Innovation & Technology in Construction – 08.12.20

Presented By:

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AUGMENTED REALITY SOFTWARE FOR CONSTRUCTION
DELIVERING 1:1 BIM EXPERIENCE TO THE JOBSITES WHERE IT MATTERS
# INDUSTRY

## AN OPPORTUNITY TO DIGITIZE THE INDUSTRY

### CONSTRUCTION INDUSTRY

<table>
<thead>
<tr>
<th>Volume</th>
<th>USD 12,031 BILLION BY 2024</th>
<th>USD 1,428 BILLION BY 2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume Growth</td>
<td>5.7% CAGR</td>
<td>5.0% CAGR</td>
</tr>
<tr>
<td>Productivity Opportunity</td>
<td>1% GROWTH OVER THE PAST 20 YEARS</td>
<td>comparable to global</td>
</tr>
<tr>
<td>Digitalization Opportunity</td>
<td>SCORING 2ND LAST ACROSS INDUSTRIES</td>
<td>comparable to global</td>
</tr>
</tbody>
</table>

KEY PAIN: PRODUCTIVITY

ON-SITE EXECUTION & TECHNOLOGY GREATEST LEVERS OF PRODUCTIVITY

LEVERS FOR CONSTRUCTION PRODUCTIVITY IMPROVEMENT, %

<table>
<thead>
<tr>
<th>LEVER</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration and Contracting</td>
<td>8-9</td>
</tr>
<tr>
<td>Design and Engineering</td>
<td>-8-10</td>
</tr>
<tr>
<td>Procurement and Supply-Chain Management</td>
<td>-7-8</td>
</tr>
<tr>
<td>On-Site Execution</td>
<td>6-10</td>
</tr>
<tr>
<td>Technology</td>
<td>14-15</td>
</tr>
<tr>
<td>Capability Building</td>
<td>-5-7</td>
</tr>
<tr>
<td>Cumulative Productivity Impact</td>
<td>48-60</td>
</tr>
</tbody>
</table>

PLAYING FIELD

IMPROVE ON-SITE EXECUTION
- Rigorous Planning Process
- Clear Agreement on KPIs
- New Project Mobilization
- Lean-Based Trade Coordination

INFUSE DIGITAL TECHNOLOGY AND ADVANCED AUTOMATION
- 3D, 4D, 5D BIM
- Advanced Analytics by IoT
- Digital Collaboration
- Mobility Tools
- Big Data Utilization
- Robotization
- Augmented and Virtual Reality

SOLUTIONS

SOURCE: MCKINSEY GLOBAL INSTITUTE
DATA IS THE TRUTH

ACQUISITION, PROCESSING & DISTRIBUTION OF ACTIONABLE BIM DATA

- AUTONOMOUS PROGRESS DATA CAPTURE
- PROJECT DATA CAPTURE
- WORKFORCE DATA CAPTURE
- WHERE IT MATTERS BIM DATA ACCESS
- BRINGING 1:1 BIM TO JOBSITES
- BRINGING 1:1 BIM TO ENGINEERING OFFICES
USER PERSPECTIVE

WHAT DO YOU SEE?
USE CASES
HOW AUGMENTED REALITY ADDS VALUE

Onsite Logistics
Training & Safety
QA/QC
Task setting & guidance
Remote Expert
Production
BIM
Engineering data visualization
Design visualization
GC/CM
ENGINEER
SUB
CHALLENGES

