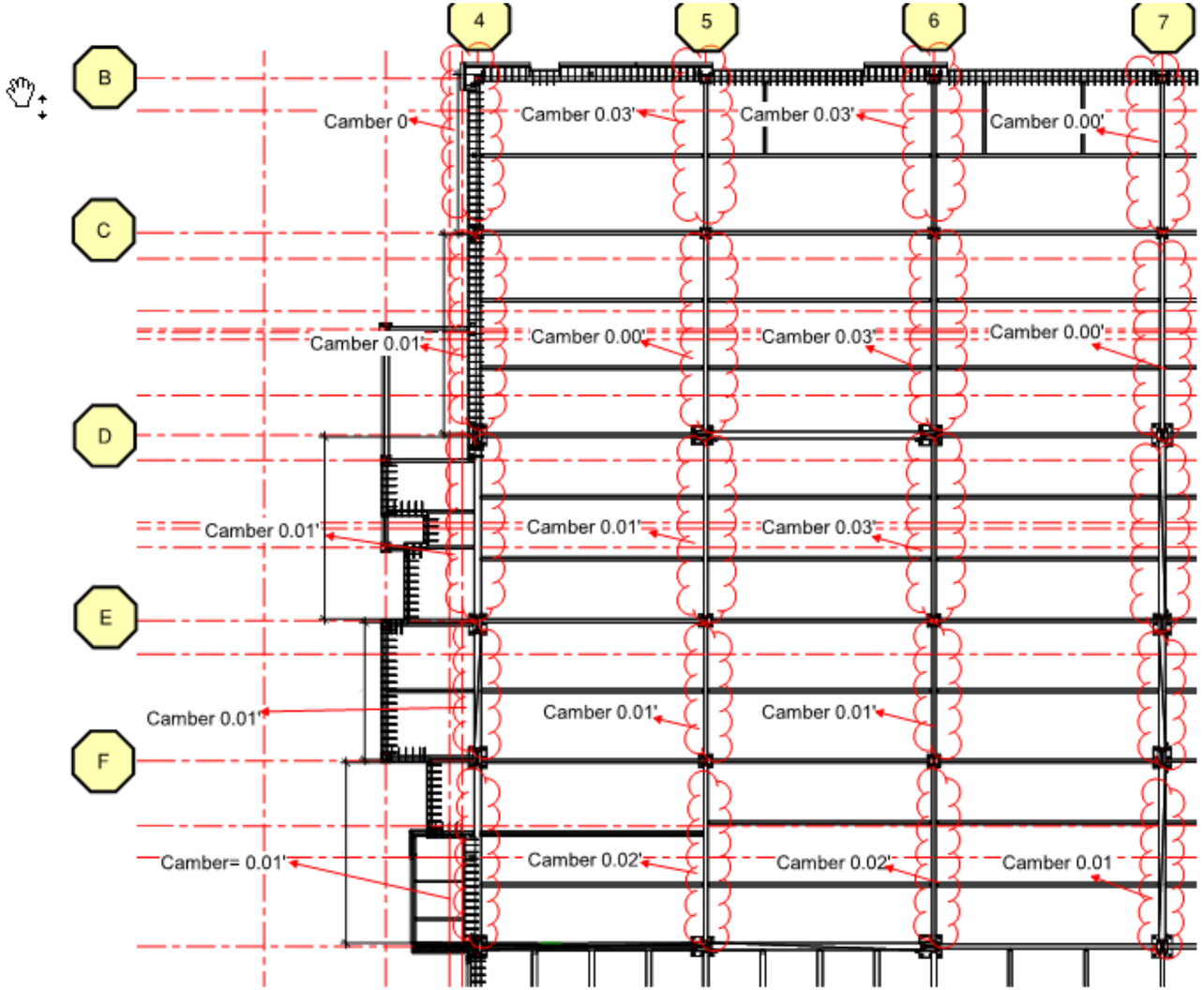
Contract Specifications

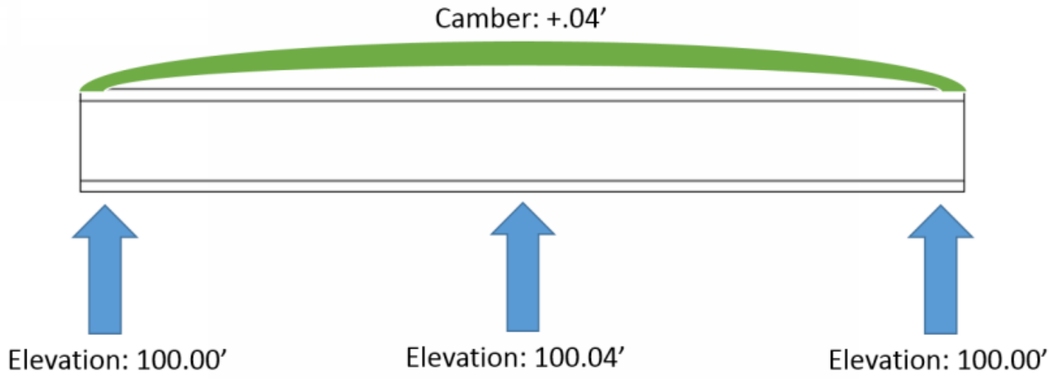
Reference	Overall Flatness	Minimum Flatness	Overall Levelness	Minimum Levelness
CSI Division 03	30	24	20	15

