# Augmented Reality: Speeding Up Field Verification and Communication

Steve Baret

Mortenson Senior Integrated Construction Coordinator

Saeed Eslami

CEO Visuallive

AUTODESK. UNIVERSITY

# Speakers Intro

# About Steve Baret

## Sr. Integrated Construction Coordinator

Steve Baret graduated from BYU Idaho in 2011 with a BS in Construction Management and AAS in architecture, and AAS in Interior Design. Since graduating Steve has worked for Layton Construction in Utah and Mortenson in Arizona before coming back to Utah in July to work on the Facebook Data Center in Eagle Mountain, UT. Steve has experience working in the areas of healthcare, data centers, hospitality, sports arenas, sports stadiums, and historical renovations. Steve has worked in the VDC field for the past 9 years. Steve has been leading the charge in implementing laser scanning, virtual reality and other solutions for Mortenson. His current primary role is the development of virtual reality, augmented reality and innovation for Mortenson. Steve has been married for 13 years to his wife Nayeli, and they are the proud parents of three children.

# About Saeed Eslami

## CEO and Founder of VisualLive

Saeed Eslami is an Augmented Reality (AR) veteran and serial entrepreneur with strong roots in software development, virtual design, and construction. He has developed over 150 apps internal Hensel Phelps while he was working there with various construction technology application and mainly AR/VR.

In 2016, he decided to open these technologies to AEC market worldwide. Therefore, he founded VisualLive software company in order to make it easy for all construction companies accessing augmented reality technology in the field with the minimum development process. VisualLive is emerging AR technology which increases jobsite productivity significantly.

Today, Saeed  is CEO of VisualLive that supplies software on Microsoft HoloLens, iOS/Android phone/tablets being used by 52% of the Top 100 Contractors in the U.S.. Saeed is a frequent conference speaker, and contributor to industry publications and advises a variety of political and economic leaders, as well as startups in Arizona on the industry’s development and related strategic positioning.

# CLASS OBJECTIVES

- DISCOVER THE BENEFITS OF USING WEARABLE AUGMENTED REALITY TO **INSPECT** INSTALLED BUILDING SYSTEMS
- COMPARE **TIME SAVINGS** GAINED WITH WEARABLE AUGMENTED REALITY VERSUS OTHER METHODS TO VERIFY **ACCURACY** OF BUILDING SYSTEMS INSTALL
- DISCOVER HOW BUILDING SYSTEMS INSTALLATION **WORKFLOWS** ARE IMPROVED THROUGH AUGMENTED REALITY
- DISCOVER HOW AUGMENTED REALITY HELPS MONITOR BUILDING SYSTEMS **INSTALL STATUS**

# Why using wearable AR

# Tapping Into Majority's Ability

Learning Methods

- 70% Visual Learners
- 25% Auditory Learners
- 5% Kinesthetic Learners

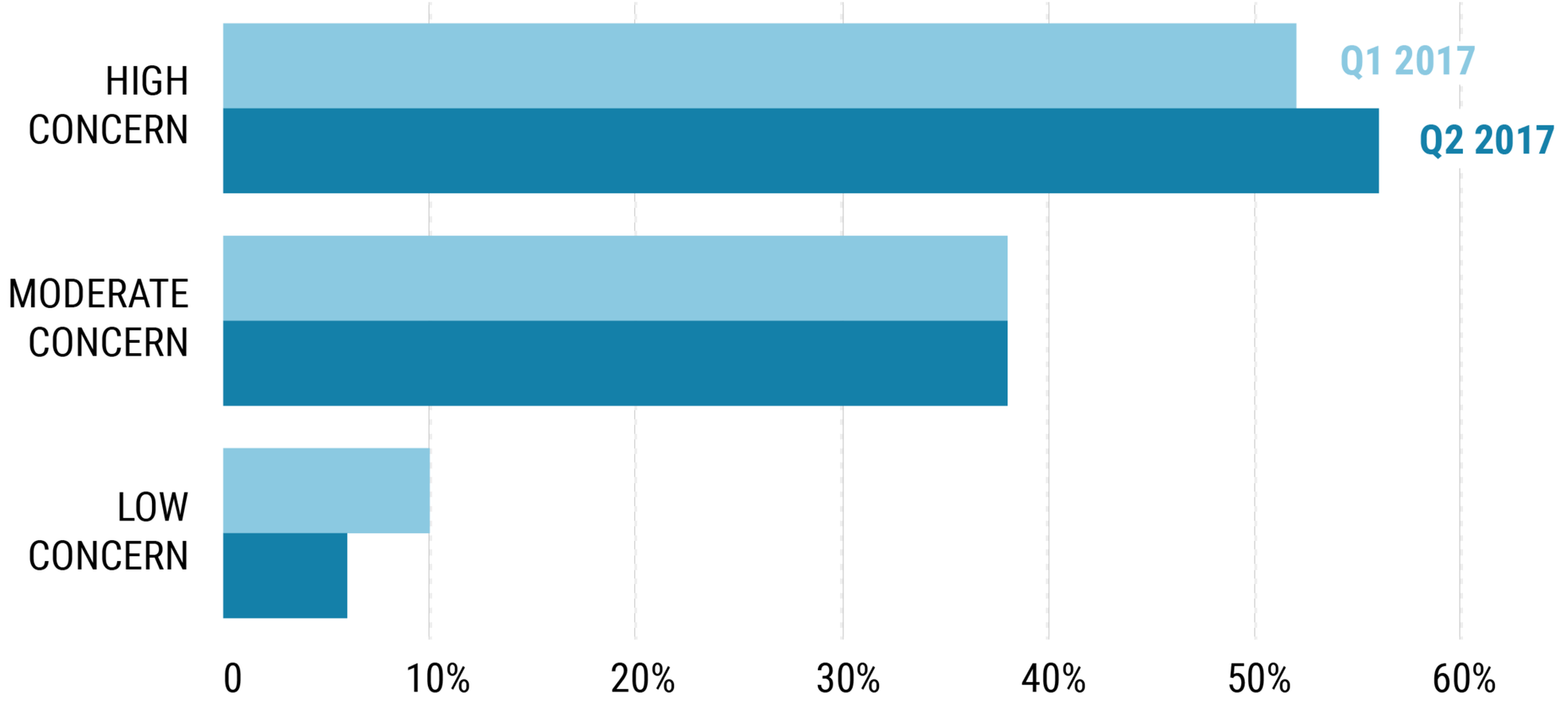
People following directions with text and illustrations do

# 323% better

than people following directions without illustrations. [14]

# CONCERN ABOUT ADEQUATE SKILL AMONG WORKERS

- Contractors in the commercial construction industry are having a hard time finding skilled workers, according to a report by the US Chamber of Commerce. In the second quarter of 2017, 56% of contractors reported a high level of concern about their workers having adequate skills for the job.