THE BIG 4 CHALLENGES OF TAKING BIM TO FIELD

File size & type

- >500MB, 2,2Mio Polygons
- <120MB, 200k Polygons

Model alignment

Control lines

Streaming vs offline

Netflix-like download

Field of view
# CUSTOMER’S JOBS

WHAT CUSTOMERS ARE TRYING TO GET DONE IN THEIR WORK

<table>
<thead>
<tr>
<th>Layout</th>
<th>Track Fastening &amp; Framing</th>
<th>Board Hanging</th>
<th>Sealing</th>
<th>Suspended Ceiling</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Establish Drawings</td>
<td>Transport tracks &amp; studs</td>
<td>Transport boards</td>
<td>Top of Wall - Firestop</td>
<td>Install trim</td>
</tr>
<tr>
<td></td>
<td>Find Control Points</td>
<td>Measure &amp; cut tracks</td>
<td>Cut boards + fitting</td>
<td>Top of Wall - Acoustical</td>
<td>Ceiling tiles</td>
</tr>
<tr>
<td></td>
<td>Layout Points (Open Space)</td>
<td>Fasten tracks to concrete</td>
<td>Position &amp; pre-fasten wall boards</td>
<td>Bottom of Wall – FS &amp; AC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Layout Points (Small Area)</td>
<td>Measure &amp; cut doors/windows frames</td>
<td>Insulation</td>
<td>Cut &amp; install grid</td>
<td>Layout lights, ducts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fasten doors/windows frames</td>
<td>Fasten wall boards</td>
<td></td>
<td>Cut &amp; install grid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fasten studs &amp; braces</td>
<td>Cut outs</td>
<td></td>
<td>Position &amp; pre-fasten ceiling boards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cut &amp; fasten tracking</td>
<td></td>
<td></td>
<td>Fasten ceiling boards</td>
</tr>
</tbody>
</table>
CASE STUDY

ECONOMICS OF FRAMING WITH AR

SET-UP HERE
CASE STUDY

ECONOMICS OF FRAMING WITH AR (CONTINUED)

NUMBERS HERE
CASE STUDY

ECONOMICS OF FRAMING WITH AR (CONTINUED)

RESULTS HERE
FEATURED PROJECTS

CURRENTLY OUR SOLUTION IS BEING USED ON THESE JOBSITES IN THE GREATER LA AREA
VR? AR? MR?

SORRY, I AM CONFUSED

VIRTUAL REALITY (VR)
Completely digital environment
Fully enclosed, synthetic experience with no sense of the real world.

AUGMENTED REALITY (AR)
Real world with digital information overlay
Real world remains central to the experience, enhanced by virtual details.

MERGED REALITY (MR)
Real and the virtual are intertwined
Interaction with and manipulation of both the physical and virtual environment.

ANSI Z87.1, CSA Z94.3 and EN 166
Applications of Augmented Reality Integrations for Construction
August 12, 2020
Introductions

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Project Engineer
Augmented Reality is changing the way we work
Increased safety
Cost reduction
Speed of decision-making
Enhanced communication
AUGMENTED REALITY

Real Environment
Your real world around you.

360° Reality Capture

Remote Assistance

Virtual Reality
Entirely simulated version of the real world (or any world!).

AR 3D Visualization

Level of immersion
1 | REMOTE ASSISTANCE
Remote Assistance

Features

• Real-time video collaboration
• Performs well in low bandwidth environments
• Share high resolution photos in real-time
• Mark-up real-time video
• Share documents
• Data security controls (e.g., disable saved photos)

Devices

Android and iOS mobile devices, PC, hands-free headset
Inspection with Remote Assistance

Field staff connected to the call through mobile phone

- Remote subject matter experts & On-site construction manager
- 30-minute live virtual inspection saved cost and time of travel to remote project site.
- Issue detected in video may was easily communicated and resolved after early detection.

View from Live Video Call

Digital ink quickly conveys any issues or proposed changes
2 | 360° REALITY CAPTURE
360-Degree Virtual Platforms

‘Google street view’ for projects: View and collaborate in an interactive 360-degree web platform
360-Degree Virtual Platforms

‘Google street view’ for projects: View and collaborate in an interactive 360-degree web platform

Features
- Secure and encrypted web portal
- Invite unlimited team members
- Fast and streamlined photo capture with mobile app
- Augment photos with text, drawings, PDFs, 2D photos, 3D objects, video, weblinks
- Measurement tools
- Split-screen mode to compare photos through time, or side-by-side with model
- Integrate with BIM360, Revit, Navisworks, others

Device Options
Android & iOS mobile devices, PC, or Virtual Reality Headset

Data Collection
Result & Value
Water Treatment Plant Construction Monitoring and Management
With 360° Reality Capture

