CS11787: Reality Capture for Construction; So I Have a Point Cloud, Now What?

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Class summary

Today, it's very fast and easy to collect large amounts of data with reality capture technology—but what can a point cloud be used for? The obvious answer is as-built verification of existing spaces. But is there something more that you can use it for? This class will focus on strategies using already existing tools within the Autodesk, Inc., product line that go beyond just as-builds. We will discuss examples of lessons learned and successes from integrating reality capture workflows while assisting new construction and renovation projects. From scanning to installation and beyond to facilities management, there is almost always something that you can create from a point cloud.

Key learning objectives

At the end of this class, you will be able to:

- Understand basic strategies for reality capture
- Understand strategies for identifying when a point cloud needs to be converted into a model
- Understand strategies for using a point cloud for 3D MEP coordination
- Understand strategies for how to integrate a point cloud for project turnover

Introduction

OKLAND
CONSTRUCTION

Introduction

Okland's Integrated Construction Team

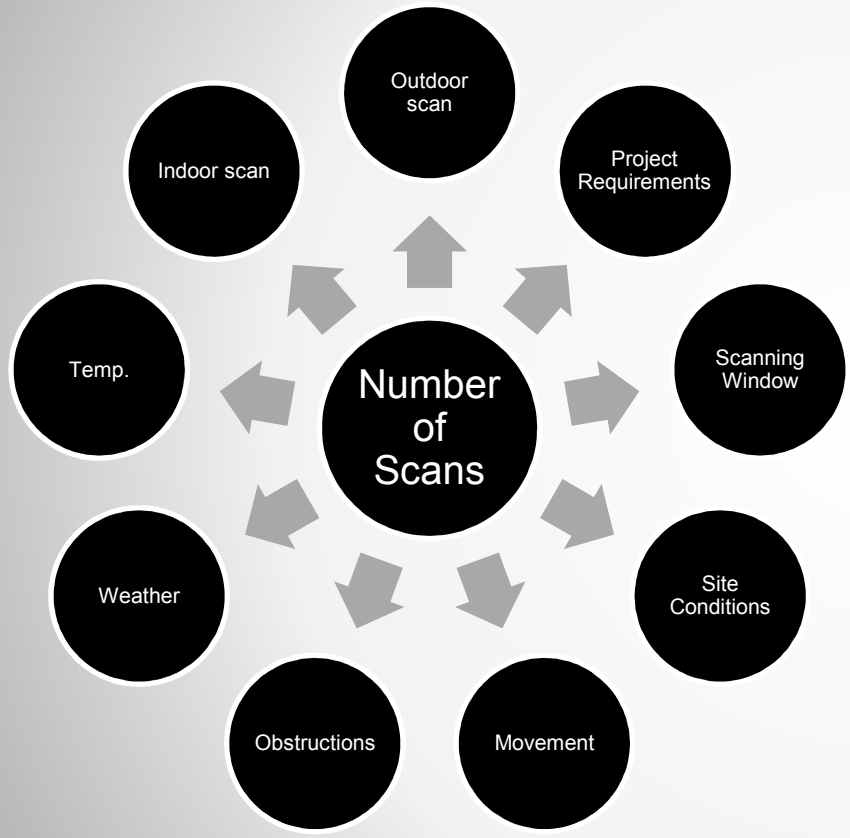
Provide Innovative Solutions through Technology to Maximize Individual Potential

OKLAND CONSTRUCTION

What can a Point Cloud be used for?

- As-Built during Pre-construction
- As-Built during Construction
- UAV for Site Conditions
- 3D MEPF Coordination
- Quality Assurance/Quality Control of Mock-ups
- Quality Assurance/Quality Control of Concrete
- Quality Assurance/Quality Control of Installation/Placement
- Owner Turnover

Basic Strategies



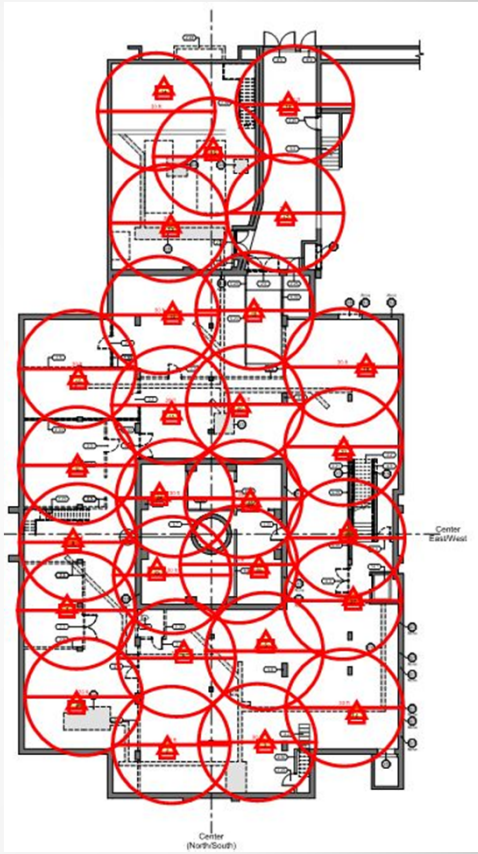
Basic Strategies - Estimating

Outdoor Scans

- Site Maps
- Google maps
- Nearmap

Indoor Scans

- Floor Plans



Basic Strategies - Estimating

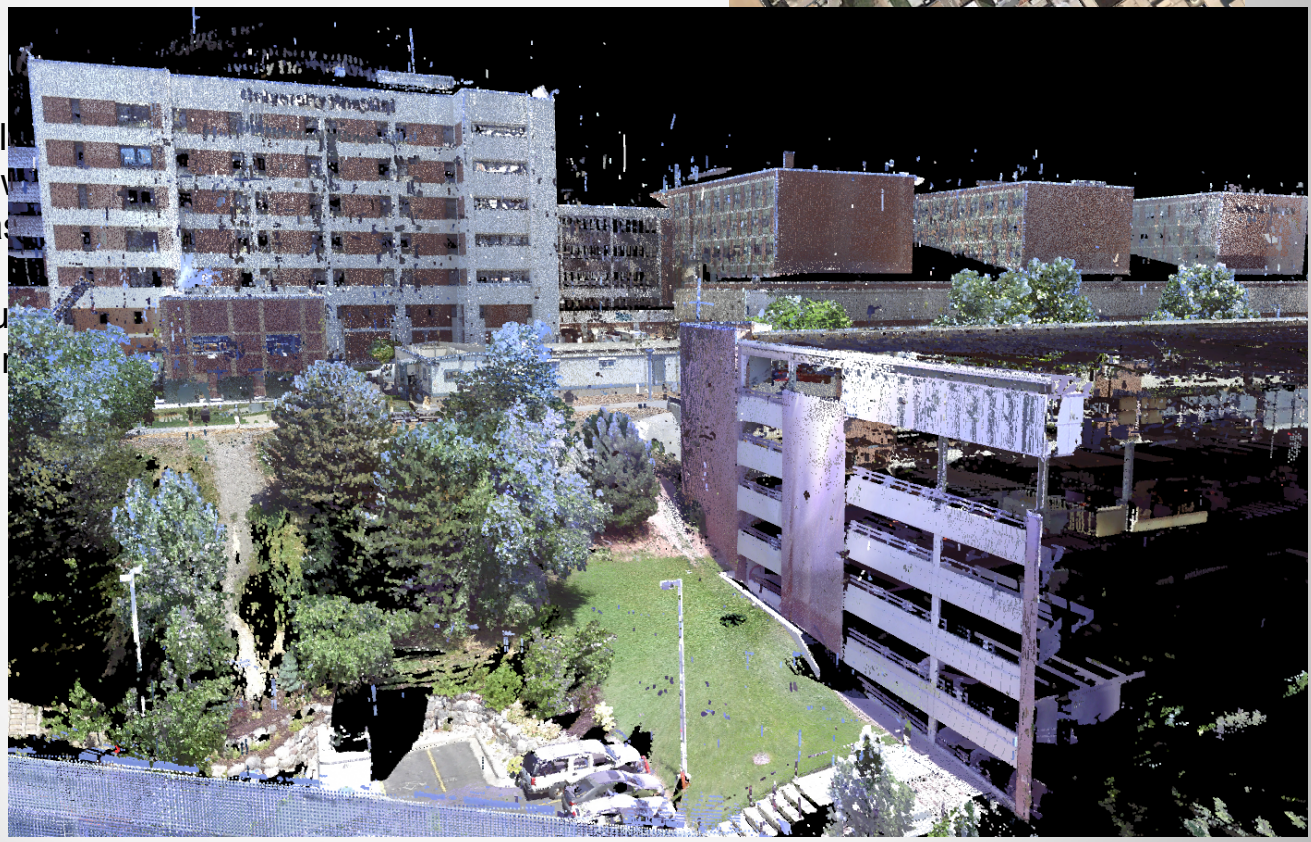
Lessons learned:

Temp.