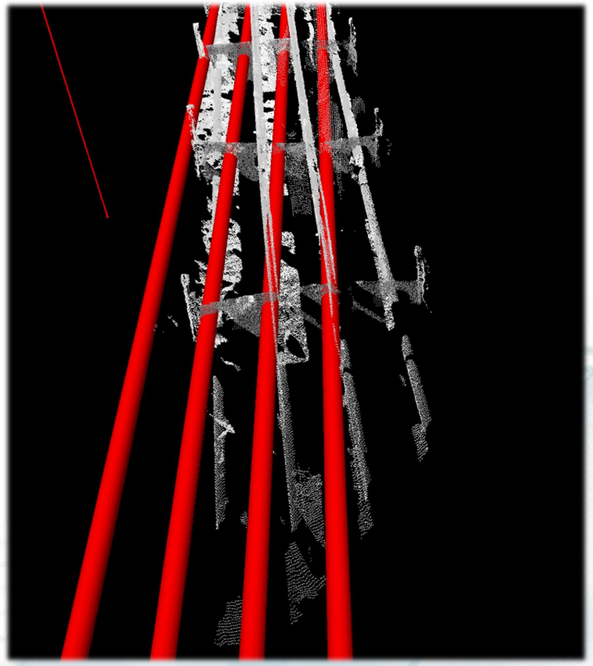

Source: COMMERCIAL CONSTRUCTION INDEX
GRACE DONNELLY/FORTUNE

# Could New Workforce Use AR?

## CURRENT SKILLED WORKFORCE

DECREASING

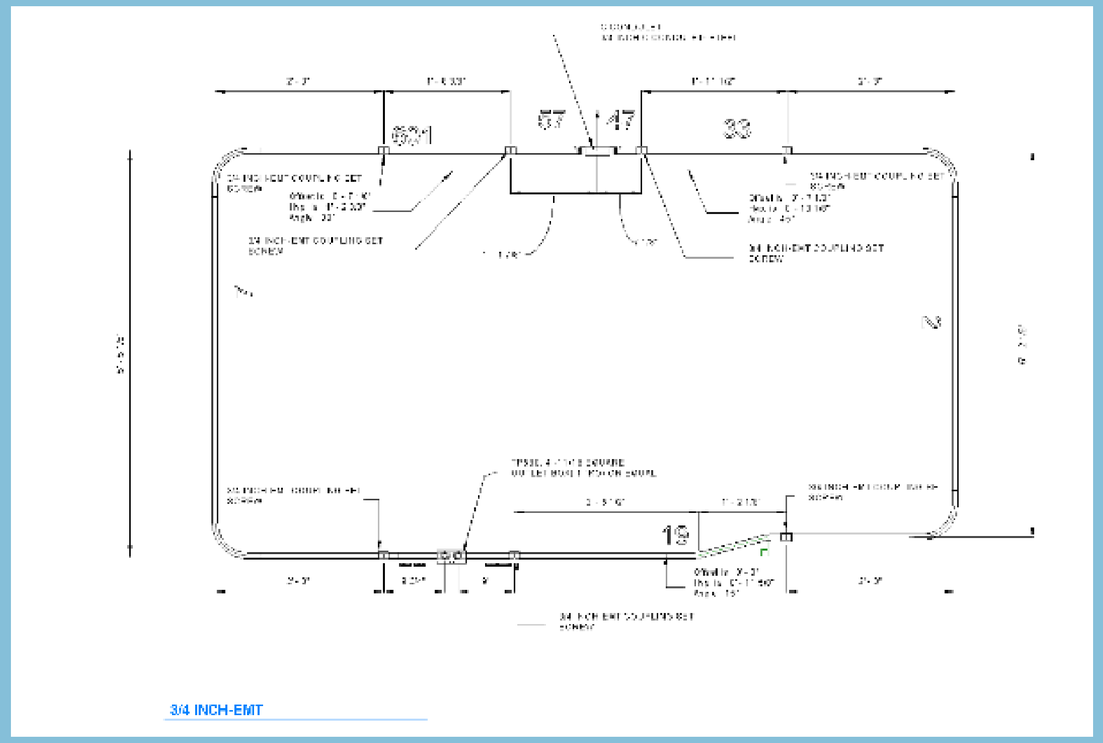
- Quantity
- Quality
- Efficiency



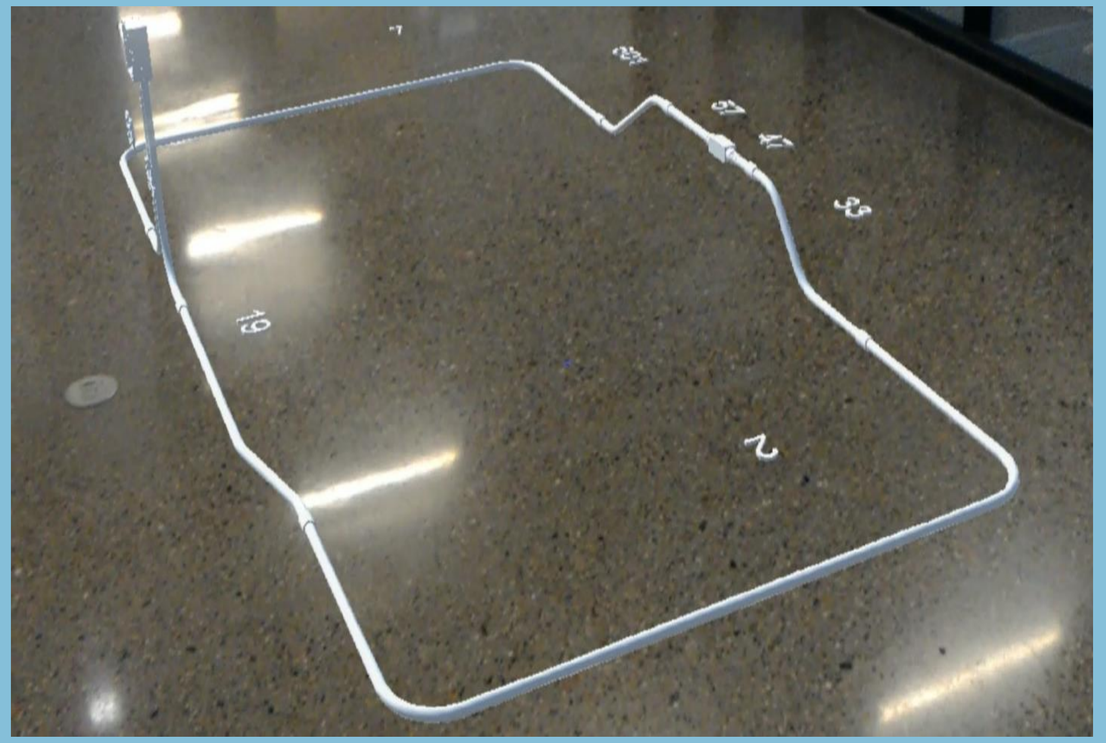
INCREASING

- Risk
- Rework
- Safety Incidents
- Delays

# CURRENT PROCESS VS IMMERSIVE AR




VS



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# Research Set Up

## 18 PARTICIPANTS

- All from Corbin's Electric Company
- Variety roles and positions
- Different areas and years of expertise