Compare 360 photos captured over time. Note the difference in brick.
3 | 3D DESIGN VISUALIZATION
Features
- “See the unseen” (not-yet built, asset information, behind drywall)
- Locate and verify assets
- Flexibility to visualize with HoloLens or mobile device
- Capture and share photos, videos
- Issue tracking connected to BIM360
- Measuring tools
- Turn model layers on/off to isolate specific model layers for optimal on-site visualization
- Options to adjust (and save) alignment; lock model to reduce drift
- Sync AR models to device for offline viewing
AR Visualization Benefits

- **Design Review**: Intuitive way to visualize design elements not-yet constructed
- **Clash Detection**: Overlay digital model and reality to easily compare built assets to modeled assets for quality reviews and record drawings.
- **Install Validation**: Prior to construction (ongoing process), use digital model to verify planned work to avoid re-work.
Enabling remote site access for stakeholders

• **Value added** from AR/VR solutions:
  • Increased safety
  • Cost reduction
  • Speed of decision-making
  • Enhanced communication

• **Shift** in how projects are perceiving virtual technology
  • Pre-COVID: “nice to have”
  • Since Spring 2020: “need to have” — a solution to keep projects on schedule
  • Post-COVID-19: longer-term planning around ‘new way of working more virtually’
Thank You!

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Value of Real-time Workforce Data

- Using Eyrus to capture and archive real-time data
- How to apply data and gain ROI
- Methods and Solutions for COVID-19 Protocols
The Construction Industry spent $177.5 Billion in labor costs in 2018…
On Non-Optimal Activities

14+ hours lost Per week

4.7 hours
Conflict resolution between stakeholders

5.5 hours
Hunting down project data

3.9 hours
Dealing with reworks & mistakes

Comprehensive Workforce Solutions

Workforce Visibility

Field Productivity

Axon

CREATE & SUBMIT DAILY LOGS

EMPOWER SUBS

Apex

INSTALL READERS & REGISTER WORKFORCE

AUTOMATED DATA COLLECTION & FORECASTING
Workforce Visibility

- Increase workflow efficiency on site
- Streamline safety communication and data
- Centralize workforce data
Workforce Visibility

Efficient & Intuitive Platform

- View real-time Data straight from the field
- Automate reports and share with stakeholders and subcontractors
- Easily filter, sort, print and export workforce and timesheet data
- Integrations with Procore and BIM 360
Workforce Visibility

Safety Features

- Use real-time evacuation tracking
- Send mass text messages to teams
- Zone Dashboard – View headcounts and attendance per zone with alert notifications
- Easily access site directory w/optional emergency contact info per person and certifications
- Engage 8 customizable alerts that provide real-time text notifications including:
  - Key person on site
  - Access violations
  - Density Thresholds
Workforce Visibility

Centralized Workforce Database

- Customize your registration process
- Filter and sort by any attribute
- Capture all timesheets per person
- Filter and sort per timeframe and attributes together
- Easily update access permission per person or zone
- Include certifications, contact info, health status, and more per person
Data Collection

- Automatic or Manual time collection
- Flexible wearable options
- Virtual zones and access control
Data Collection

**On-site Hardware**

- Eyrus Readers collect wearable BLE or NFC data & send to the cloud
- Use Readers to create zones on site
- Control access and density per zone
- Turnstile Integration available
Data Collection

Flexible Wearable Options

Choose wearables for the workforce based on project needs:

**Automatic Data:**
- BLE hard hat beacons
- BLE ID badges

**Manual Data:**
- NFC Cards
- Turnstile integration
COVID-19 Protocols

- Features to maintain efficacy and safety
- Wearables to support the team
- Data for contact tracing and insurance support
Social Distancing Solutions

SafeProx Badges & Contact Tracing

- SafeProx Badges alert within 6 to 10 ft. of other badges
- Data communicated via the cloud
- Easily charge SafeProx with USB
- Interaction data per person available in Apex for Contact Tracing or insurance purposes
Social Distancing Solutions

Density Alerts and Zoning

- Create Zones to see attendance in designated areas throughout the site
- Use Density settings to select a max headcount per zone for social distancing
- Set Density alerts to get real-time texts when headcount max is reached
Industry Experience