In direct sunl
Plan cool dow
shaded areas

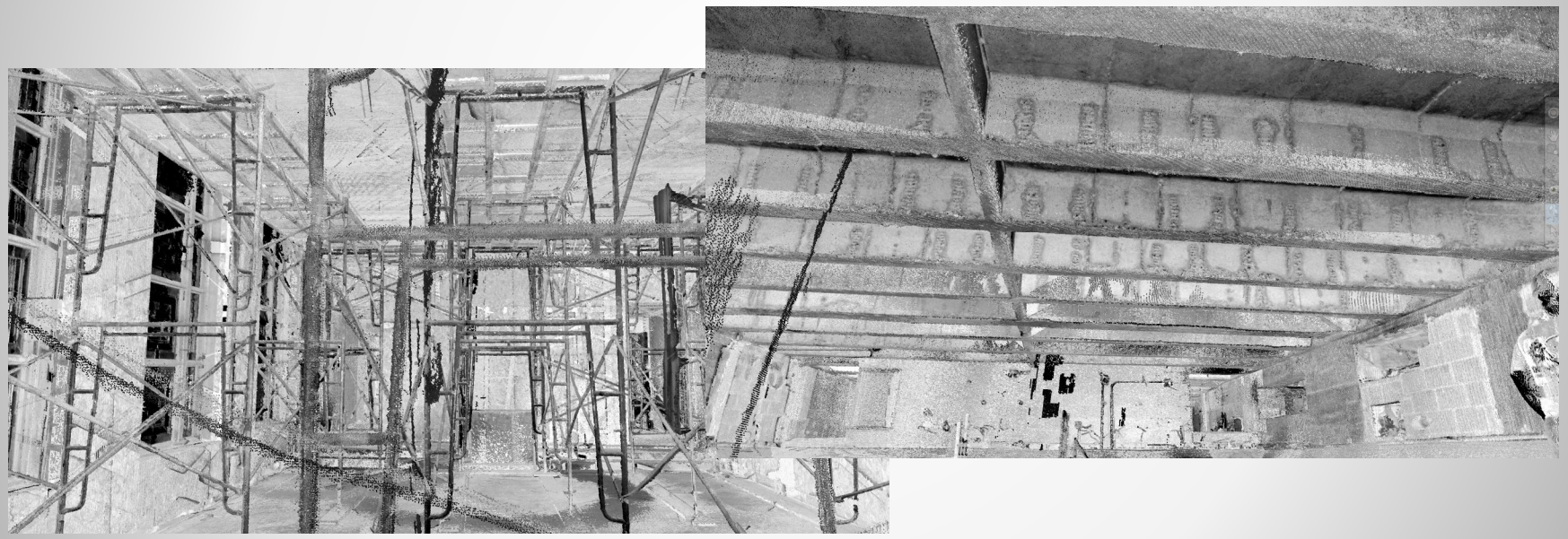
Site Conditions

Realizing bu
different thar

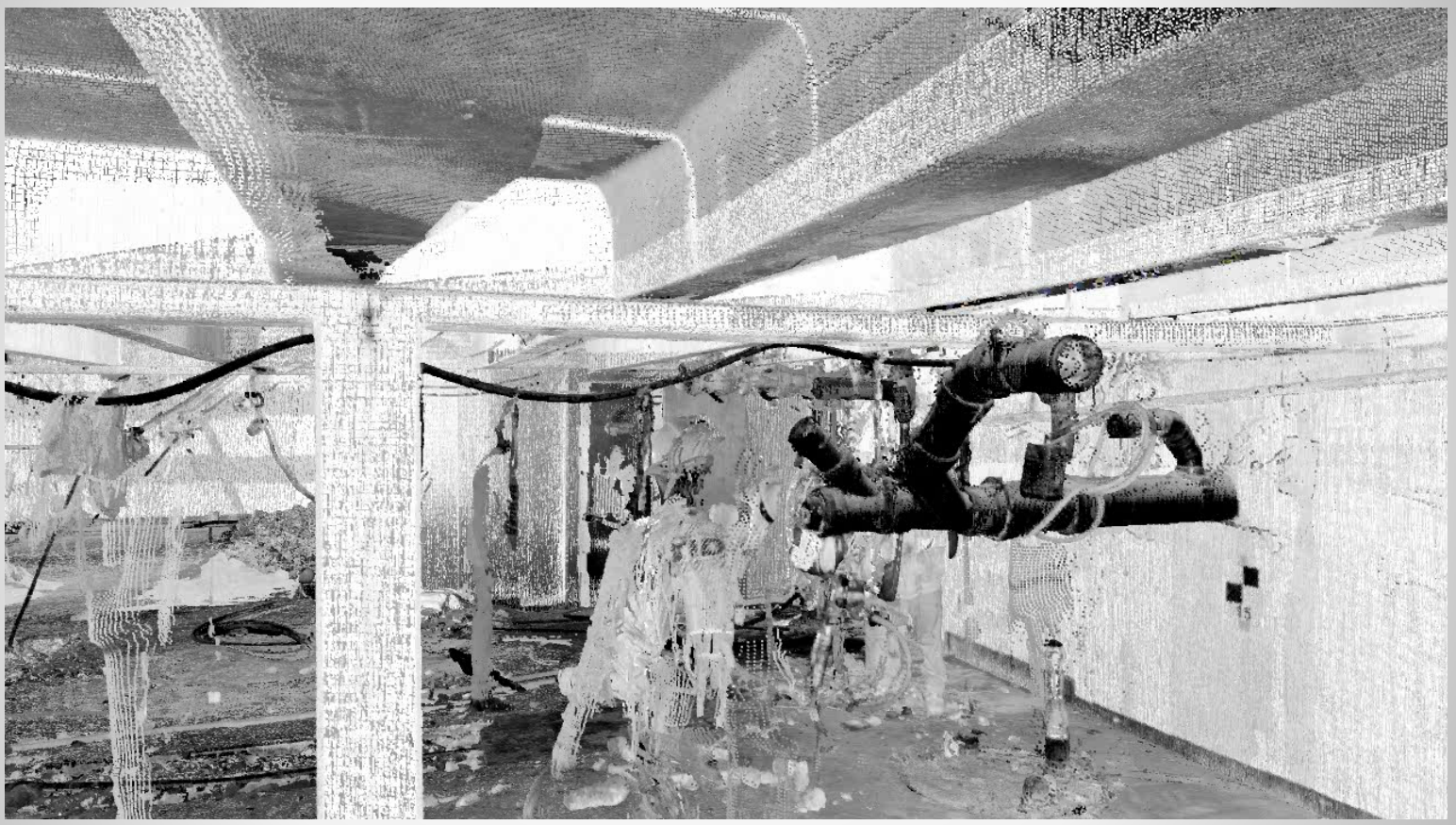


What Happens when you don’t have a plan?

- Take way more scans than you need which wastes time
  - Think Critically about your project



Basic Strategies



Progressive Scanning

Pre-Construction & Design

During construction

Owner Turnover

Pre-Demolition

Mock-Ups

Monitoring

Pre Design

Post Demolition

Concrete Placement

Systems Placement

Existing Conditions

QA/QC Scans

Placement

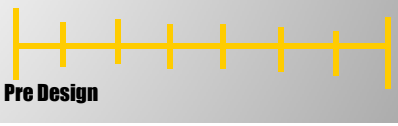
Pre-Design Scans

As-Built during Pre-construction:

Scan in order to check preexisting conditions

-Remodel

-Building with multiple additions



Pro's and Con's of scans during demolition Activities

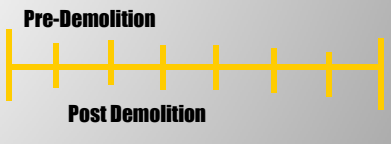
Pro's

- Very valuable if the design team did not scan for the design phase
- Extremely valuable if no model is provided by the design team
- May discover items not shown on the drawings that need to be incorporated
- Shows all existing systems in context
- May be used to update the model
- May be used for 3D MEPF coordination

Con's

Need's to be timed well

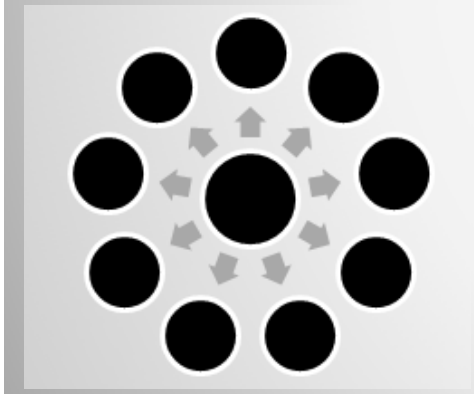
May require multiple visits

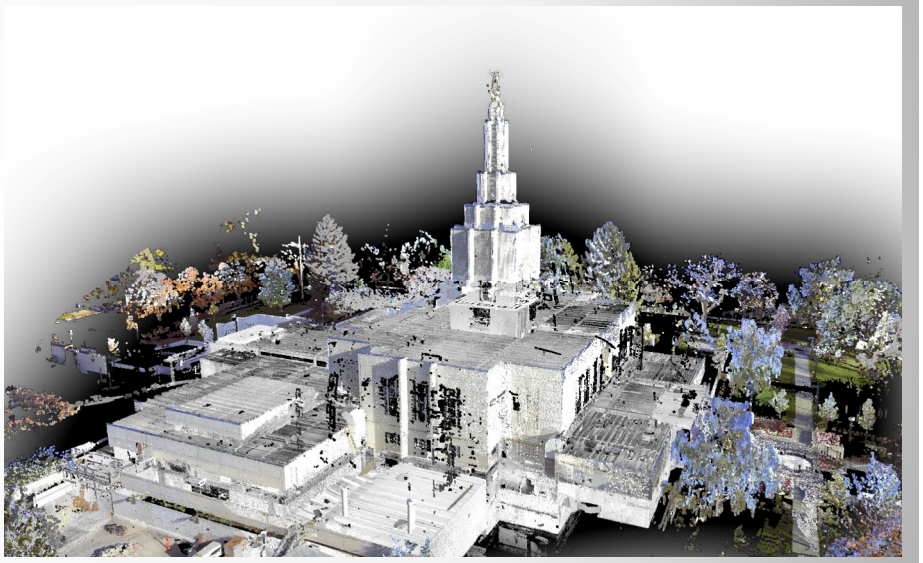


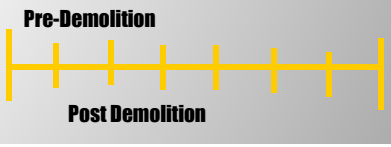
Scans During demolition phase

Example:

-Concrete building
Original construction……1946
Additions and renovations……Over 15

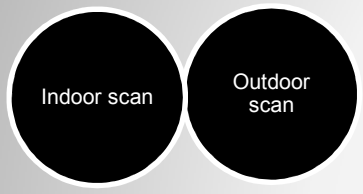




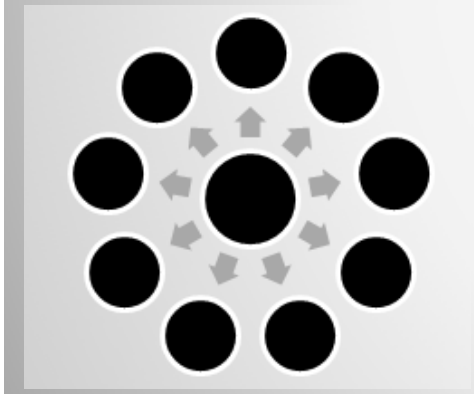


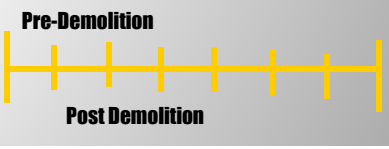
Scans During demolition phase

Lessons learned:



Indoor outdoor conditions:
Changing settings to capture both.