- Arizona State University
  - Steven Ayer

- Corbins Electric
  - Aaron Thompson

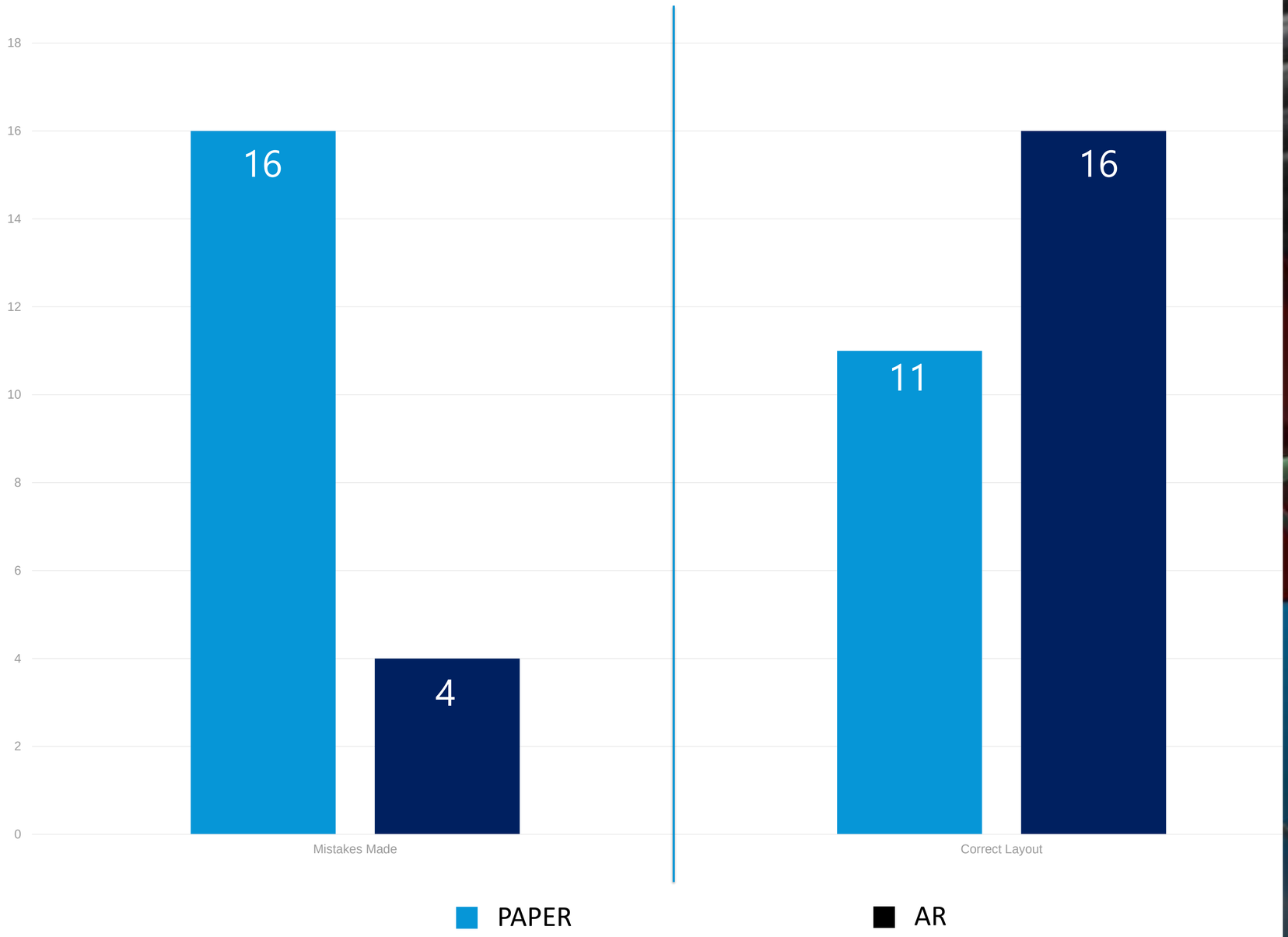
# PAPER VS HOLOLENS

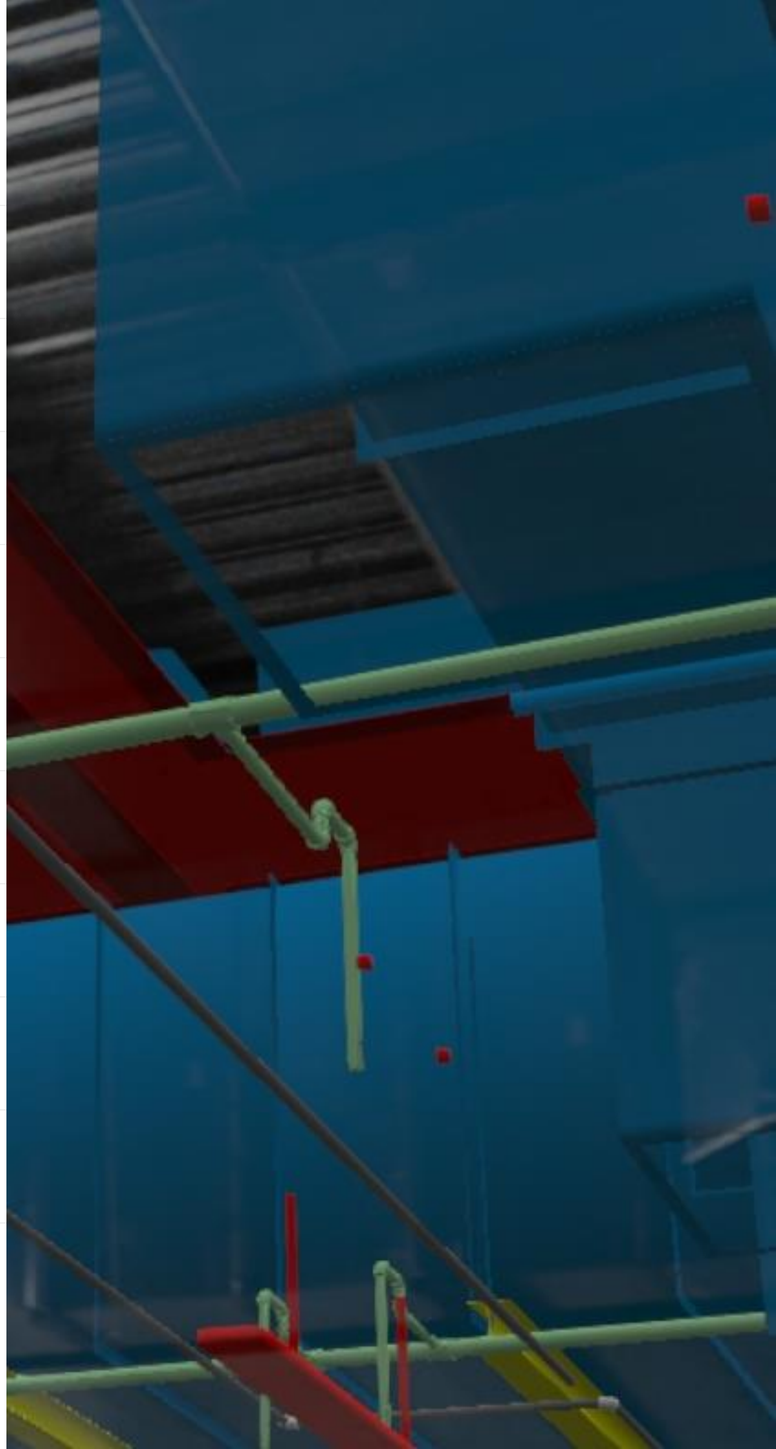
Who wins?