Overall Results

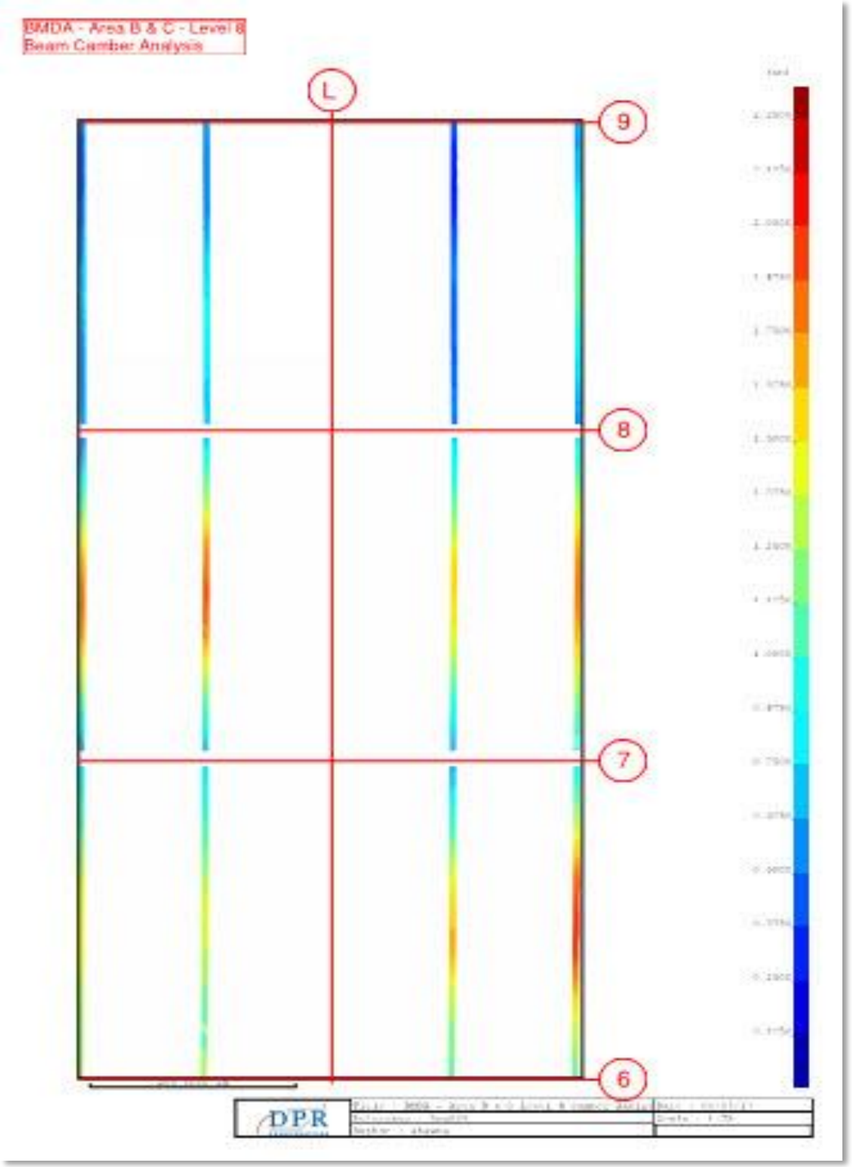
Measured Flatness (FF)	33.45	Measured Levelness (FL)	39.00
FF 90% Confidence	30.95 - 35.95	FL 90% Confidence	34.97 - 43.04
Measured Flatness Test	PASS	Measured Levelness Test	PASS
Minimum Flatness (FL_min)	29.00	Minimum Levelness (FL_min)	26.44
FF_min 90% Confidence	18.69 - 39.31	FL_min 90% Confidence	11.61 - 41.28
Minimum Flatness Test	PASS	Minimum Levelness Test	PASS

