Construction Technology Forecast: Harnessing Integration, Mobile, Sensors & Augmented Reality

James M. Benham
Chief Executive Officer
JBKnowledge, Inc.

This session is eligible for 1.5 Continuing Education Hours.

To earn these hours you must:
– Have your badge scanned at the door
– Attend 90% of this presentation
– Fill out the online evaluation for this session
2015 Construction Technology Forecast

Harnessing Integration, Mobile, Sensors & Augmented Reality

James Benham
Twitter: @JamesMBenham, #JBTechTalk
A Little About Me

COLLEGE STATION, TX
BATON ROUGE, LA
CORDOBA, MEXICO
SALTA, ARGENTINA
Currently offer Construction and Insurance enterprise development and consulting

Over 600 clients across US, Canada, Caribbean, and Middle East - 140 Employees, 5 Offices.

2001
Started in Dorm 2 on A&M campus

2002
Started Argentina operation

2006
Expanded into products

2014
OUR PRODUCTS
FOUNDED IN 2006

- Over 600 General Contractors
- Invitations to Bid
- Plan Distribution
- Subcontractor Data
- Project Communication
- Prequalification

SMARTBIDNET.COM
<table>
<thead>
<tr>
<th>Sep 2014</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1376 COIs Issued.</td>
<td>324,432 COIs Currently Stored in the System</td>
</tr>
<tr>
<td>490 COIs Collected.</td>
<td>153,516 COIs issued.</td>
</tr>
<tr>
<td></td>
<td>170,916 COIs issued.</td>
</tr>
<tr>
<td></td>
<td>112,898 vendors currently managed across the system.</td>
</tr>
<tr>
<td></td>
<td>47,721 insureds.</td>
</tr>
<tr>
<td></td>
<td>65,188 holders.</td>
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</table>

SMARTCOMPLIANCE.CO
An online dashboard for construction businesses to securely maintain, request and share operational, risk management and project qualification data.

Seamlessly consolidate, send and request company data to better clear qualification hurdles for any construction project and maintain your construction qualification database.

Enter your information securely online.  
Control distribution and collection of that information.  
Request information on the party requesting information on you.  
Track relationship by numbers of request, project awards, responsive and more.  
Integrate all of this data into your software.

SMARTINSIGHT.CO
Augmented Reality Mobile App for Construction available on android & iOS

www.smartreality.co
TECHNOLOGY

WHY DO WE BOTHER?
TECHNOLOGY

WHY DO WE BOTHER?

THE PYRAMIDS AT GIZA - 2560 BC
TECHNOLOGY

WHY DO WE BOTHER?

THE EMPIRE STATE BUILDING - 1930
TECHNOLOGY

WHY DO WE BOTHER?

THE HOOVER DAM - 1936

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TECHNOLOGY
WHY DO WE BOTHER?

BIG INCH (350 DAYS) AND LITTLE BIG INCH - 1942

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TECHNOLOGY

SO WHY DO WE BOTHER?
TECHNOLOGY

WHY DO WE BOTHER?

GREATER MARGINS

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WHY DO WE BOTHER?

CHANGING COMPETITIVE LANDSCAPE

Crystal Bridges
Burj Khalifa
Bird’s Nest
Palm Jumeirah

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TECHNOLOGY

WHY DO WE BOTHER?

SAFETY

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WHY DO WE BOTHER?

WORKER QUALITY OF LIFE

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I have no time to see a salesman, I’ve got a battle to fight.
A RECENT QUOTE

“I got into construction decades ago because you didn’t have to be a rocket scientist, only to find out that now, you have to be a rocket scientist to be in construction.”
"The only constant is change."

"To improve is to change, so to be perfect is to have changed often."

Winston Churchill

“We don’t have to be way ahead, we have to be a year ahead.”
SOME QUICK DEFINITIONS
What is the Cloud? It’s (NIST Definition):

- Self Service
- Resource Pooling
- Scalable
- Programmable
- Broad Access

Public/Private/Hybrid
DEFINITIONS

Big Data (from Michael Stonebraker @ MIT)

- **Big Volume**
  (Simple SQL analytics, Complex non-SQL)

- **Big Velocity**
  (Drink from a fire hose)

- **Big Variety**
  (Large # of diverse data sources for integration)
DEFINITIONS

Machine Learning (from WhatIs)

- A type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed.