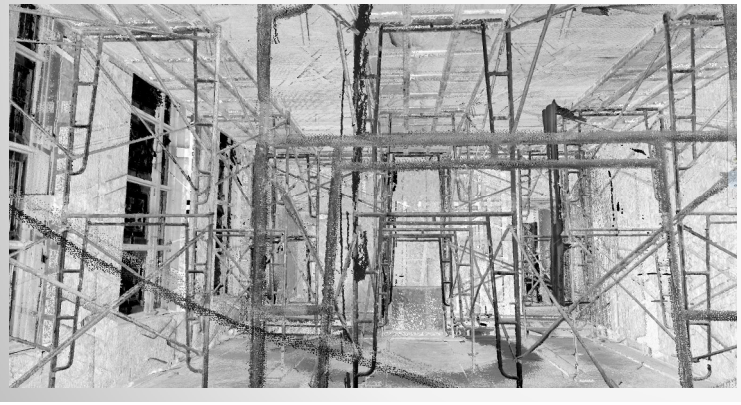


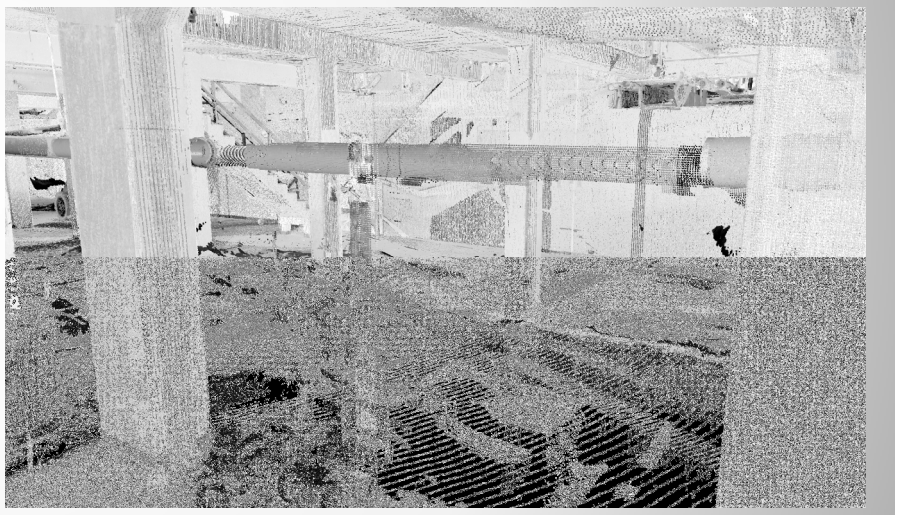
Scans During demolition phase

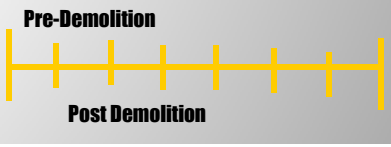
Lessons learned:

Indoor outdoor conditions:
Changing settings to capture both.

During Demolition many obstructions, dust in the air, area's that can't be reached







Scans During demolition phase

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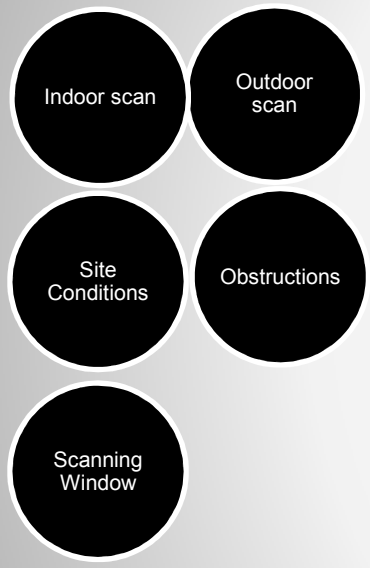
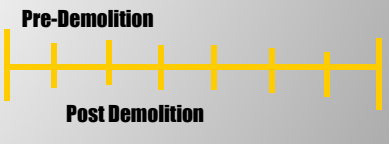
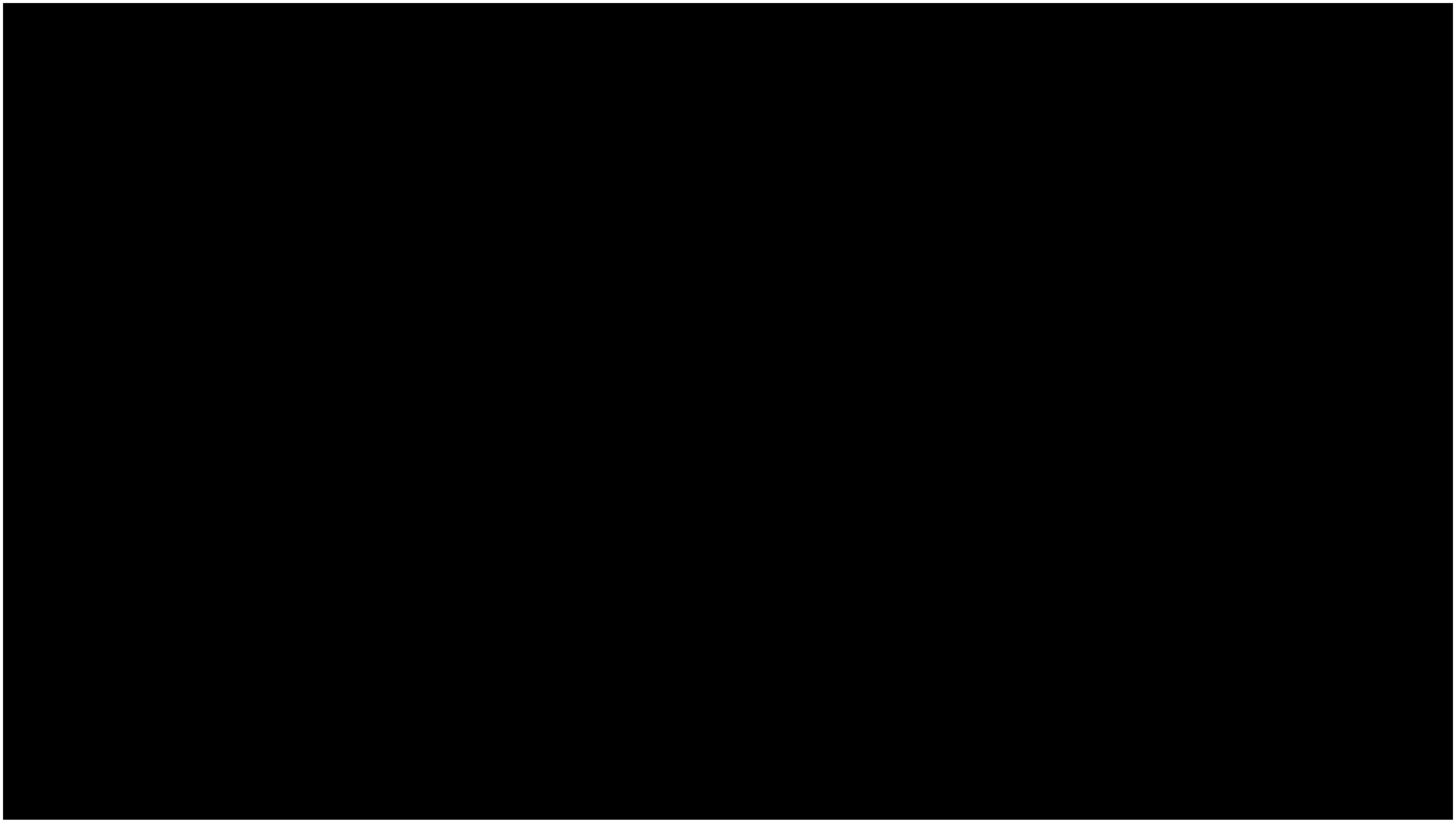


Indoor outdoor conditions: Changing settings to capture both.

During Demolition many obstructions, dust in the air, area's that can't be reached

Building was demolished by floor. Had short window between when it was demolished, and when new construction going in

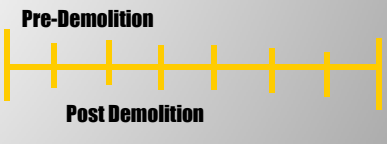




Pro's and Con's of scans during demolition Activities

Example:

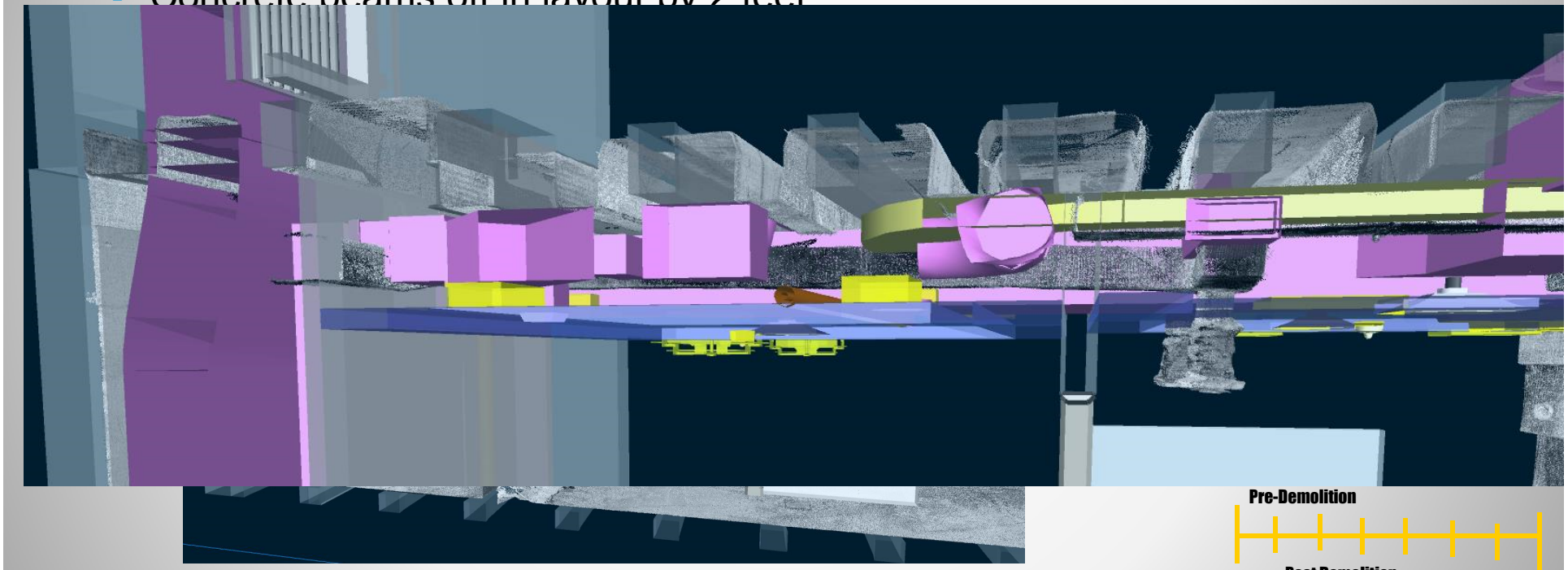
- Valuable to find items not shown in drawings