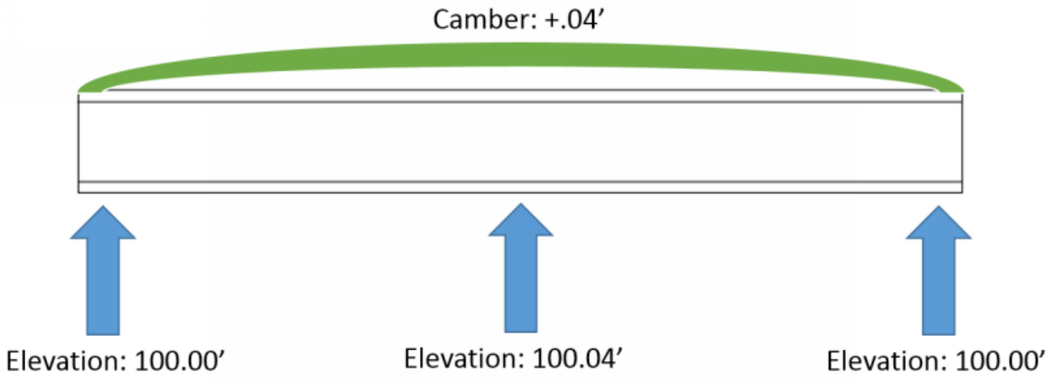
Camber Analysis – Approach 1



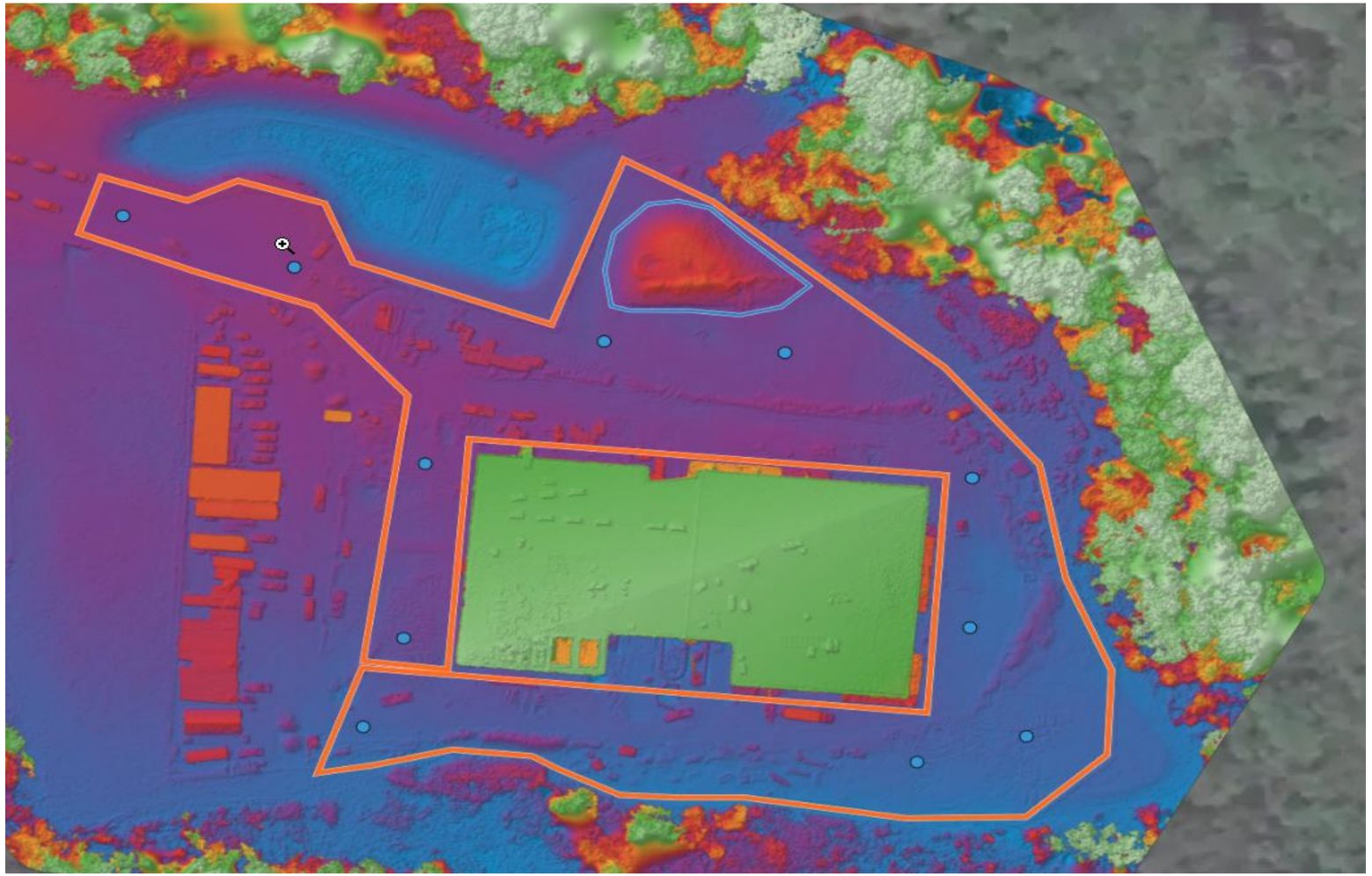


Camber Analysis – Approach 2

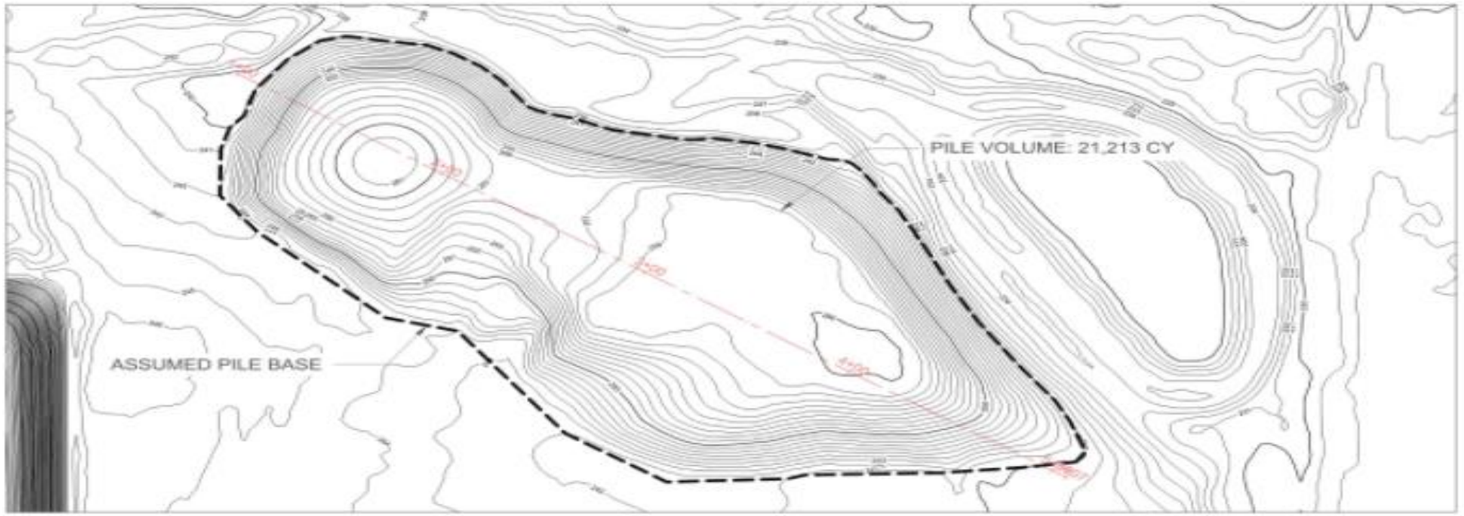


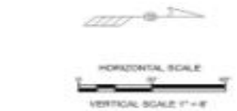


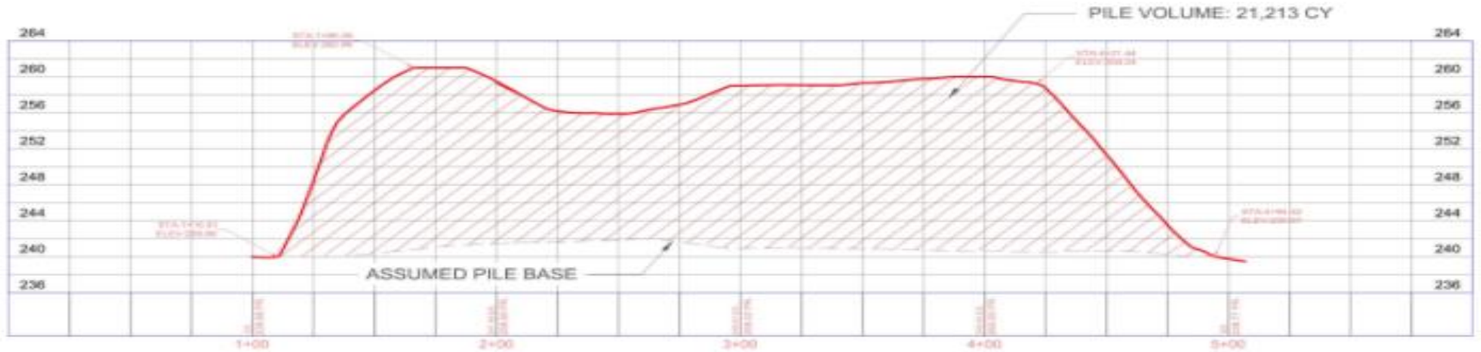
Site Analysis – Cut/Fill



Site Analysis – Stockpile

