TOMORROW IS HERE:
THE FUTURE OF BUILDING THINGS

George White
CEO & Co-Founder

Dean Bowman, PE
Bentley Fellow

Kevin Halter
Director Of Western U.S
TOMORROW IS HERE:
THE FUTURE OF BUILDING THINGS

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CEO, Co-Founder
TRANSPORTATION INFRASTRUCTURE IS FUNDAMENTAL TO OUR WAY OF LIFE.

Why we do what we do...
MEGA TRENDS SHAPING THE FUTURE

Massive financing need
$3.6 trillion of investment needed by 2020

Aging Infrastructure
28+ average age of streets and highways in U.S.

Bigger, more complex projects
2mi underground boring Alaskan Way Viaduct

Sources: ASCE; Bureau of Economic Analysis; Press Reports; Q13Fox
Resource scarcity consumer of global raw materials is the construction industry

Sustainability Requirements
50% of solid waste in U.S. is produced by construction industry

Slow permit and approval process
$1.2tn of infrastructure would be added by 2030 if all countries committed to specific time limits for approvals

Sources: World Economic Forum; The Boston Consulting Group
MEGA TRENDS SHAPING THE FUTURE

Resilience Challenges

3x as many disasters reported last year as in 1980

Talent and aging workforce leaving 50% of employees eligible for retirement by 2018

Sources: Press reports; World Economic Forum; The Boston Consulting Group
Managing Risk Through Asset Life Planning
Design and Engineering
Construction
Operations
Managing Risk Through Asset Life (Time, Quality, Cost)

Ease of change  
Frequency of changes in traditional process  
Cost of change

Planning  Design and Engineering  Construction  Operations

Source: Adapted from World Economic Forum; The Boston Consulting Group
OPPORTUNITIES TO EVOLVE

Mon: 98° - 79° P. CLOUDY
8/25 0800 - 5:00 pm  Seq: 8
BASE: Crew - Damiens
0: Super 1: Skill 0: Unskill
Equip: 0: Loader 1: Track Hog

Base Construction, Excavating Trenches for 24" RCP pipe for adjoining storm water inlets that are also being installed along EBFK US-290 at approx. sta. 1174+00 to 1177+00

Tues: 92° - 77° P. CLOUDY  Seq: 8
8/26 08:00 - 5:00 PM GTS: 054466
BASE: Damiens Crew

Wed: 93° - 78° P. CLOUDY
8/27 0800 - 5:00 pm Seq: 8
BASE: Crew - Crew
0: Super 1: Skill 0: Unskill
Equip: 0: Loader 1: Track Hog

Excavating soil for installation of (36") RCP pipe to adjoin with (5x5) storm box located at Sta. 3143+50 for MH-1 to L-A15-1 16' and grouted pipe and boxes

See plan sheet 1141:
BASE: Excavating soils for installation of (36") RCP pipe to adjoin with storm box (5x5) location at WBFK US-290
OPPORTUNITY TO CONNECT SILOS
Core Enabling Technologies

User interfaces + applications
Software platform + control
Digital/physical integration

Technology Integrations

Life-Cycle Integrations

Big Data / Analytics
Simulation and V/R
BIM / Cloud
Ubiquitous Connectivity / Tracking
LIDAR / 3D Scanning
UAV
Automation
Embedded Sensors
Mobile and A/R

Sources: World Economic Forum; The Boston Consulting Group
Opportunities Enabled By Digital

Real-time data sharing, integration, and coordination across stakeholders

User interfaces + applications
Software platform + control
Digital/physical integration

Data-driven construction planning and lean execution
New fabrication methods
Automated and autonomous construction
Rigorous construction monitoring and surveillance
Real-time Strategic Project Inspection

Inspectors

Project Engineer

Resident Engineer

Documents and Approval Workflows

Archival and Audit

paviasystems
## Benefits To Be Realized

<table>
<thead>
<tr>
<th></th>
<th>Office building</th>
<th>Highway</th>
<th>Power plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact on life cycle cost (%)</td>
<td>-15%</td>
<td>-16%</td>
<td>-12%</td>
</tr>
<tr>
<td>• Design and engineering</td>
<td>±0%</td>
<td>±0%</td>
<td>-5%</td>
</tr>
<tr>
<td>• Construction</td>
<td>-12%</td>
<td>-19%</td>
<td>-14%</td>
</tr>
<tr>
<td>• Operations</td>
<td>-18%</td>
<td>-10%</td>
<td>-10%</td>
</tr>
<tr>
<td>Impact on construction time (%)</td>
<td>-30%</td>
<td>-23%</td>
<td>-15%</td>
</tr>
</tbody>
</table>

Source: IHS; The Boston Consulting Group
Benefits To Be Realized

Highway

Impact on life cycle cost (%)
-16%

- Design and engineering ±0%
- Construction -19%
- Operations -10%

Impact on construction time (%)
-23%

$24.1 Billion Annually

Source: CBO – Public Spending on Infrastructure March 2015 (Highway/Transit/Ferry)
The First Step Is Digitization

Access to Field Documentation  Construction Inspection  Pay Estimate  Change Orders  Material Certification/Testing  Audit/Search  Project Completion  Design  Bidding  Contract Award/Notice to Proceed

John Doe

pavia systems
e-Construction Establishes The Path
The catch? Expectations vs. Reality

Source: John Kotter International
Connected, Open, Integrated Environment

Contract Award/Notice to Proceed
Bidding
Design
Project Completion
Audit/Search
Material Certification/Testing
Change Orders
Pay Estimate
Construction Inspection
Access to Field Documentation
CHALLENGE THE STATUS QUO