Pro's and Con's of scans during demolition Activities

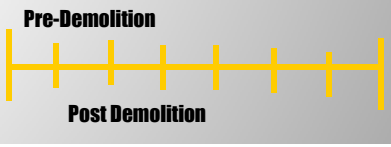
Example:

- Concrete beams off in layout by 2 feet



When to convert to a model

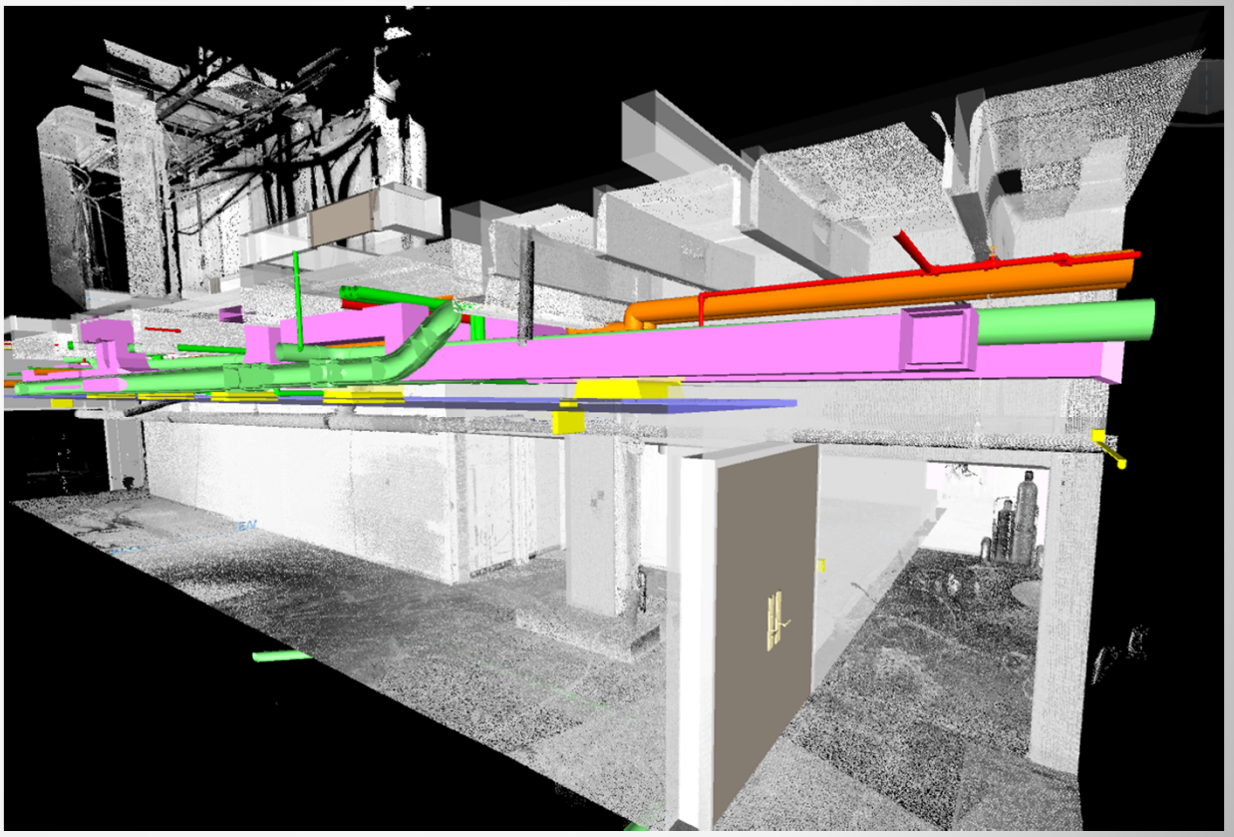
Coordination of Existing space	Mostly structural elements – few systems	Use Point cloud as-is
Coordination with Existing Equipment	Some large pieces of equipment and structure	Portions of Point cloud converted to model
Coordination in a complex area	Structure is complicated and there will be remaining systems	Convert entire point cloud into model

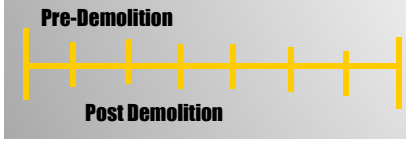


MEPF Coordination - No Model from Point Cloud

Existing Concrete coordination

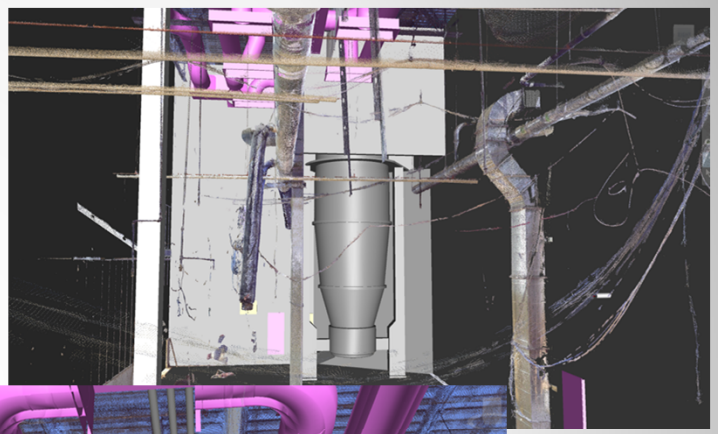
-Simply use Point cloud to coordinate with

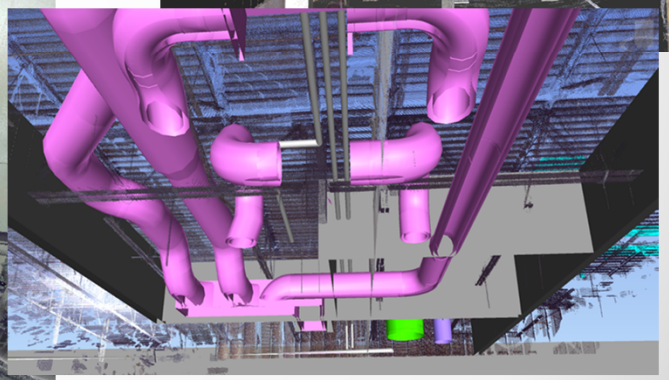




MEPF Coordination - Partial Model Created from Point Cloud

Coordination of specialty equipment in an existing space





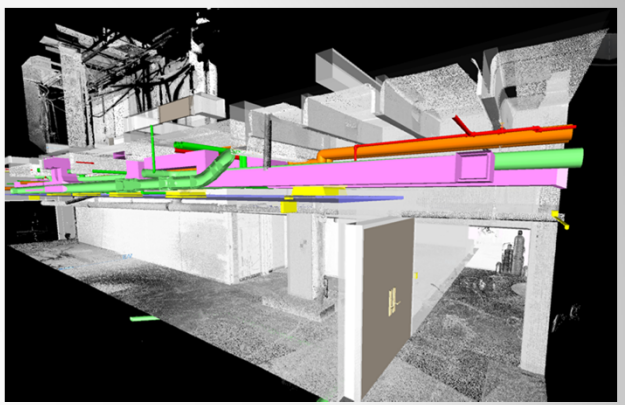
Pre-Demolition

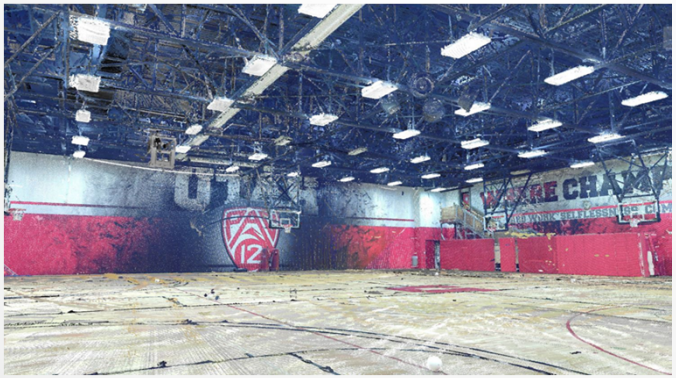
Post Demolition

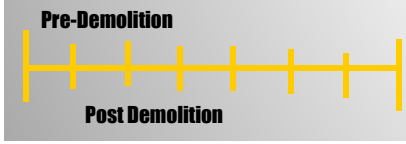
When to convert to a model – MEPF Coordination

Overall Scanning during demolition saves:

-Time
-Money
-It's safer
-and it's more
accurate







Progressive Scanning

Pre-Construction & Design

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Mock-Ups

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Concrete Placement

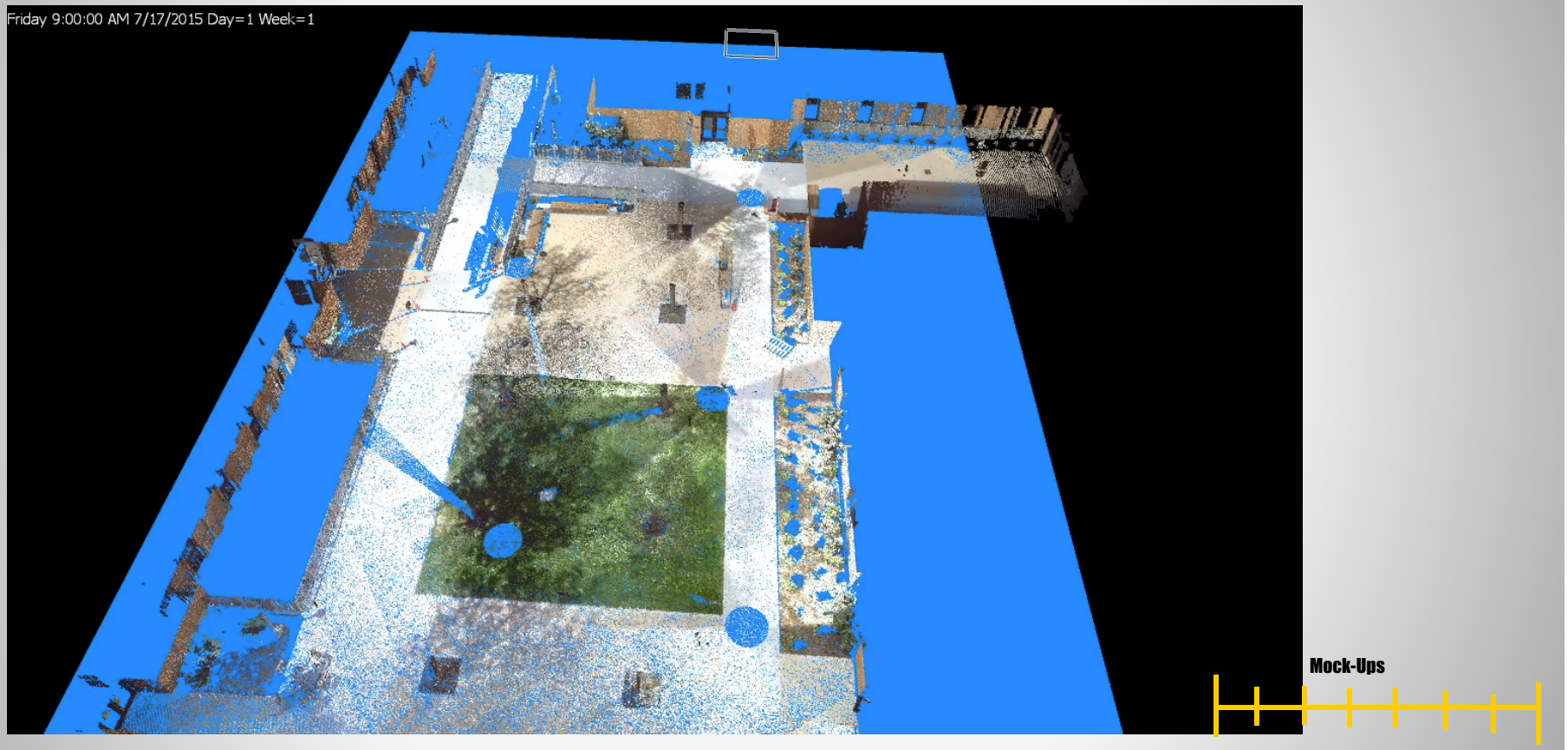
Systems Placement

Existing Conditions

QA/QC Scans

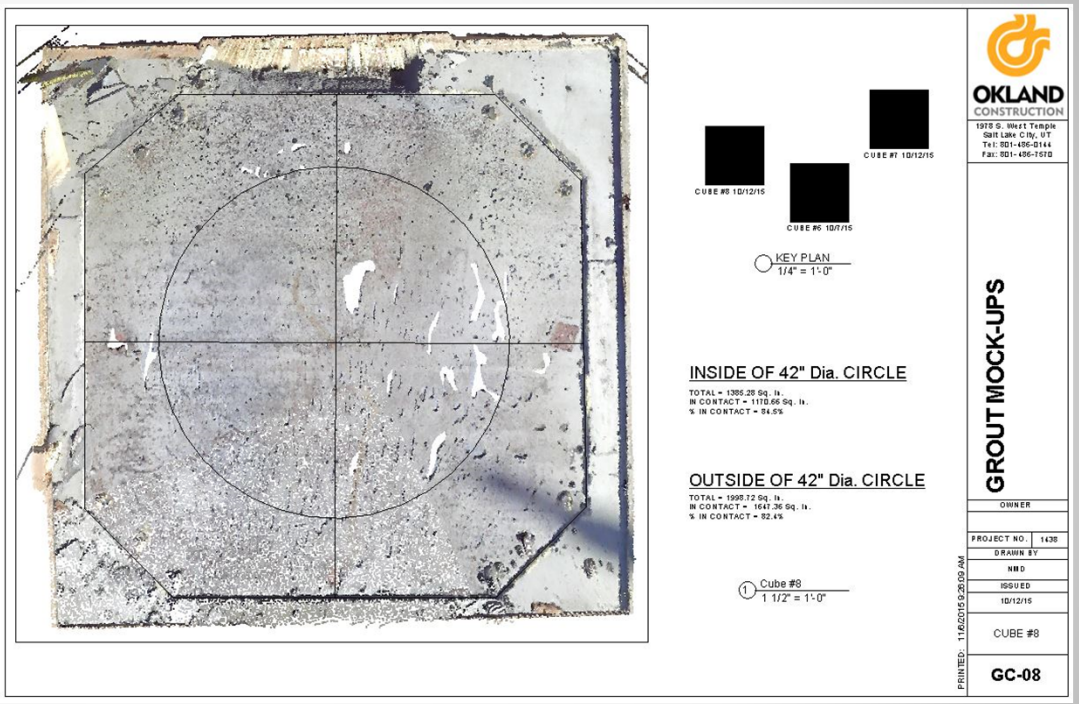
Placement

Mock-Ups - Virtual



Mock-Ups - Physical

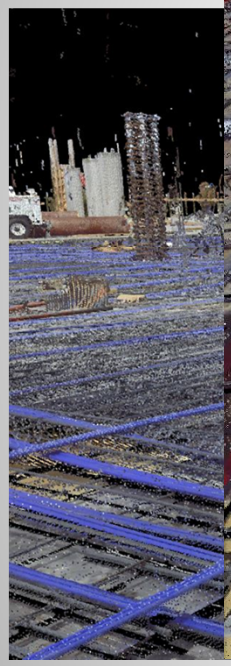
What percentage of this grout would be in contact with the bottom plate?