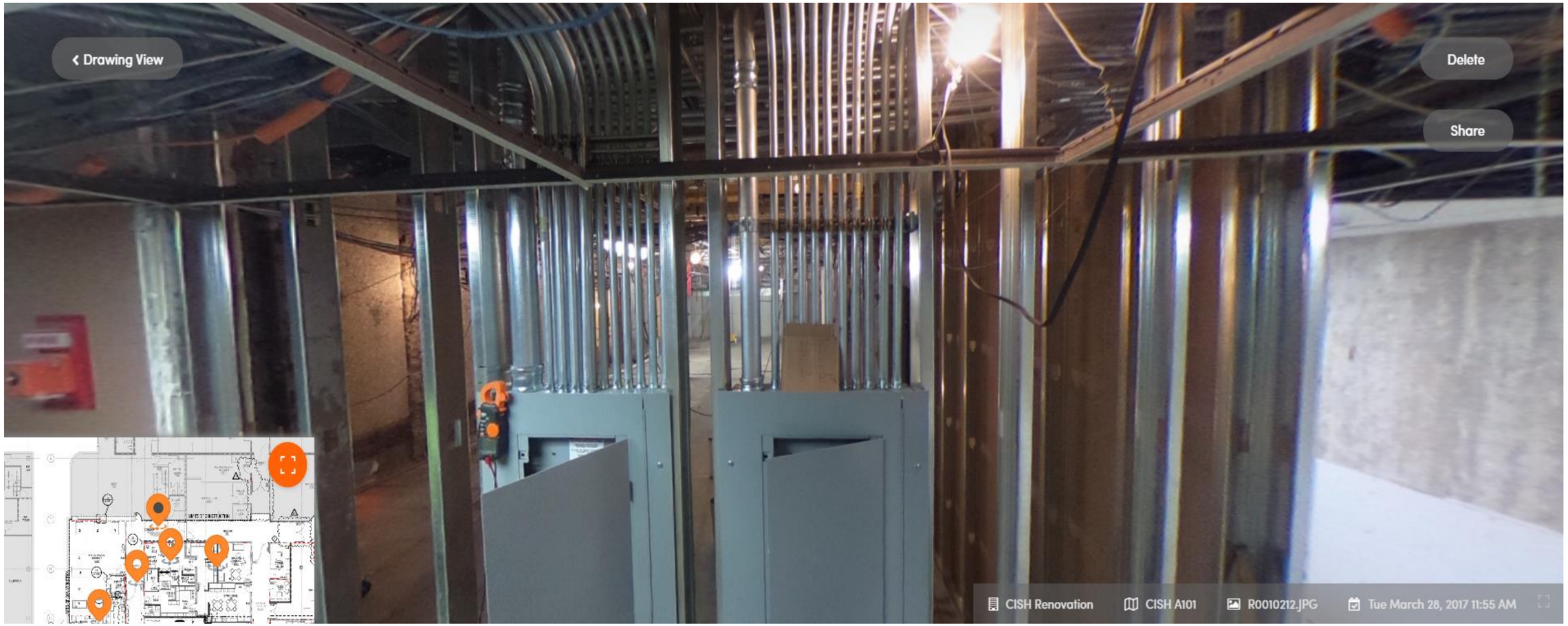






Site logistics and Safety

Progress Tracking (Virtual Walk Through)



Value of Reality Capture

5%-12%

Project cost is wasted on rework, schedule delays downstream clashes

5%-7%

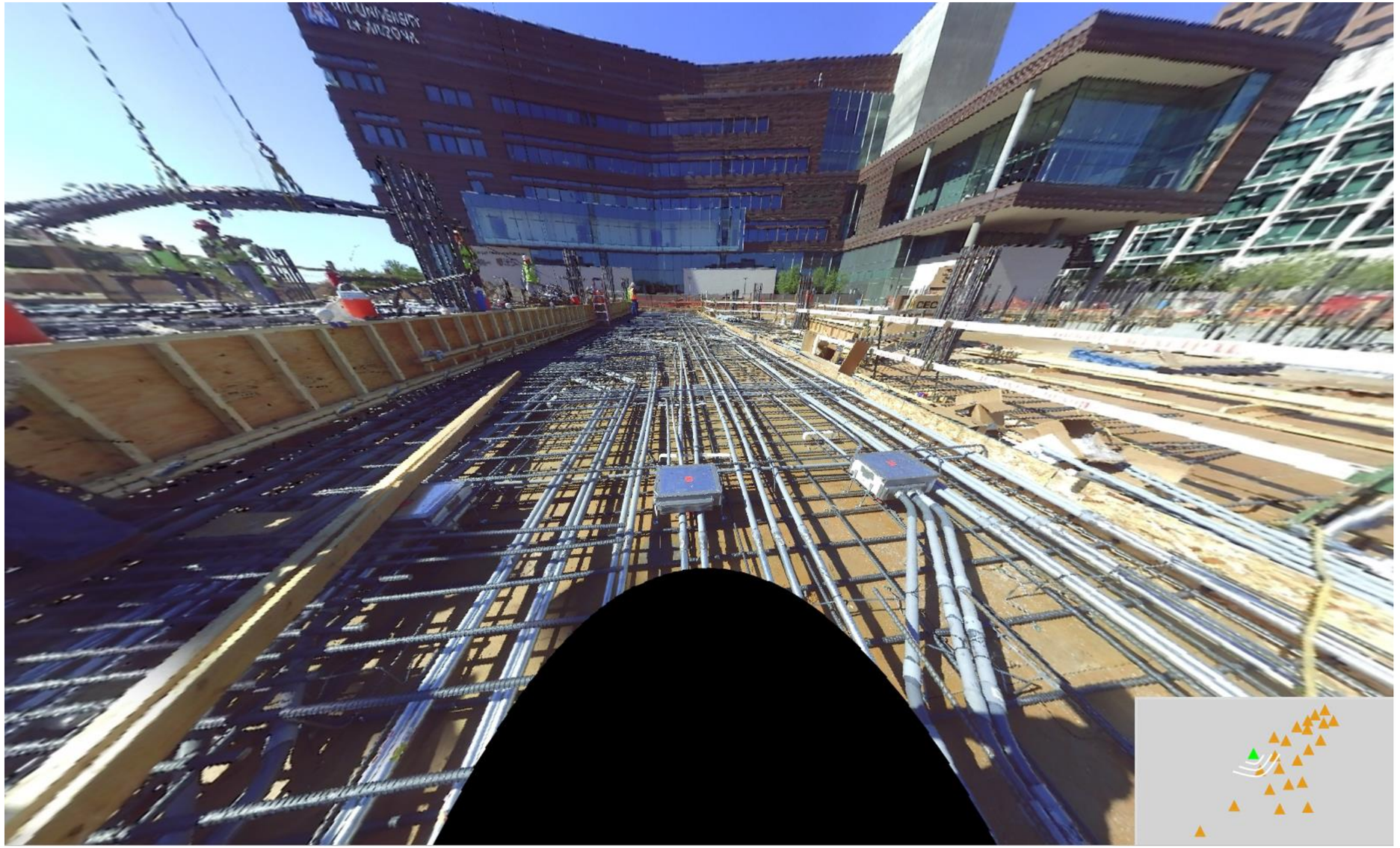
Reduce Total installed cost of Brownfield project cost