Credit: Arizona State University/Corbin’s Electric

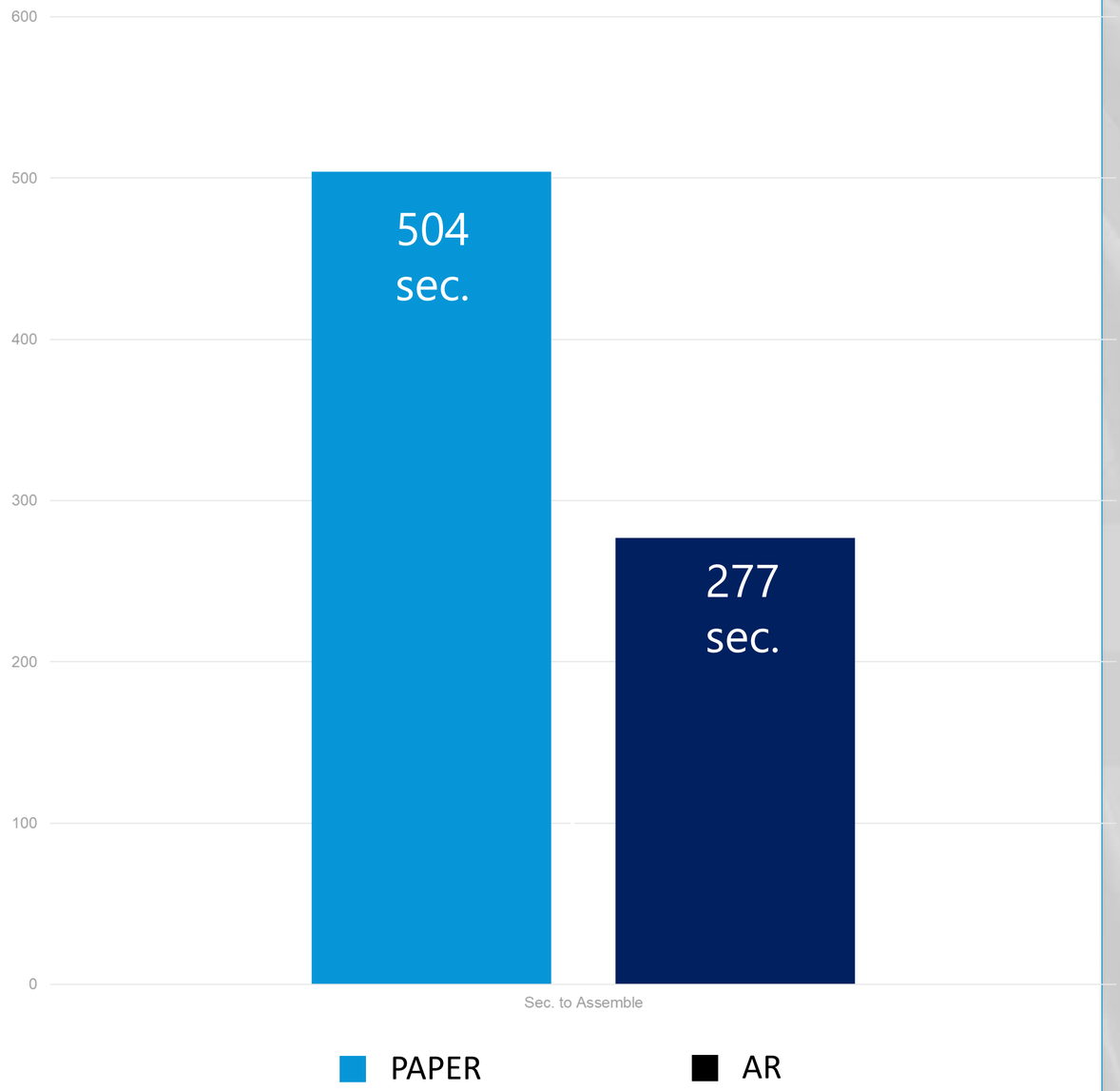
# MISTAKES MADE

# CORRECT LAYOUT



# SECONDS




# WHAT'S THE DIFFERENCE

**227 sec.faster**

**45% faster**

- Fastest using paper –10 years experience

**294 sec.**

- Fastest using AR - no experience

**223 sec.**

# AR vs other methods

# What are the benefits of using AR

- Design Review/Planning
- Field Visualization
- Constructability Review
- Office Presentation
- Install Validation
- Install Progress Report
- Pre-Fab QA/QC
- Issues Collaboration
- Live Stream Field-Walk
- Re-work reduction
- AR/MR vs. Laser Scan
- Access to Data Realtime
- Design Coordination
- Safety
- Design in AR Realtime

- Field Visualization/ Verification
- Install Progress Report
- AR/MR vs. Laser Scan
- Livestream Field Walk/Issues

# Is there any Savings?

- Catching issues days earlier vs iPads and other methods
- Visually report issues in field vs Model
- Better visual awareness

# What can we inspect?

## Overhead

- MEPF systems
- Structural
- Architectural
- Access

## Underground

- Stub-ups
- All UG conduits and lines
- Vaults

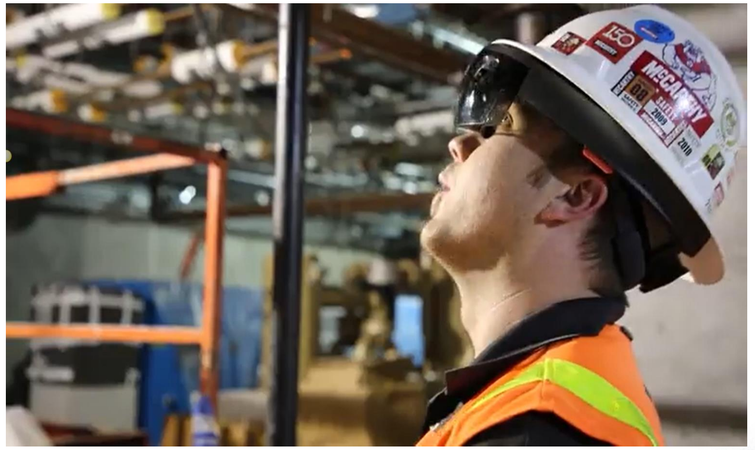
# How do we communicate Issues

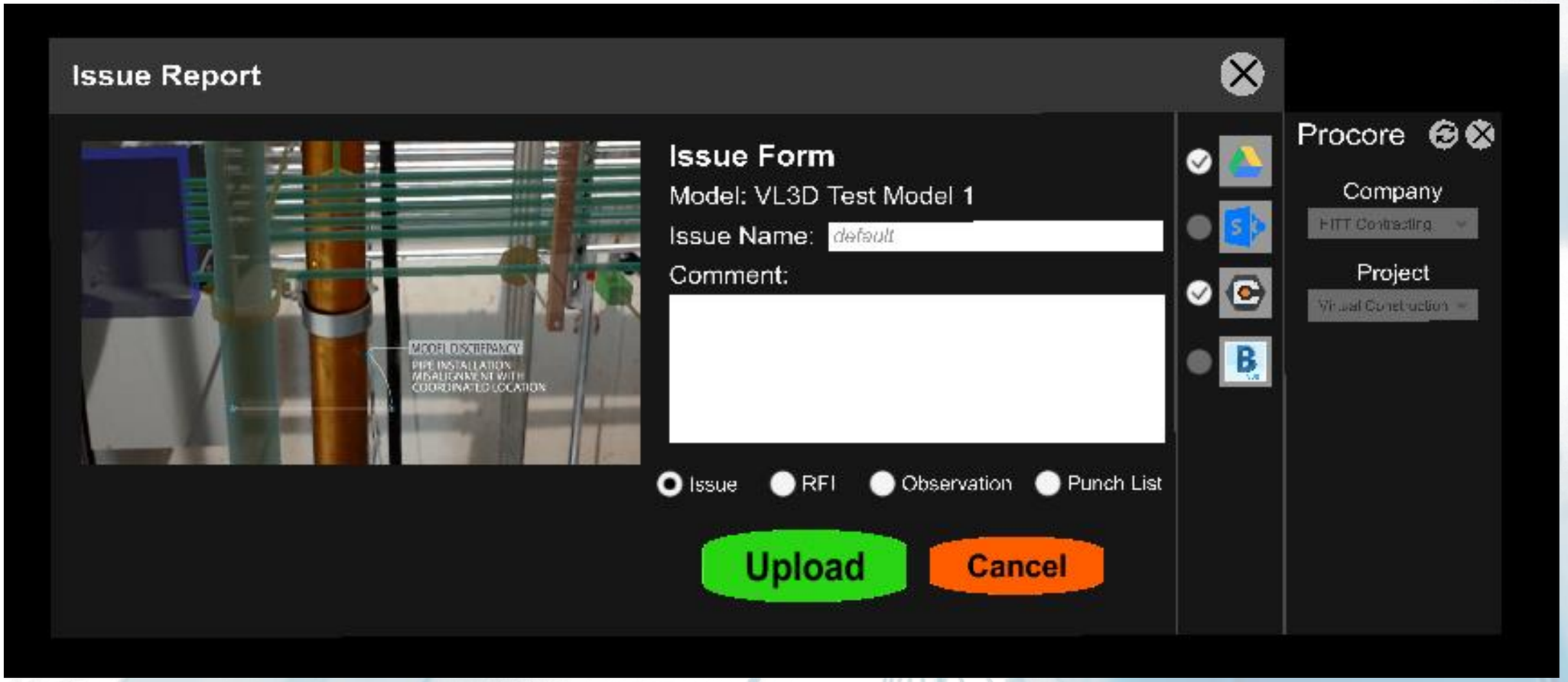
Google Drive

SharePoint

AUTODESK® BIM 360™

PROCORE®





# AR vs Laser Scanning

Laser Scanning

| 1 Crew | Processing | exporting | Overlay scans to model | Communication |
|---|---|---|---|---|
| 5 hrs | 8 hrs | 4 hrs | 8 hrs | 3*3 hrs |

40 hrs *$80 = $3200 each scanning time

5 times/week = $16,000 weekly = $192,000 annual labor cost + $80,000 equipment

~~$272,000 investment~~

VS.