Mock-Ups

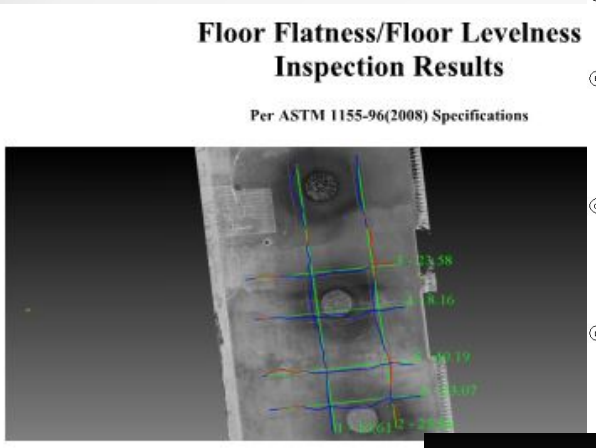
Concrete Placement

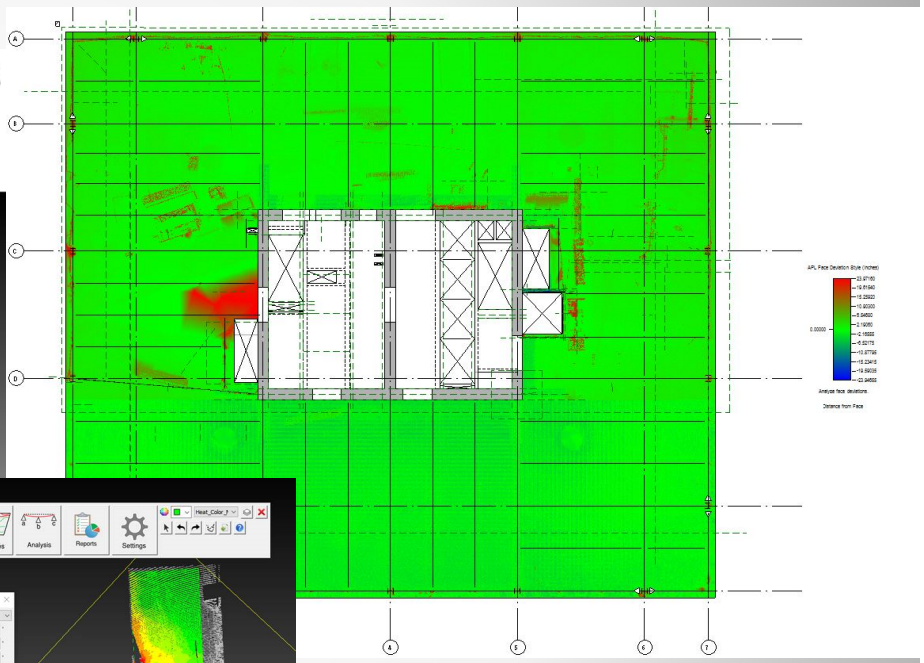
PT Cable



Concrete Placement

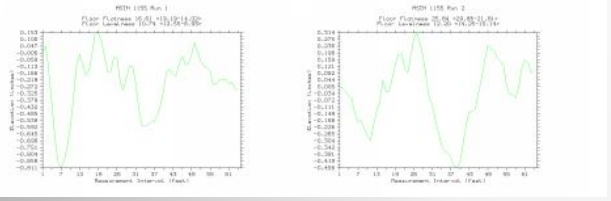
Concrete Placement – QA/QC

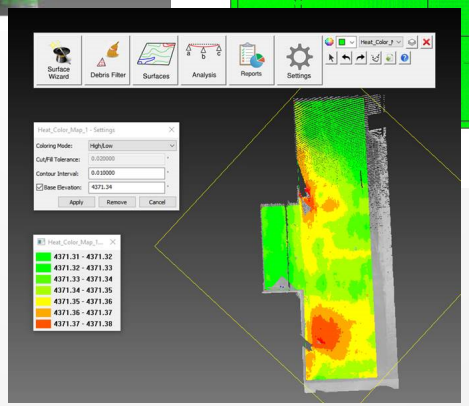




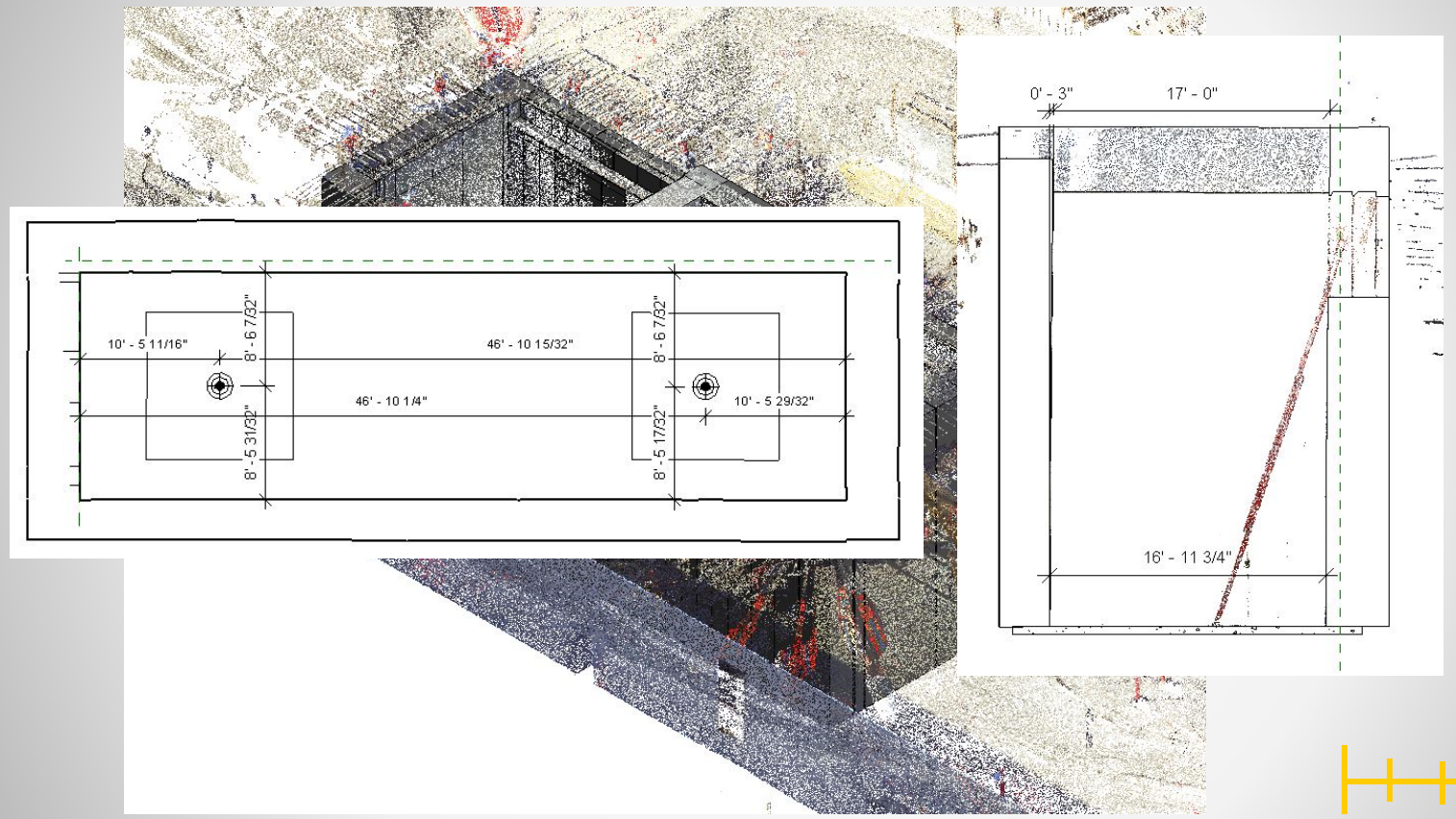
Logtitudinal measurements

Run #	Flatness (FF)	Status	90% Confidence			
1	16.6056	FAIL	14.02 - 19.19	10.7386	FAIL	8.93 - 12.55
2	25.836	PASS	21.81 - 29.86	12.1985	FAIL	10.14 - 14.25
3	23.5772	FAIL	18.20 - 28.96	19.9562	PASS	14.58 - 25.33
4	8.15524	FAIL	6.29 - 10.02	8.10505	FAIL	5.92 - 10.29
5	40.1933	PASS	31.02 - 49.36	30.1511	PASS	22.03 - 38.27
6	23.0682	FAIL	17.80 - 28.33	14.0586	FAIL	10.27 - 17.85



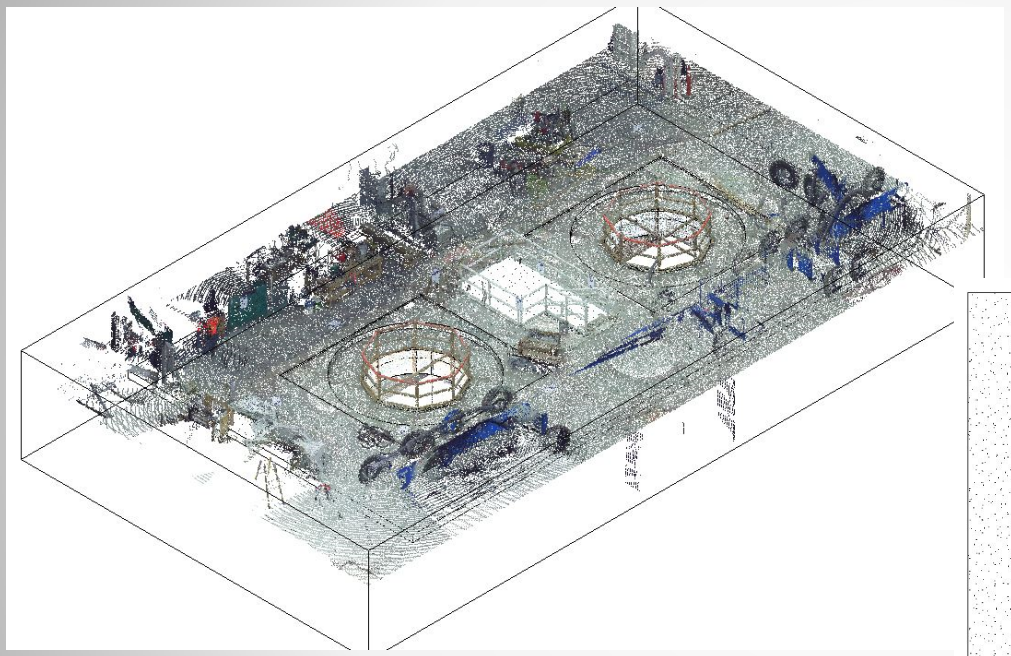


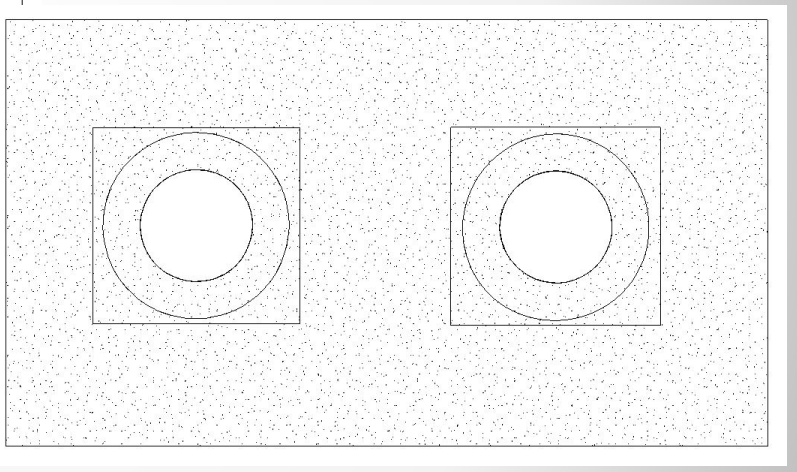
Concrete Placement – When Things go wrong



Concrete Placement

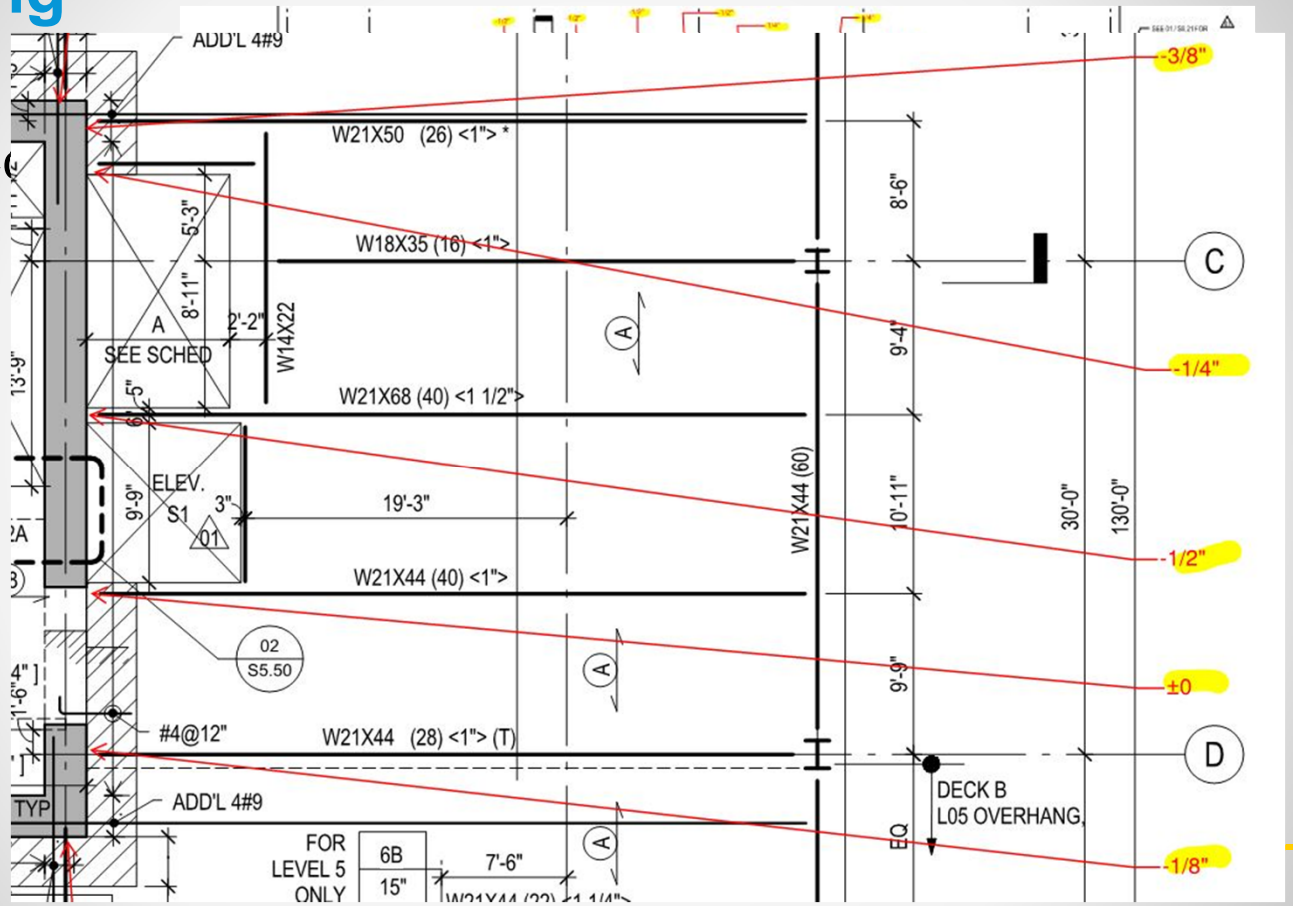
Concrete Placement – As-built Verification