- Focuses on the development of computer programs that can teach themselves to grow and change when exposed to new data.
What changed in the last 12 months?
What Changed in the Last 12 Months

Job site connectivity continues to improve.

- Google Fiber (up to 1Gbps)
- XLTE Ready (up to 80Mbps)
- 5G (up to 1Gbps)
What Changed in the Last 12 Months

Devices and hardware continue to improve.
What Changed in the Last 12 Months

Mobile job site computing became much easier.
What Changed in the Last 12 Months

Cheap sensor hardware is here.

Leap Motion

SoftKinetic

Structure Sensor

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What Changed in the Last 12 Months

The internet of things has arrived.

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What Changed in the Last 12 Months

Google got into construction with Google X and ATAP.

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What Changed in the Last 12 Months

Big data and machine learning are intersecting.
Augmented and Virtual Reality

Scanning for AR & VR - Google Project Tango

Project Tango
Augmented and Virtual Reality

Scanning for AR & VR - Project Tango by MatterPort
Who Was Surveyed

- Estimator: 31.4%
- Executive (CEO, CIO, CFO, etc.): 30.6%
- Project Manager: 20.5%
- Other: 17.3%
- Preconstruction Manager: 13.2%
- Owner/Principal: 12.0%
- IT Staff: 9.7%
- Engineer: 6.7%
- BIM Manager: 5.4%
- Architect: 1.8%

Primary Industry of Surveyed

- Commercial Construction: 74.4%
- Specialty Trade: 19.6%
- Civil Construction: 17.9%
- Federal Construction: 17.9%
- Residential Construction: 15.9%
- Construction Services Provider: 15.2%
- Heavy & Highway: 13.0%
- Other: 8.4%
- Construction Technology Provider*: 1.3%
2014 Construction Technology Report

Size of Companies

- 4.9% 1-5
- 7.7% 6-20
- 16.8% Over 1,000
- 16.4% 21-50
- 6.9% 501-1,000
- 15.7% 201-500
- 17.1% 51-100
- 14.5% 101-200

Corporate Revenue

- 5.7% less than $1 mil
- 18.2% Over $500 mil
- 12.5% $201-500 mil
- 9.9% $101-200 mil
- 15% $51-100 mil
- 17.2% $21-50 mil
- 14.9% $1-5 mil

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Percentage of Corporate Revenue Spent on IT

- Less than 1%: 31.0%
- 1%: 10.6%
- 2%: 6.5%
- 3%: 5.0%
- 4%: 2.7%
- 5%: 0.8%
- 6%: 0.4%
- Over 7%: 1.7%

Dedicated IT Department

- Yes: 58.9%
- No: 41.1%
We are underspending other industries by 75%
What Software Can Be Cloud Based?

2013:
- Invitation to Bid/Plan Room: 78.1%
- Project Management: 73.1%
- CRM: 57.6%
- All: 54.3%
- Estimating: 54%
- BIM: 44.6%
- Accounting: 29%

2014:
- Invitation to Bid/Plan Room: 78.3%
- Project Management: 65.6%
- Prequalification: 63.2%
- Project Scheduling: 58.1%
- CRM: 51.4%
- BIM: 44.8%
- All: 42.4%
- Estimating: 40.2%
- Accounting: 31.1%
There is an irrational fear of cloud based solutions
Client Relationship Management Software

### 2013

<table>
<thead>
<tr>
<th>Software</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>46.4%</td>
</tr>
<tr>
<td>Microsoft Excel</td>
<td>34.2%</td>
</tr>
<tr>
<td>Manual/Paper Process</td>
<td>28%</td>
</tr>
<tr>
<td>Other</td>
<td>26.3%</td>
</tr>
<tr>
<td>Salesforce®</td>
<td>11.4%</td>
</tr>
<tr>
<td>Cosential</td>
<td>8.5%</td>
</tr>
<tr>
<td>SageCRM®</td>
<td>4.5%</td>
</tr>
<tr>
<td>SAP®</td>
<td>1.9%</td>
</tr>
<tr>
<td>SalesLogix®</td>
<td>1.9%</td>
</tr>
<tr>
<td>InfusionSoft®</td>
<td>0.5%</td>
</tr>
<tr>
<td>SalesNet™</td>
<td>0.3%</td>
</tr>
<tr>
<td>SugarCRM™</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