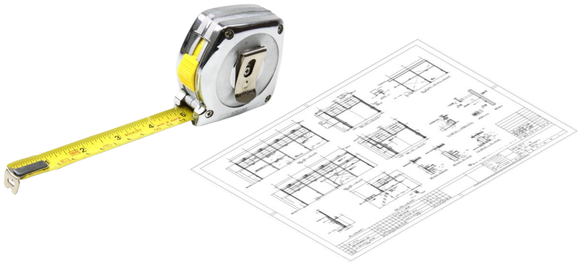
Mixed Reality

+

HOLOLIVE

5 minutes

# Compare



TIME -

TIME+

EASE OF USE

# Systems installation workflows with AR

# Phases of Installation
## (Current)

### COORDINATION MODEL SIGN OFF

PRO-ACTIVE

Navisworks models are finalized and signed off for fabrication drawings

### INSTALLATION

PRO-ACTIVE

Field workers are installing per shop drawings that SHOULD match contract documents and coordination models

### INSPECTIONS

REACTIVE

After install, quality control would inspect the finished work

### LASER SCAN/ REALITY CAPTURE

REACTIVE

Installed and approved work is captured for as-built purposes

# What are the consequences of rework

**“Around 30% of the work performed by construction companies is actually rework”**

**“… the majority of it arises due to a lack of communication and supervision”**

**Hurry**

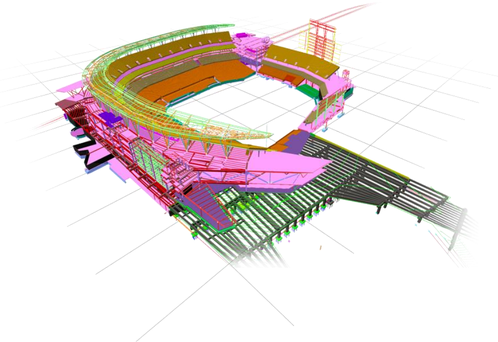
**Stress**

**Shortcuts**

**Injuries**

- Source https://jobsite.procore.com/construction-rework-causes-costs/

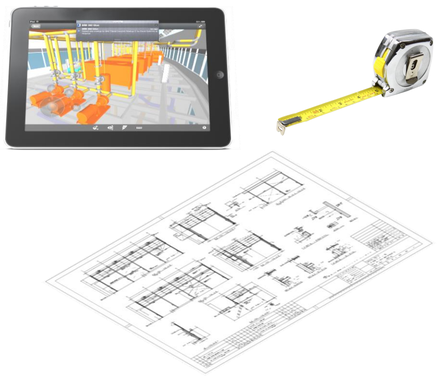
# Phases of Installation
## (With AR)



### COORDINATION MODEL SIGN OFF

PRO-ACTIVE

Navisworks models are finalized and signed off for fabrication drawings



### INSTALLATION

PRO-ACTIVE

Field workers are installing **per AR model** that SHOULD match contract documents and coordination models

### INSPECTIONS

PRO-ACTIVE

Quality control **during** the installation process by both install team and verifying party