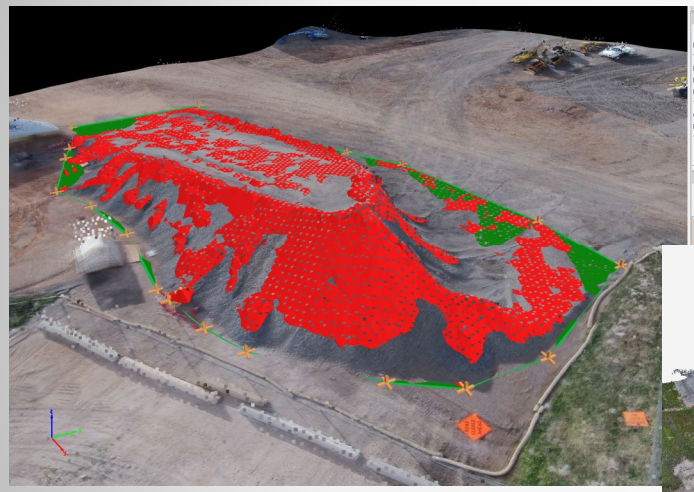


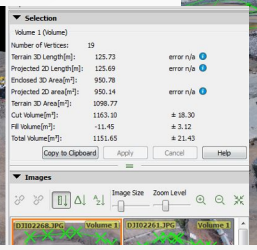
Monitoring

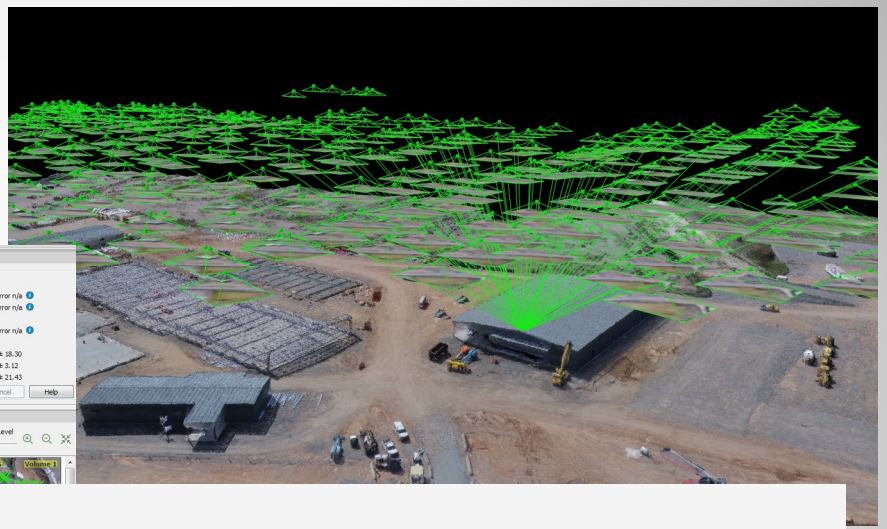
Concrete C
Embeds



UAV Scans for sites



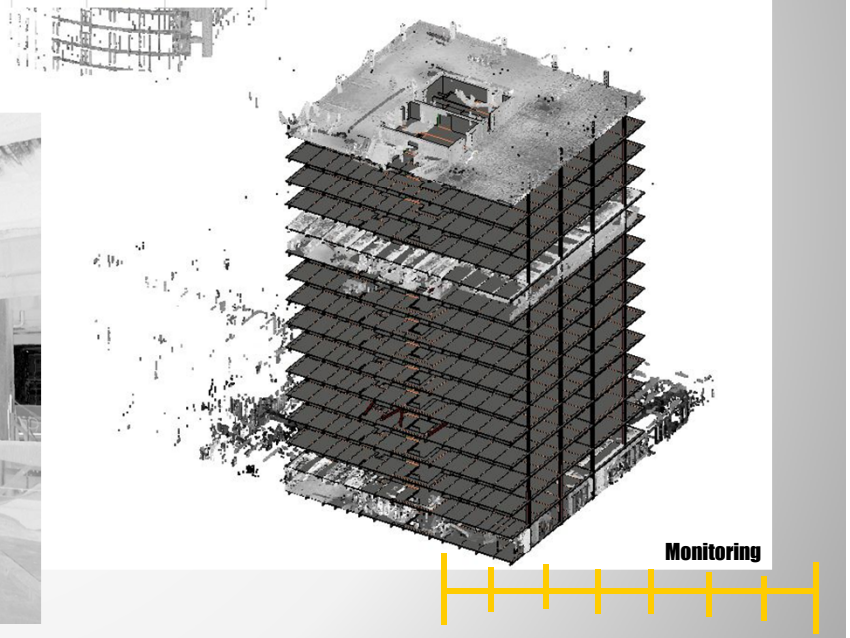




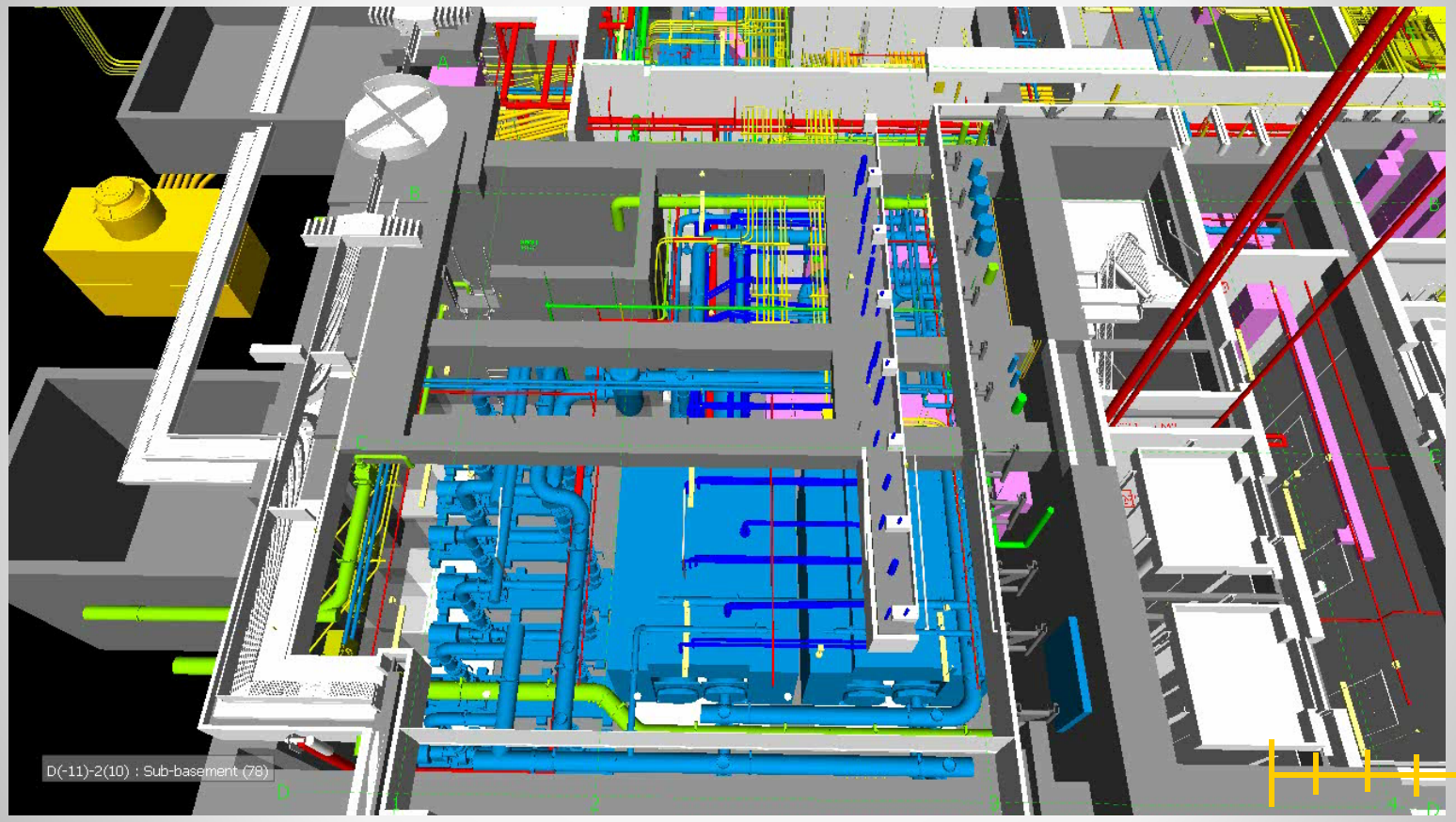
Monitoring

Concrete Core

Level 5									
015	8/25/2015	9/1/2015	9/8/2015	9/15/2015	9/22/2015	9/29/2015	10/7/2015	10/13/2015	10/20/2015
8"	N- 1/8"	-	N- 1/8"	N- 1/8"	N- 1/8"	N- 1/8"	N- 1/8"	N- 1/8"	N- 1/8"
2"	E- 1/2"	E- 1/2'	E- 1/4"	W- 3/8"	W- 3/8"	W- 5/16"	W- 1/4"	W- 1/4"	W- 1/4"
16"	N- 3/16"	N- 1/4"	N- 3/8"	N- 1/2"	N- 1/2"	N- 1/2"	N- 3/8"	N- 3/8"	N- 3/8"
16"	W- 3/8"	W-3/8"	W- 1/4"	W- 1/4"	W- 1/4"	W- 3/16"	W- 1/4"	W- 1/4"	W- 1/4"
	-	-	S- 1/16"	S- 1/16"	S- 1/16"	-	S- 1/16"	S- 1/16"	S- 1/16"
8"	E- 1/8"	E- 1/8"	E- 1/8"	E- 1/8"	E- 1/8"	E- 1/8"	E- 3/16"	E- 3/16"	E- 3/16"
	-	-	-	-	-	-	-	N- 3/16"	N- 1/8"
16"	E- 3/4"	E- 3/4"	E- 5/8"	E- 3/8"	E- 3/8"	E- 3/8"	E- 5/8"	E- 5/8"	E- 5/8"