### 2014

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None - we do this manually.</td>
<td>33.1%</td>
</tr>
<tr>
<td>Outlook</td>
<td>20.9%</td>
</tr>
<tr>
<td>None - we use spreadsheets.</td>
<td>14.8%</td>
</tr>
<tr>
<td>Custom-In-House Solution</td>
<td>14.2%</td>
</tr>
<tr>
<td>Other</td>
<td>10.5%</td>
</tr>
<tr>
<td>Custom-In-House Solution</td>
<td>7.4%</td>
</tr>
<tr>
<td>Cosential</td>
<td>5.8%</td>
</tr>
<tr>
<td>Salesforce®</td>
<td>3.1%</td>
</tr>
<tr>
<td>SageCRM®</td>
<td>1.7%</td>
</tr>
</tbody>
</table>
There is a huge opportunity to improve business development with CRM technology.
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BIM Software

2013

2014

- Revit (Autodesk) 42.6%
- We do not use BIM. 37.6%
- Navisworks (Autodesk) 30.1%
- Sketchup (Trimble) 18.9%
- We outsource BIM. 11.1%
- Tekla (Trimble) 6.1%
- Other 4.4%
- VICO 4.0%
- QTO (Autodesk) 4.0%
- Innovaya 4.0%
- Assemble Systems 3.0%
- Custom In-House Solution 2.7%
- Beck Technology DProfiler 2.1%
4D, 5D & 6D BIM Adoption is happening now.
2014 Construction Technology Report

Engineer and Contractor Design Build Meeting
2014 Construction Technology Report

Estimating Takeoff Software

2013

- OnScreen Takeoff: 43.2%
- Sage Estimating: 25.6%
- Plan Swift: 8.6%
- Proest: 4.9%
- Cloud Takeoff: 1.9%
- Maxwell Systems: 1.9%

2014

- OnScreen Takeoff: 41.4%
- Other: 22.4%
- None - we use spreadsheets: 20.9%
- Sage: 13.8%
- Planswift: 9.5%
- None - we do this manually: 8.5%
- Custom In-House Solution: 8.4%
- MC2ICE: 6.1%
- HardDollar: 3.6%
- ProEst: 2.4%
- Maxwell Systems: 1.5%
- Cloud Takeoff: 1.4%
Estimating is undergoing a fundamental change.
2014 Construction Technology Report

Invitation to Bid Software

2013

2014

SmartBidNet 32.3%
iSqFt 20.7%
Bluebook® 18.1%
GradeBeam® 12.5%
eBid Exchange 9.8%
eBuilder® 9.1%
PipelineSuite® 9.1%

None - we do this manually. 8.6%
Dropbox 7.5%
Outlook & FTP Sites 6.4%
Other 6.1%
None - we use spreadsheets. 4.8%
Bluebook 3.3%
Box.com 1.7%
Pantera 1.0%
eBid Exchange 1.0%
Pipeline Suite 0.8%
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Project Scheduling & Management Software

2013

<table>
<thead>
<tr>
<th>Software</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primavera</td>
<td>23.6%</td>
</tr>
<tr>
<td>Other</td>
<td>23.6%</td>
</tr>
<tr>
<td>Prolog</td>
<td>21.5%</td>
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<tr>
<td>Sage 300</td>
<td>14.5%</td>
</tr>
<tr>
<td>CMiC</td>
<td>9.1%</td>
</tr>
<tr>
<td>Viewpoint</td>
<td>7.4%</td>
</tr>
<tr>
<td>Autodesk® Constructware®</td>
<td>5.8%</td>
</tr>
<tr>
<td>Microsoft® Projects</td>
<td>2.5%</td>
</tr>
<tr>
<td>Procore™</td>
<td>2.1%</td>
</tr>
<tr>
<td>Custom</td>
<td>2%</td>
</tr>
<tr>
<td>Co-Construct™</td>
<td>0.4%</td>
</tr>
<tr>
<td>eCMS</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