2%

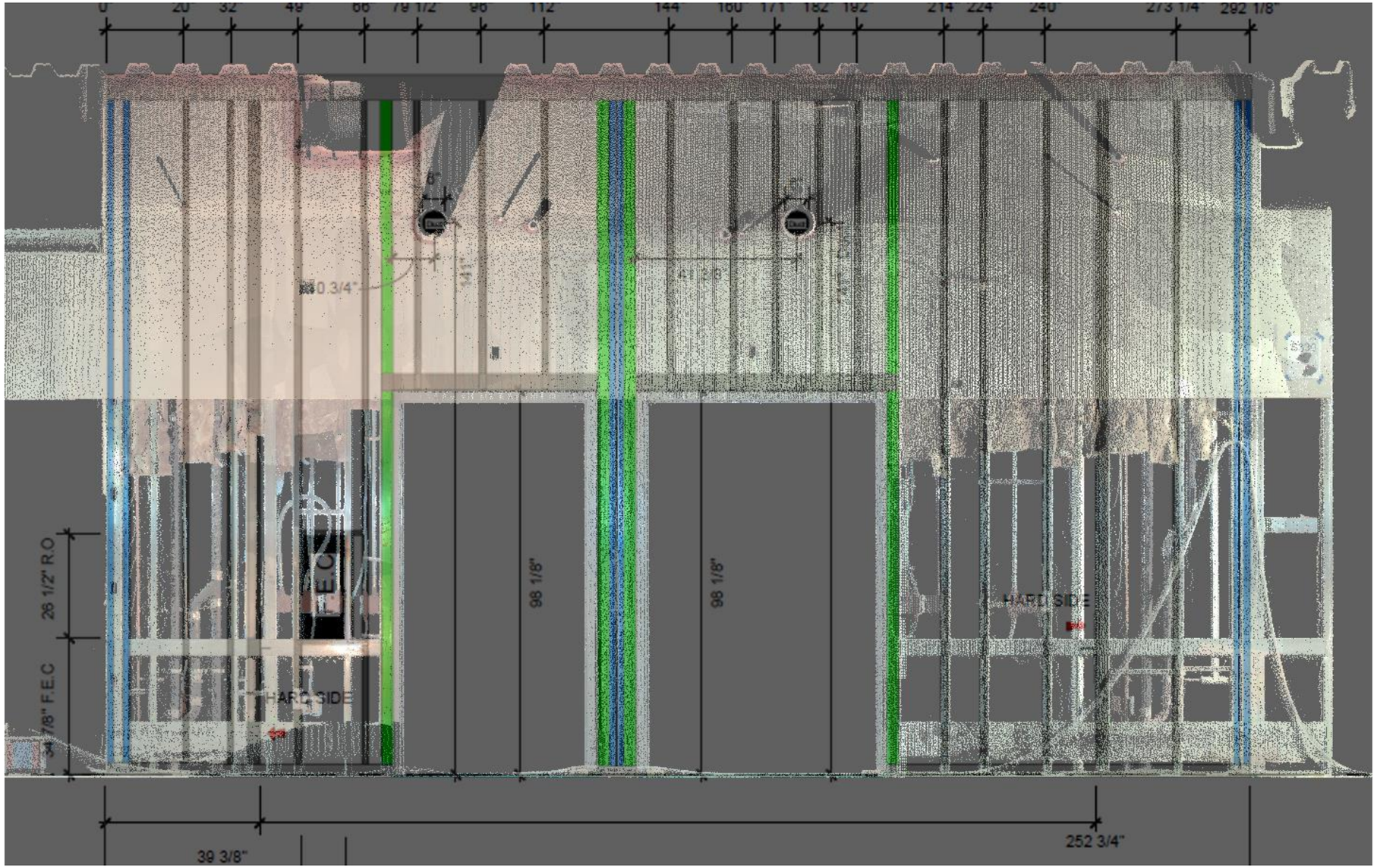
Driving rework contingencies down

Post Construction Use Cases

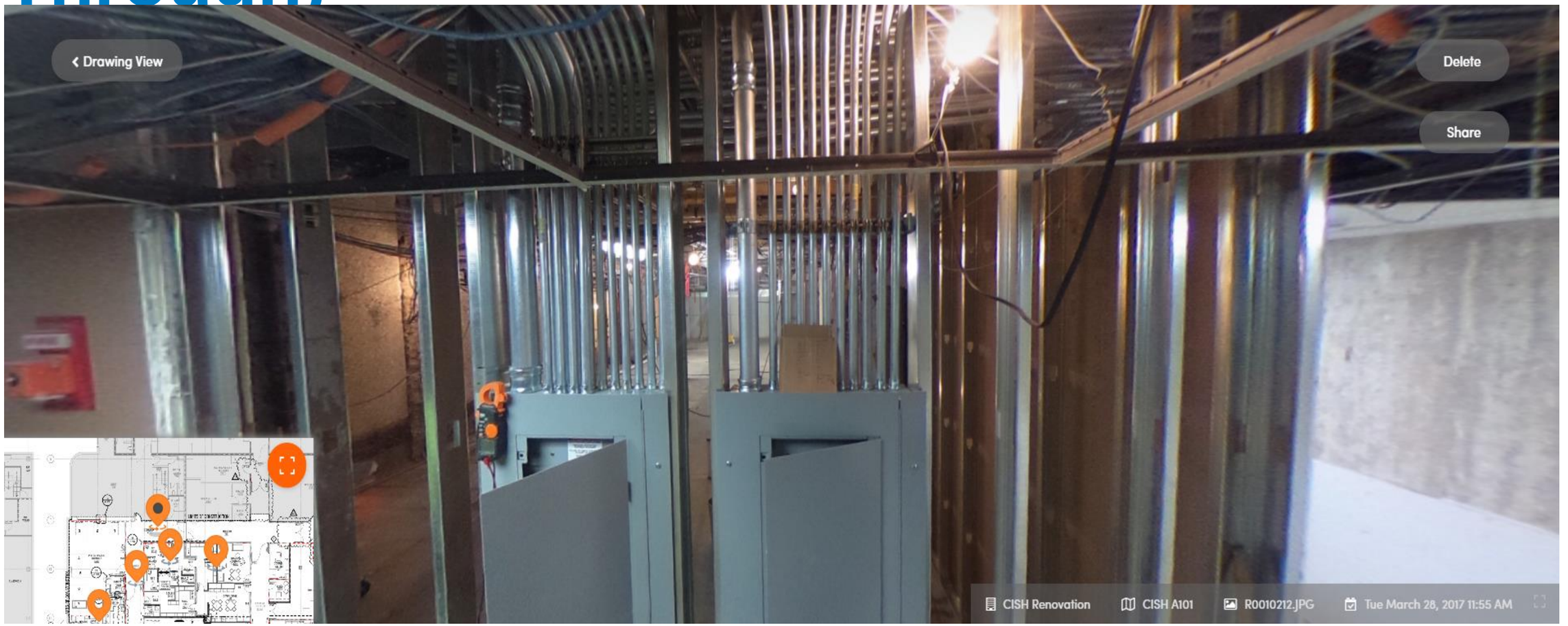
Documentation – In slab