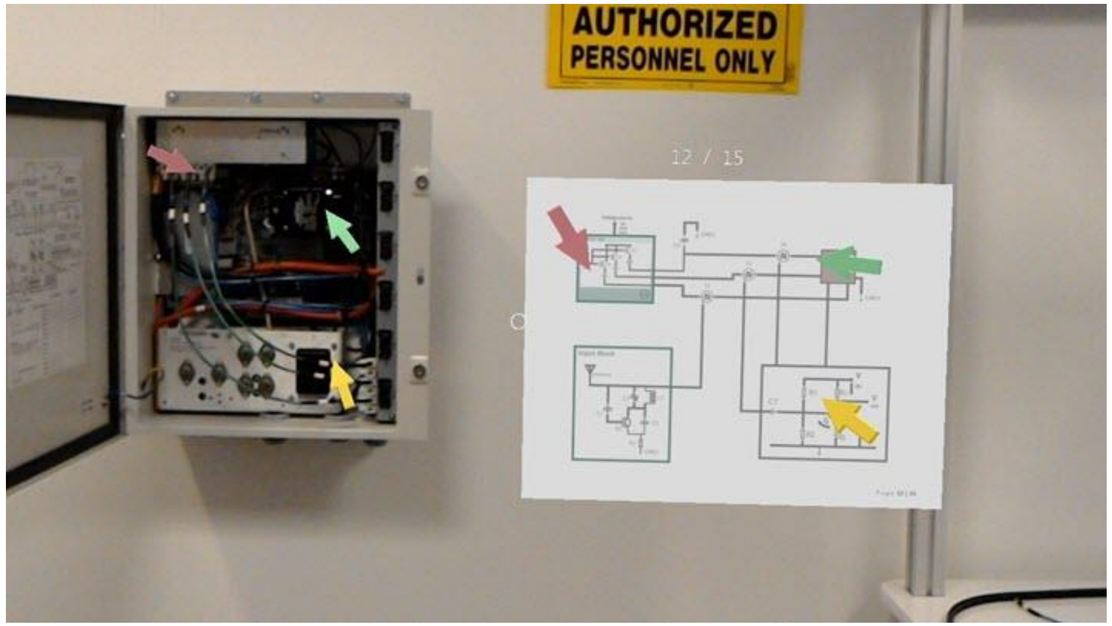
### LASER SCAN REALITY CAPTURE

REACTIVE

Installed and approved work is captured for as-built purposes

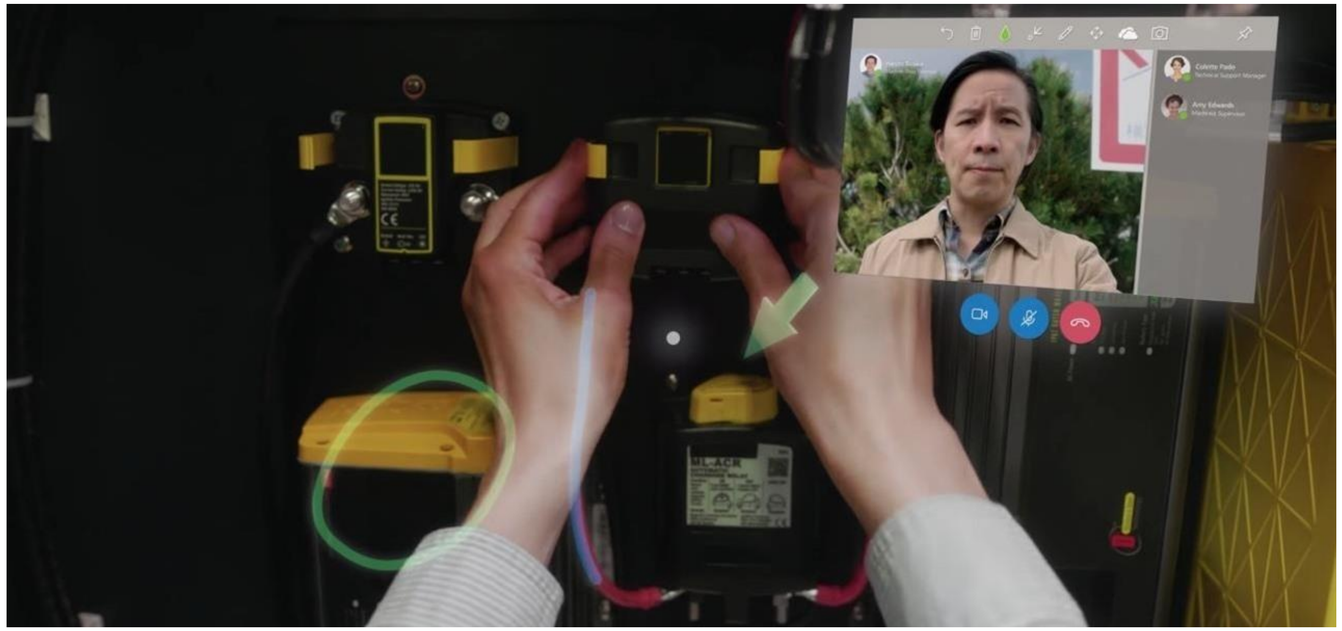
# Livestream Walks and Inspections:Key to success

# Streamlining Communication




## Advantages

- Visual step by step workflows
  - Standard Installation Process
  - New Field workers Training
    - Experienced people offsite assisting
  - Safety Trainings