2014

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<tr>
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<td>None - we do this manually.</td>
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<td>Viewpoint</td>
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</tr>
<tr>
<td>Sage</td>
<td>5.8%</td>
</tr>
<tr>
<td>Custom In-House Solution</td>
<td>4.8%</td>
</tr>
<tr>
<td>CMiC</td>
<td>3.2%</td>
</tr>
<tr>
<td>Procore</td>
<td>2.7%</td>
</tr>
<tr>
<td>Constructware</td>
<td>1.5%</td>
</tr>
<tr>
<td>Computer Ease</td>
<td>1.4%</td>
</tr>
</tbody>
</table>
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Accounting Software

2013

2014

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Number of Applications Used Daily

18.2% More than 6
12.5% 5 Apps
8.4% 4 Apps
18.6% 3 Apps
24.8% 2 Apps
13.7% 1 App
3.7% None

How many of their applications integrate?

5.2% More than 6
4.1% 5 Apps
5.2% 4 Apps
14.8% 3 Apps
27.7% 2 Apps
31.7% 1 App
9.8% None

How do they transfer data if applications don’t integrate?

Spreadsheets: 57.3%
CSV: 26.2%
Custom Built Integration: 23.4%
Email: 20.0%
We don’t transfer data: 17.3%
XML: 8.8%
I don’t know: 8.7%
Other: 6.2%
Are their software vendors making integration efforts?

- I don't know: 61.2%
- Only custom integrations we request: 22.0%
- They do not offer integration services: 7.0%
- Yes *: 5.6%
- Other: 5.3%
- Yes, through agcXML: 4.0%

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People and companies still depend far too much on Excel.
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How important is mobile?

- 20.7% Not very. We'd purchase either way.
- 31.4% Very important. They must have a mobile version.
- 47.9% Important. They must at least have plans for mobile development.

Which providers offer mobile apps?

- Other: 62.96%
- Field Data Collection: 53.00%
- Project Management: 46.80%
- Invitation to Bid/Plan Room: 41.90%
- BIM: 29.50%
- Accounting: 28.60%
- CRM*: 26.80%
- Estimating: 23.90%

*CRM: Customer Relationship Management
2014 Construction Technology Report

Daily Device Usage & BYOD

2013

- Laptop: Personal 40.6%, Company 79.2%
- Tablet: Personal 62.7%, Company 52.2%
- Smartphone: Personal 48.6%, Company 71.5%

2014

- Laptop: Personal 27.4%, Company 86.3%
- Tablet: Personal 48.8%, Company 60.1%
- Smartphone: Personal 41.6%, Company 72.3%
Do companies secure personal devices?

**2013**
- 59.5% No
- 40.5% Yes

**2014**
- 39.8% No
- 60.2% Yes

27.5% I don't use personal devices at work.

**Mobile Operation Systems**
- 46.3% iOS
- 31.8% Windows
- 20.1% Android
- 1.8% Blackberry

Collecting Data in the Field

- We collect data manually: 44.1%
- We use spreadsheets: 37.4%
- Custom In-House Solution: 19.6%
- We use a software or mobile product: 19.3%
- We don't collect data on the job sites: 9.6%
- Other: 2.9%
ConAppGuru Top Mobile Apps

- FotoIN
- EGNYTE
- PlanGrid
- assemble
- safesite
- thingtech
- smartuse
- FIELDLENS
- StriveZero
- SKYSITE
- Raken

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Mobile adoption is happening now and very quickly
Top Free Web-Based & Desktop Software

<table>
<thead>
<tr>
<th>Software</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dropbox</td>
<td>67.0%</td>
</tr>
<tr>
<td>Google Earth</td>
<td>63.7%</td>
</tr>
<tr>
<td>GoToMeeting</td>
<td>58.9%</td>
</tr>
<tr>
<td>Google Drive</td>
<td>26.9%</td>
</tr>
<tr>
<td>Skype</td>
<td>24.6%</td>
</tr>
<tr>
<td>Box</td>
<td>19.7%</td>
</tr>
<tr>
<td>Sketchup (Trimble)</td>
<td>18.8%</td>
</tr>
<tr>
<td>Microsoft Office 365 Live</td>
<td>16.2%</td>
</tr>
<tr>
<td>Join.Me</td>
<td>16.2%</td>
</tr>
<tr>
<td>YouSendIt</td>
<td>12.2%</td>
</tr>
<tr>
<td>Other</td>
<td>5.2%</td>
</tr>
<tr>
<td>Tekla BIMsight</td>
<td>3.3%</td>
</tr>
</tbody>
</table>
What technologies are builders excited about?