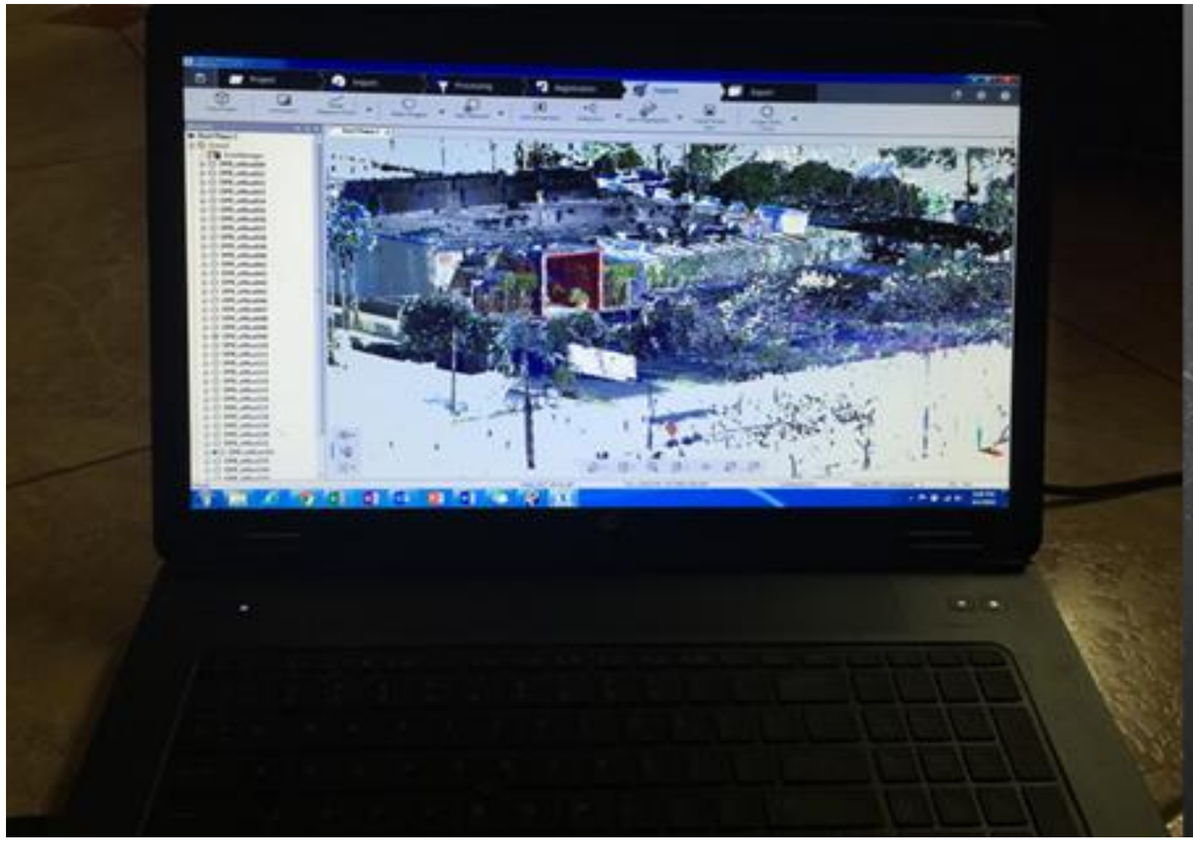
Documentation – In Wall

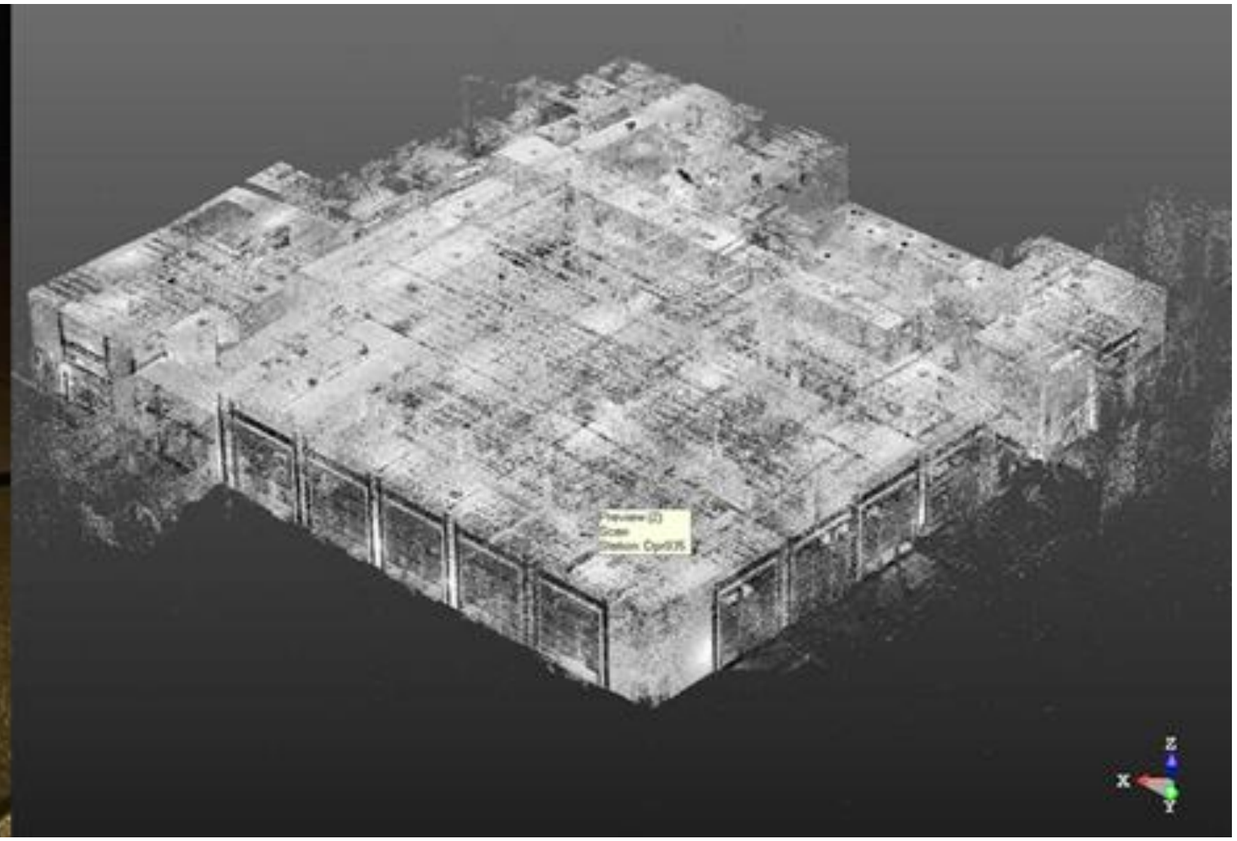


Documentation – Project (Virtual Walk Through)