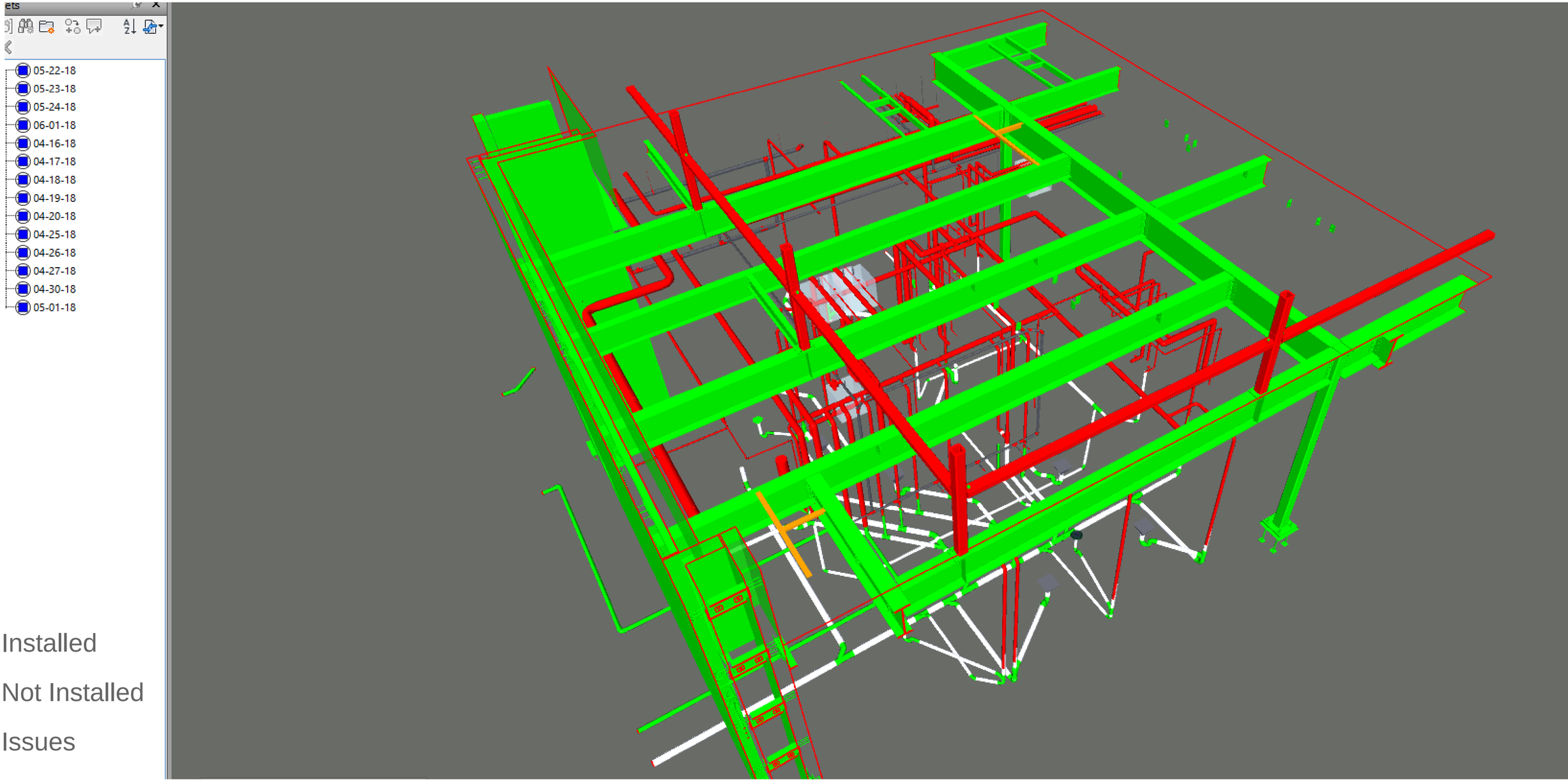


## Advantages

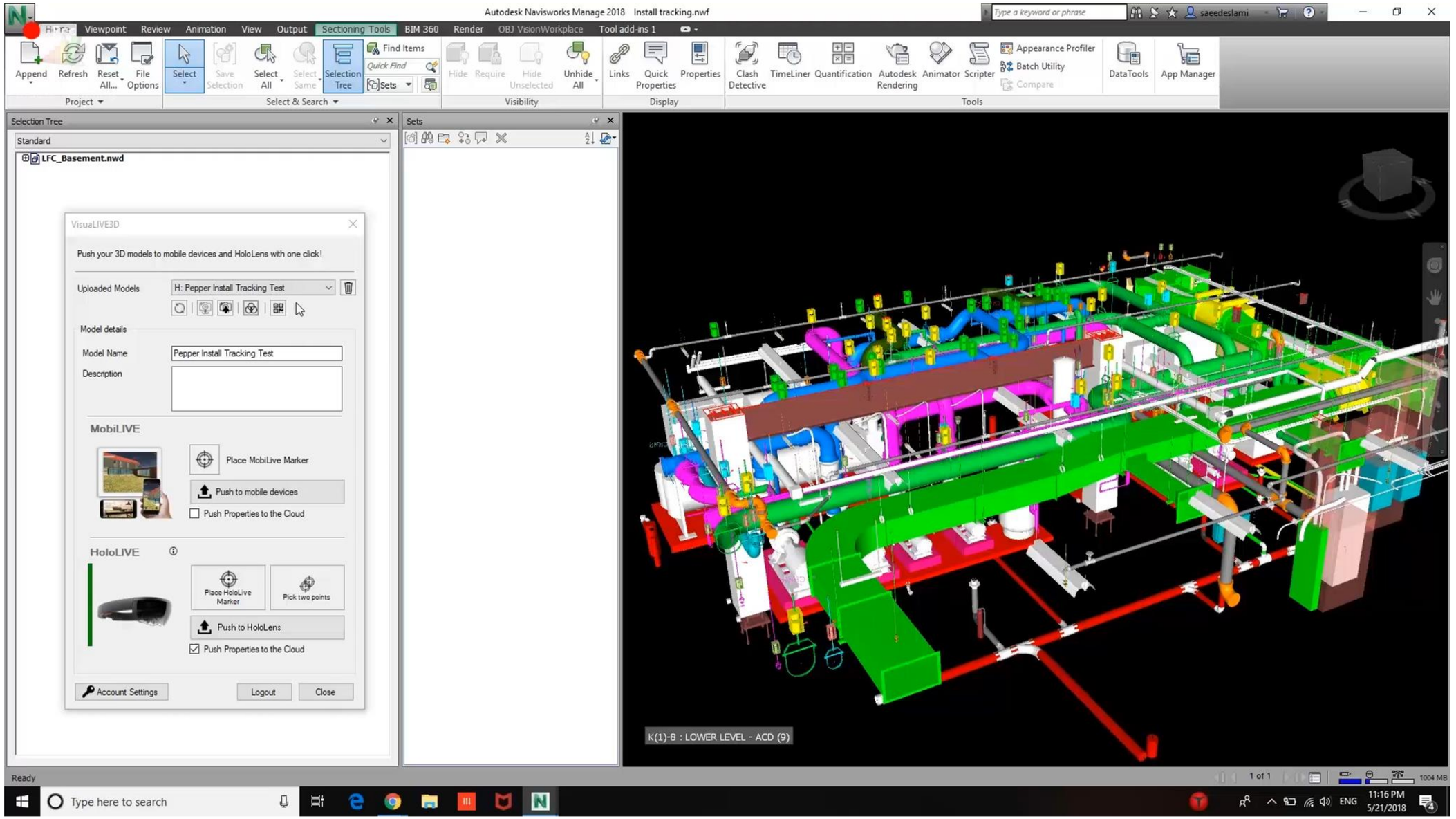
- Problem Resolution
  - Avoid repetitive trips between office and field
  - On the spot video conference
  - Bi-directional screen annotation