**Data Centers**
Cyrus One – fastest built in the world | Largest in the U.S.

**Office / Mixed Use**
Cyrus One – fastest built in the world | Largest in the U.S.

**Industrial / Manufacturing**
Water Treatment Facilities | Guinness Brewery

**Renovations / Interiors**
Nestlé U.S. HQ | IMF HQ1

**Multi-Family**
1200 Units in DC Metro | 400 Units in Miami

**Hospitals**
Texas Health

**Schools**
K-12 Baltimore City | Santa Monica

**Public Housing**
City of Seattle

**Hospitality**
Miami SLS Tower

**Civic / Stadium**
Most visited museum in the U.S.

5 years

Nationwide

$20 Billion
CMAA SoCal

Innovation and Technology

Jon Liebe – VP of Public Works
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COMMITTED TO INNOVATION
We are making significant investments in research & development with hundreds of software developers around the world working hand in hand with industry professionals.

DRIVING PREDICTABLE PROJECT OUTCOMES
At their core, our solutions are designed to make sure project stakeholders have the information they need when and where they need it…to avoid surprises and make informed decisions.

CORE VALUES
We are passionate about the future of work in the construction industry — improving outcomes, predictability, and safety.

Our core values — integrity, respect, passion, innovation and accountability — are how we bring that future to life.

To help our customers realize the “best path of construction” by building and integrating technology solutions that span the life of a structure; providing the data and insights to better predict cost, build time and lifespan.
Loss of Value in Silo Approach

Concept / Preplanning
- Initiate and plan
- Execute
- Monitor and control
- Closeout

Design and Engineering
- Initiate and plan
- Execute
- Monitor and control
- Closeout

Procurement
- Initiate and plan
- Execute
- Monitor and control
- Closeout

Construction
- Initiate and plan
- Execute
- Monitor and control
- Closeout

Commissioning & Startup
- Initiate and plan
- Execute
- Monitor
- Closeout
Value of Integrated Platform
WE’VE GOT YOU COVERED WITH SOLUTIONS TO YOUR GREATEST PROJECT CHALLENGES.

**PCM**  PROJECT COST MANAGEMENT
Estimate **25% more work** with current staff
Increase **forecasting accuracy by 3%**

**VDC**  VIRTUAL DESIGN AND CONSTRUCTION
Increase **clash resolution efficiency by more than 200%**

**SCH**  PLANNING, SCHEDULING AND RISK
Cut **planning time by 25%**
Execute **with GREATER confidence**

**CCM**  CAPITAL AND CONTRACT MANAGEMENT
Reduce **time to execute a contract by 20%**
Turn change orders around **10-20% faster**

**FXM**  FIELD EXECUTION
**5-10% reductions in project costs**
**Save 37 minutes** a day in payroll review

**DOC**  DOCUMENT MANAGEMENT
Cut **document searching time in half**
Reduce **RFI, Submittal other processing time by 30-40%**

**CAN**  CONNECTED ANALYTICS
Cut **project analysis time by 50%**
**100% portfolio visibility**

**SQC**  SAFETY, QUALITY AND COMMISSIONING
Lessen field time by **40%** and consolidation time by **30%**

**10% reduction in rework**

PROVEN PROJECT CERTAINTY.
CAPABILITIES AT EACH STAGE OF THE PROJECT LIFE CYCLE

1. CONCEPT / PRE-PLANNING
   - Properly evaluate cost and schedule risk
   - Choose the right projects to fund
   - Clearly define project scope
   - Manage engineering deliverables

2. DESIGN AND ENGINEERING
   - Align estimates and schedules with scope changes
   - Easily assess schedule impacts from design delays
   - Manage contracts and procurement
   - Update earned values, budgets, and forecasts based on progress

3. CONSTRUCTION
   - Coordinate all stakeholders through work packaging and field execution

4. COMMISSIONING AND STARTUP
   - Stay in control of issues and change orders
   - Manage document workflows and project correspondence
   - Manage QA/QC, punch lists, and commissioning
   - Connect as-designed data with as-built data ("digital twin")

5. OPERATIONS
   - Turn over digital project archives to operations
   - Integrate project data with asset management systems
Thank you!

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QUESTIONS?
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