Systems Placement



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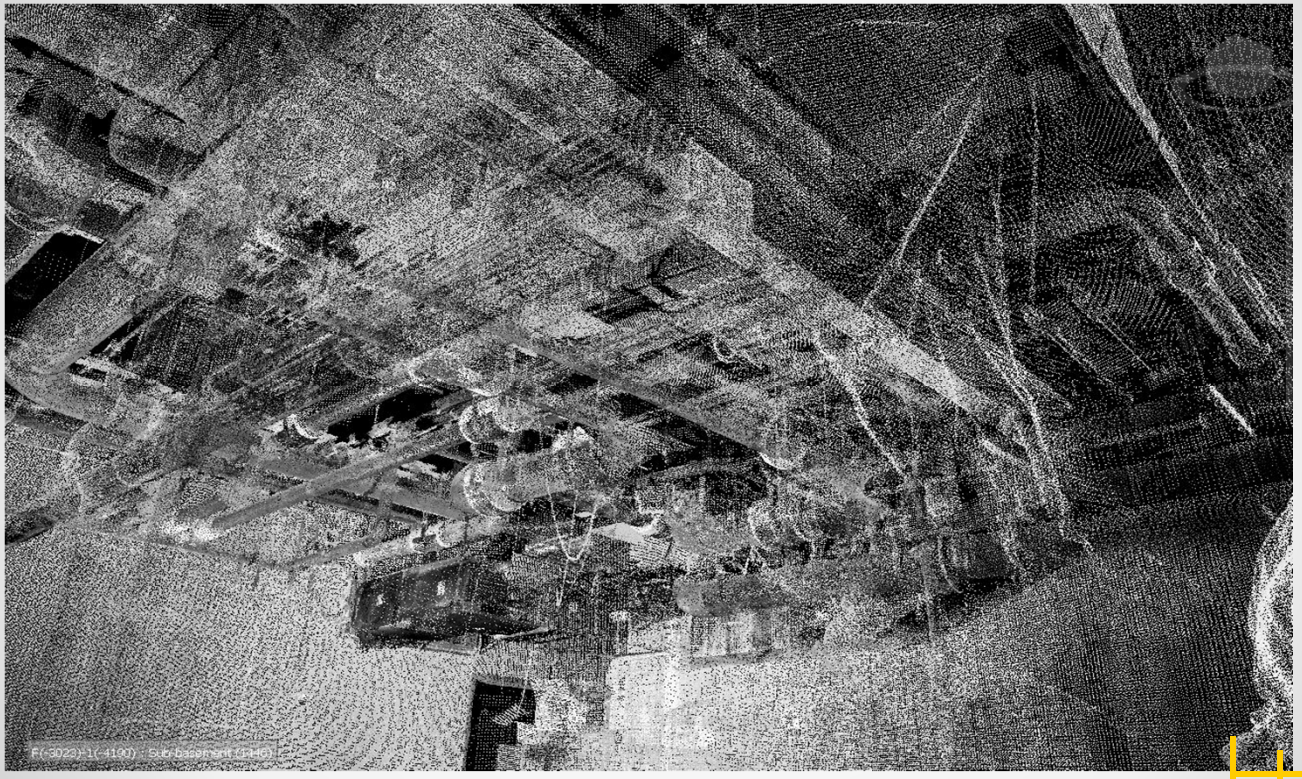
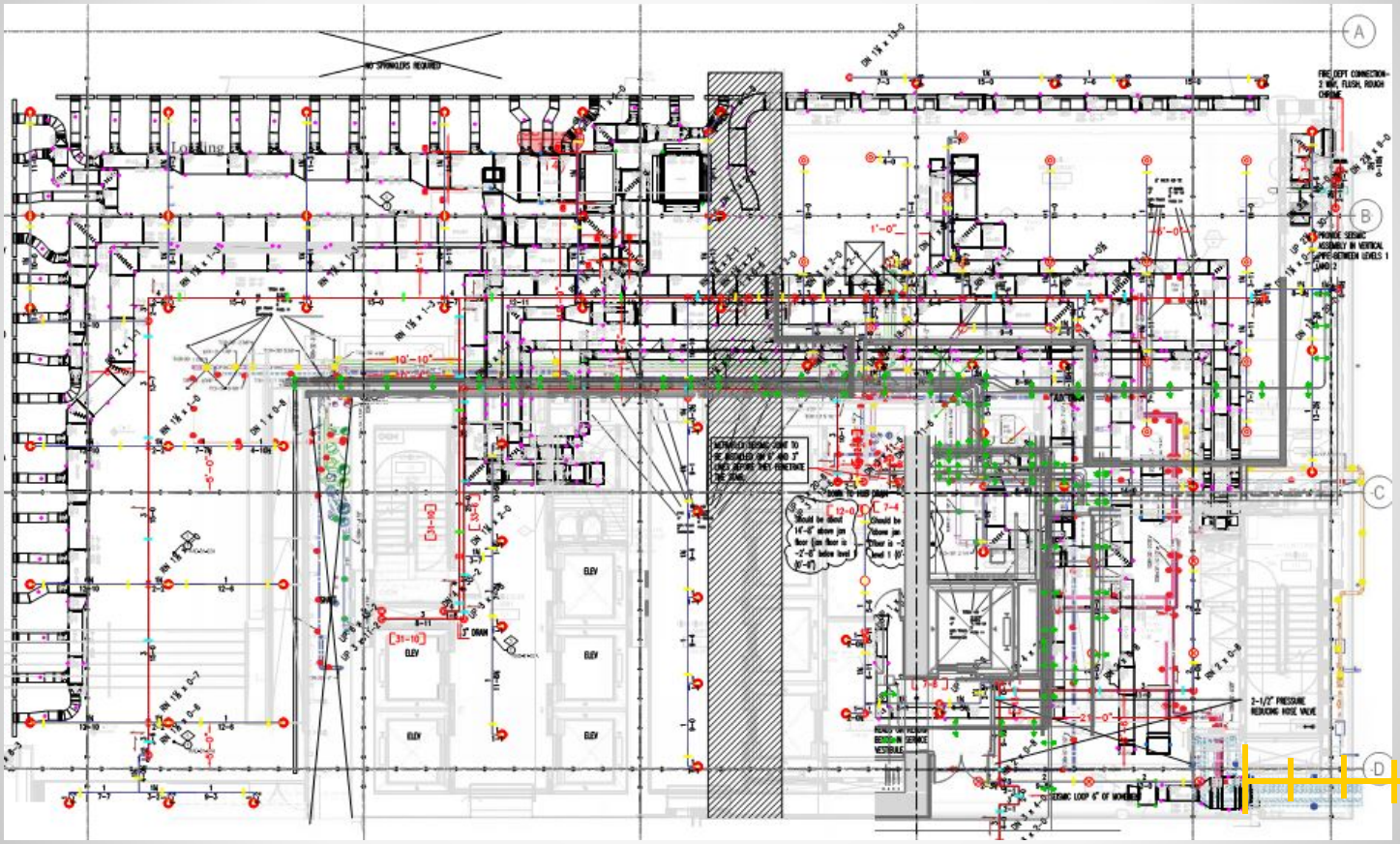
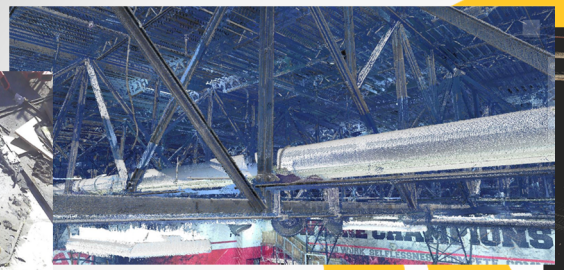


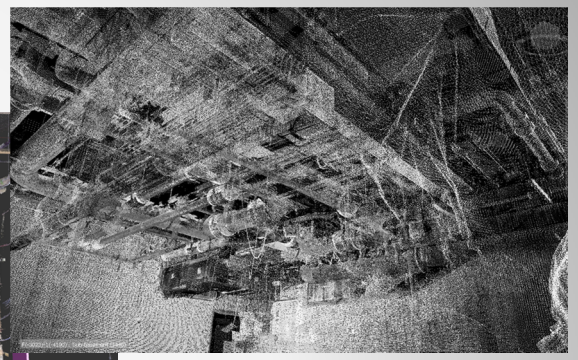
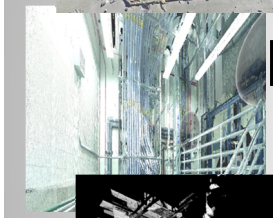
Systems Placement



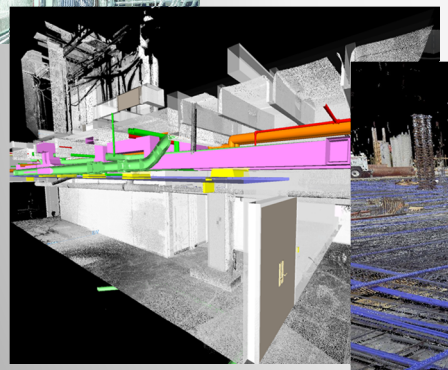
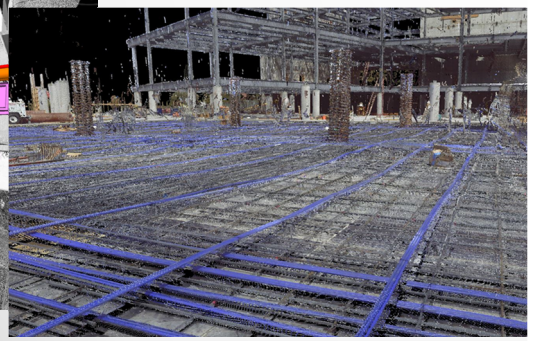
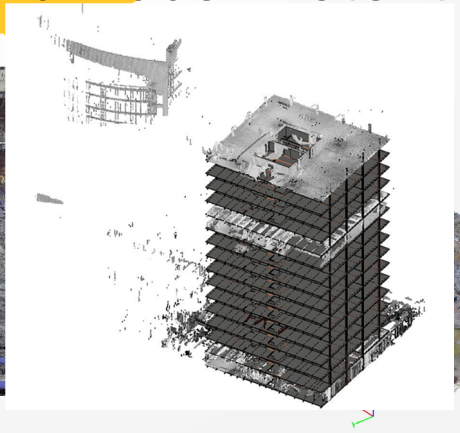
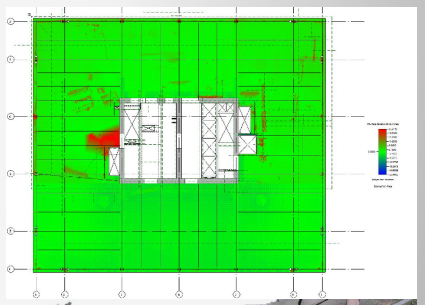
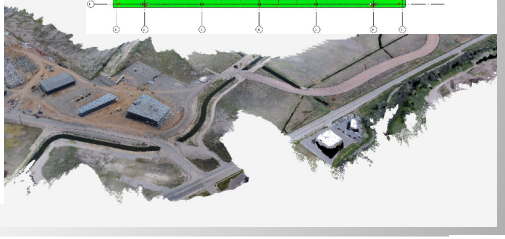
Systems Placement

To Wrap Up

Provide Innovative Solutions through Technology to Maximize Individual Potential

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