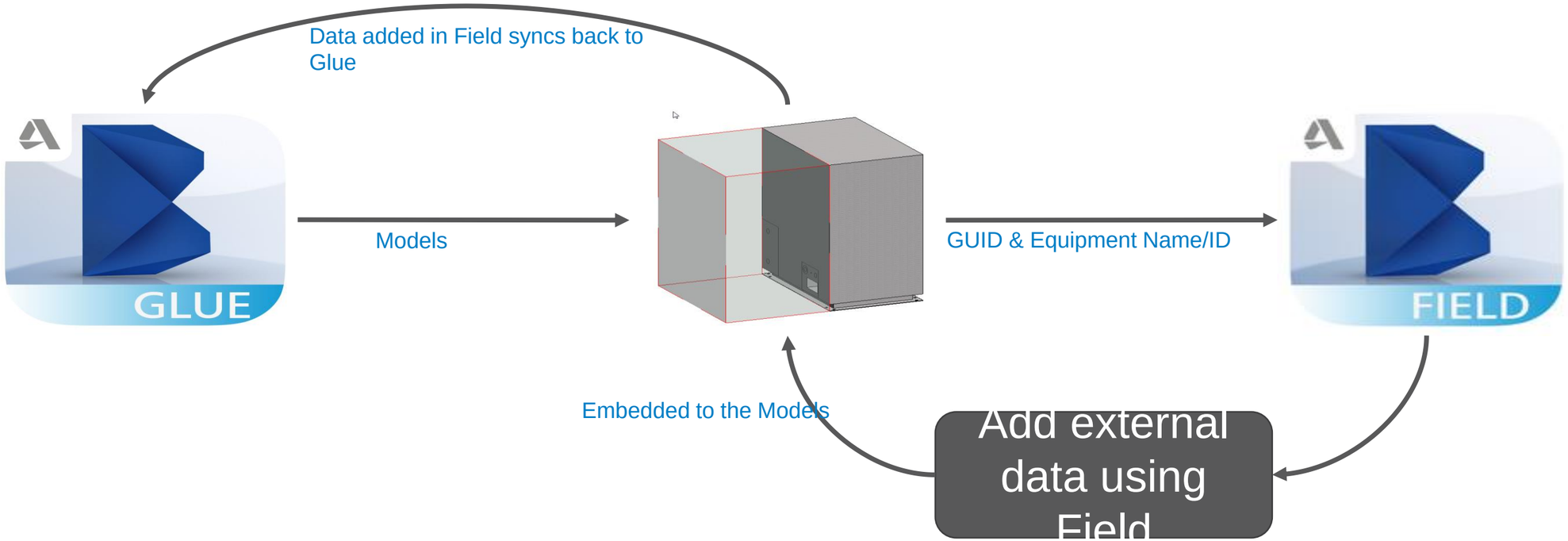


Facilities Management



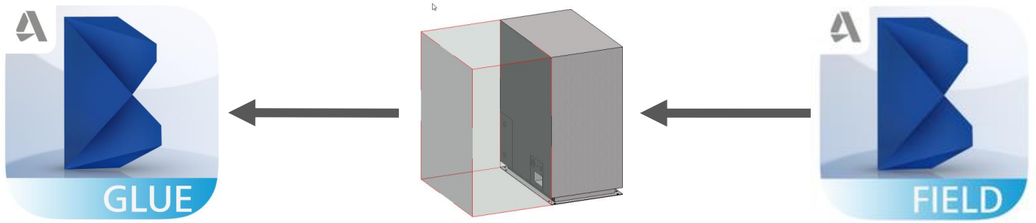


Facilities Management

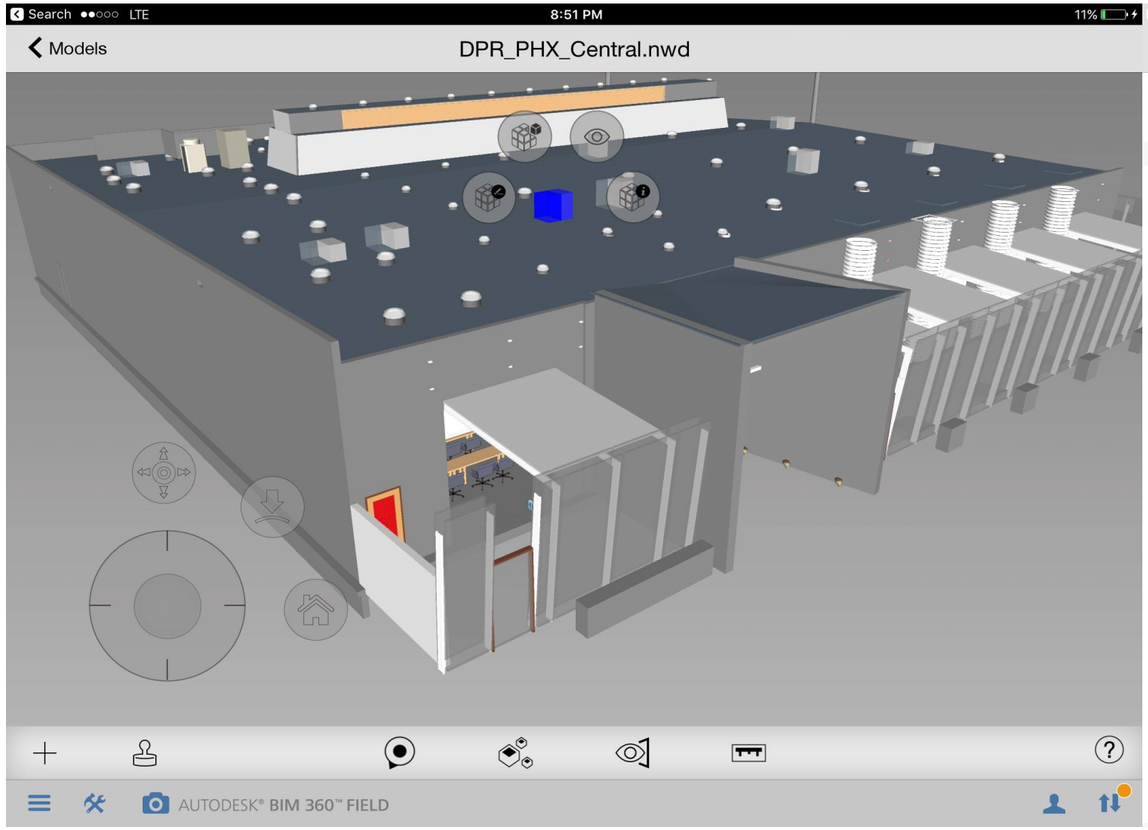


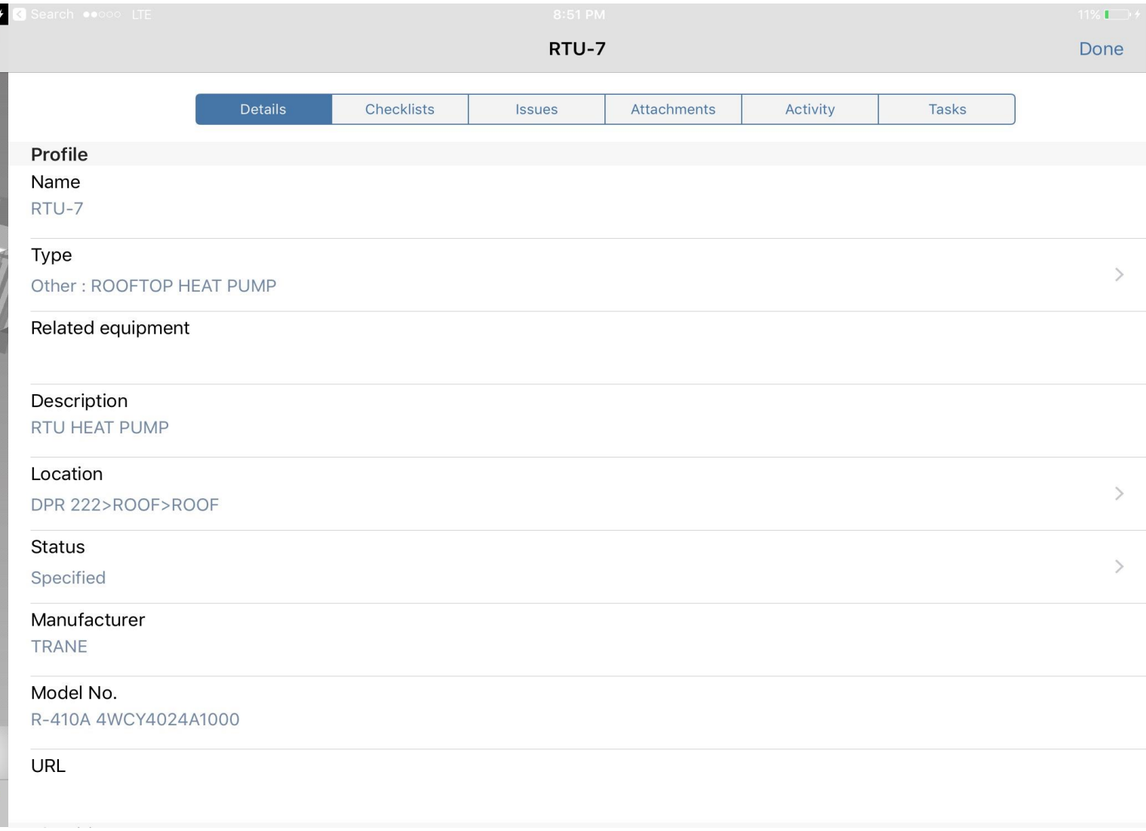
Facilities Management

	Name	Type	Description	Location Path	Manufacturer	Model No.	Serial number	Barcode	BIM Object ID
☐	RTU-1	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCY4030A1000	11215J4K9H	PHXR01RTU01	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-7	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCY4024A1000	11205GXS9H	PHXR01RTU07	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-6	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCZ6036A3000	11212F639H	PHXR01RTU06	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-3	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCZ6036A3000	11215JSY9H	PHXR01RTU03	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-5	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCZ6036A3000	11214J059H	PHXR01RTU05	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-8	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCY4030A1000	11215JST9H	PHXR01RTU08	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-2	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCZ6036A3000	11211JJL9H	PHXR01RTU02	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-9	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCY4030A1000	11215JSP9H	PHXR01RTU09	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-10	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCC3018A1000	11202MSE9H	PHXR01RTU10	3acf221e-c9f7-473c-9b0a-e704b46f
☐	RTU-4	ROOFTOP HEAT PUMP	RTU HEAT PUMP	DPR 222>ROOF>ROOF	TRANE	R-410A 4WCZ6036A3000	11211JJN9H	PHXR01RTU04	3acf221e-c9f7-473c-9b0a-e704b46f



Facilities Management



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