- Software Integrations
- Wireless Chargers
- Hyper-Speed Rendering
- 4D BIM
- Tablets
- BIM
- Self-Driving Cars
- Mobile Apps
- Google Glass
- SmartReality
- Wearable Devices
- Virtual Reality
- 3D Printing
- Quadcopters
- Augmented Reality
- 5D BIM
- Oculus Rift
- Drones
- 3D Laser Scanning
- Photogrammetry
- Google Genie
- GPS on Equipment
Virtual and Augmented Reality Will Change Computing
Are they using augmented or virtual reality solutions?

- Yes: 3.4%
- No: 70.6%
- I don't know: 26%

Are they using wearable devices?

- Yes: 2.5%
- No: 81%
- I don't know: 16.5%
Augmented and Virtual Reality

What is enabling this?

- CAMERAS
- MOTION SENSORS
- GPS
- CONNECTIVITY
- COMPASS
- DATA
- 3D MODELS
Augmented Reality

Are augmented reality and virtual reality solutions in search of a problem?
Augmented and Virtual Reality
AUGMENTED REALITY FOR BUILDERS

AEC PROFESSIONALS USE AR AND VR TO SHOW HOW THINGS SHOULD BE BUILT ON SITE
AUGMENTED REALITY FOR BUILDERS

CONTRACTORS, DEVELOPERS AND ARCHITECTS USING AR TO MORE EASILY PITCH NEW PROJECTS
AUGMENTED REALITY FOR BUILDERS

AEC PROFESSIONALS TAKE SCHEDULES TO THE FIELD TO FIND PROBLEMS THEY NEVER WOULD HAVE
WEARABLES FOR AR
Virtual Reality - Oculus and Gear VR

VR - The Pursuit of Presence & Mobility
RoomAlive: Magical Experiences Enabled by Scalable, Adaptive Projector-Camera Units

Brett Jones¹, Rajinder Sodhi¹, Michael Murdock², Ravish Mehra³, Hrvoje Benko, Andrew D. Wilson, Eyal Ofek, Blair MacIntyre⁴, Nikunj Raghuvanshi, Lior Shapira

Microsoft Research
¹University of Illinois at Urbana-Champaign, ²University of Southern California, ³University of North Carolina at Chapel Hill, ⁴Georgia Institute of Technology

ACM UIST 2014

All clips in this video were captured live in real-time without any post production or compositing.
VR for Builders - Dive

Ultra Portable VR

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Drones are already becoming commonplace
Unmanned Aerial Vehicle

BP pilot testing for use of UAV in pipeline inspection at Prudhoe Bay, Alaska. Fall, 2012
Aerial Drones for 4D Data Capture

Puma AE UAS Equipped with Integrated LIDAR System
Conclusions and Predictions

New Tech is cool but most contractors are struggling with paperless conversions and Excel over-utilization
Conclusions and predictions

Our spend and dedication to IT as a core function still lags behind - we must push budgets up.
Conclusions and predictions

The lines between computer science and construction science will blur.

IT departments will transform into revenue generators.
Conclusions and predictions

The question will change from whether to go paperless to whether to go Excel-less.
Conclusions and predictions

Inexpensive 3D printers, drones, wearables and other hardware become available - and companies set budgets for experimentation.
Conclusions and predictions

Digital offsite prefabrication and 3D building printing become a reality.
Conclusions and predictions
Conclusions and predictions

The pace of change will increase.
Get Started Tonight

Address your budget.
Do you have dedicated Tech staff?
Are you underspending?
A Note About “Free” Software:

“When an online service is free, you’re not the customer. You’re the product.”

- Tim Cook
Conduct periodic tech reviews.
Look for paper and excel utilization.
Get Started Tonight

Make sure the innovators, not the naysayers, are in charge of technology
Get Started Tonight

Become a tinkerer
Get Started Tonight

Install and Try Out

Google Drive
Google docs
SketchUp
SMARTReality™
Cloud Takeoff
TEKLA BIMsight