# How AR Monitors Building Systems Install Status

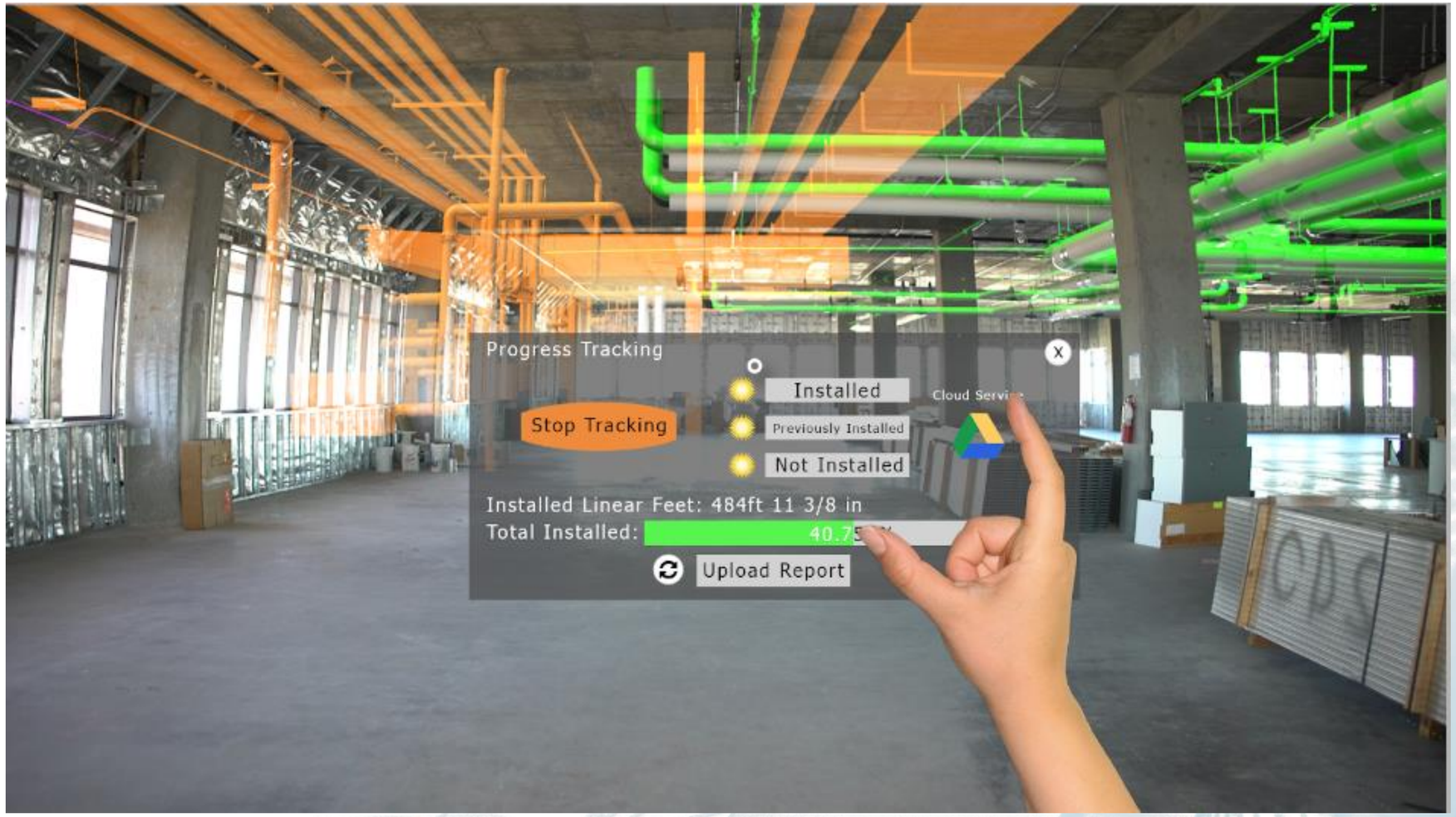
# Monitoring through AR

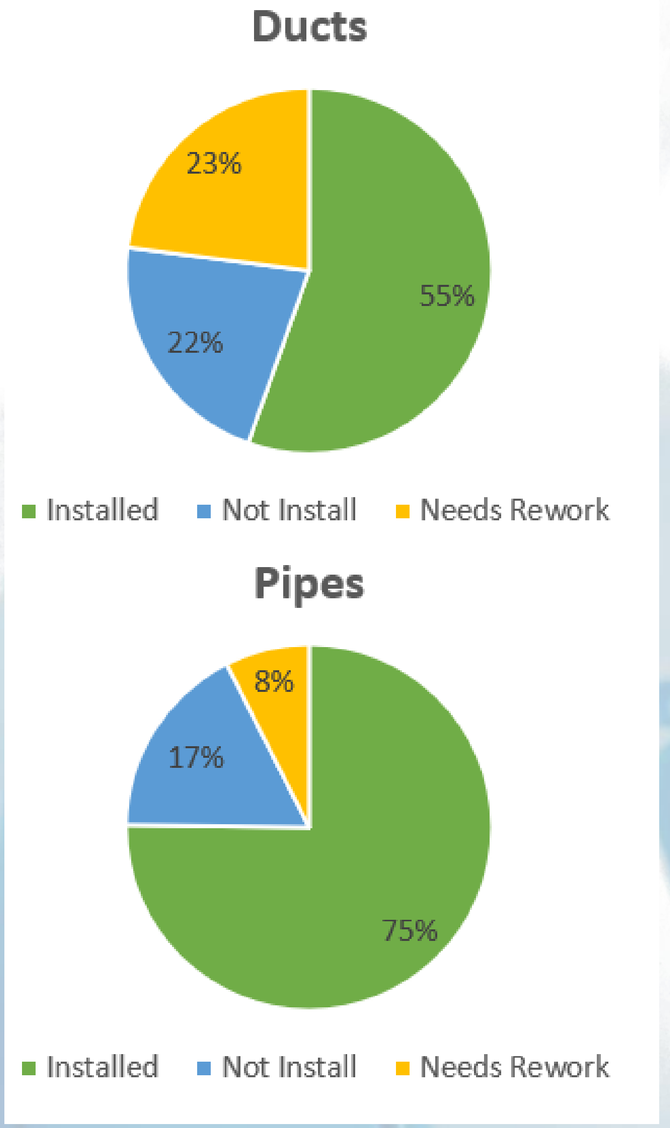


# Monitoring through AR

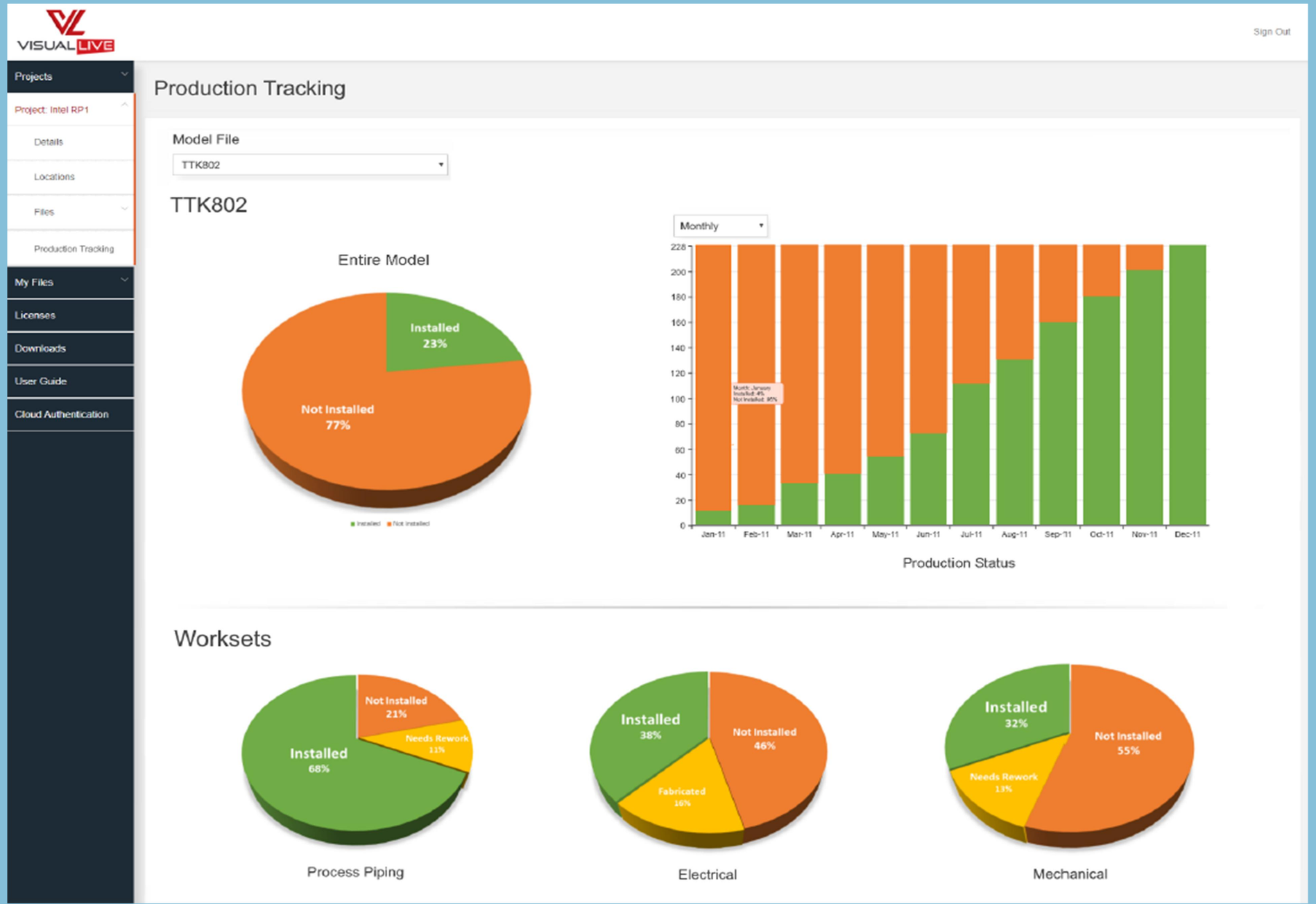


# Install Validation – Install Progress Tracking



# What can we track



# ROI

| Assumes $150 million project | | | | | |
|---|---|---|---|---|---|
| Activity | Hours | People | Per week | Rate | Annual Savings |
| Status Meetings | 2 | 10 | 3 | $80.00 | $249,600 |
| RFI's - Issue Tracking - QA/QC | 8 | 10 | 2 | $80.00 | $664,800 |
| Travel to field for issue review | 2 | 2 | 2 | $80.00 | $33,280 |
| Field to Office real-time Communication | 3 | 10 | 5 | $80.00 | $624,000 |
| Tool Install Tracking - Report | 5 | 8 | 2 | $80.00 | $332,800 |
| Realtime Change orders and time savings | 2 | 2 | 3 | $80.00 | $49,920 |
| Laser Scanning Savings – Design in the field | 10 | 2 | 5 | $80.00 | $532,000 |
| Clash detection, Prefab validation, avoid rework * | | | | | $680,000 |
| Facility management - handover the owner with real data | | | | Value of: | $350,000 |
| **Total Estimated savings:** | | | | | **$3,484,400** |
| | | | | | |
| Cost of Visual Live mixed reality solutions | | | | | $80,000 |
| Gold Package | | | | | |
| **Pay Back:** | | | | | **8 Days** |
| **ROI:** | | | | | **3529.56%** |

Source: VisualLive

# What’s Next?

## FACILITIES OPERATIONS

Ability to access equipment information previously set up via the AR headset

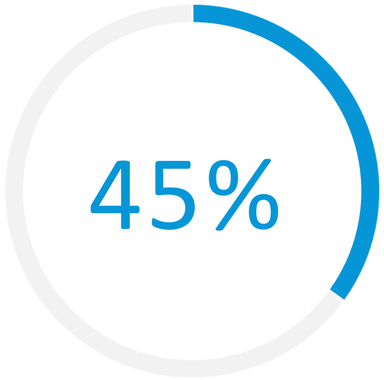
## DESIGN MODIFICATIONS/ONSITE AS BUILT MODIFICATIONS

Not only sync several headset together, but being able to design on the spot via the AR headset

# AR Summary in Numbers

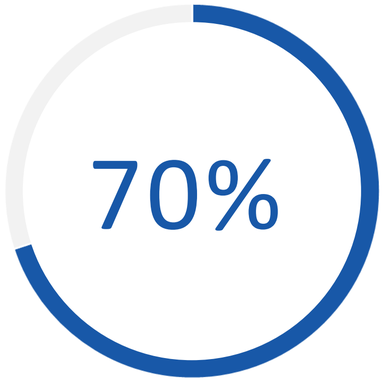
## EALRY ISSUE IDENTIFICATION

Identify and communicate issues earlier than current workflow




## Faster than traditional Method

Individuals with AR are 45% faster than people with install drawings on paper




## Visual People

70% of the world’s population learns best through visuals

## Days to Achieve PAyback

The streamlining of communication through AR is vital to the success of the project

# Questions

# Contact Info


## Steve Baret

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