



# Harness the Technology Innovation Revolution

Course Number TH204

Thursday, June 21, 2018, 7:30 AM – 9:00 AM

Learning Units 1.5 LU RIBA

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Questions related to specific products and services may be addressed at the conclusion of this presentation.

# Acknowledgements/Credits

Onuma Inc

BIMStorm

Hagan Technologies LLC

Construction.com

Construction Data Ventures LLC

Jeff Gravatte and CADD Micro

# Speakers List

## Stephen Hagan FAIA

- President | CEO, Hagan Technologies
- Principal, Construction Data Ventures

## Kimon Onuma FAIA

- President, Onuma, Inc.

## Jonathan Widney

- Principal, Construction Data Ventures

## Steve Jones

- Senior Director, Dodge Data & Analytics



# Course / Learning Objectives

1. Upon completion, participants will be able to establish and prioritize the top 3 or 4 emerging technologies that interest them and their firms and pose great opportunities for the future of their practice. These innovative technologies enable the architect and architectural practice to increase the value of the built environment in terms of safety, occupant comfort and well-being, often using data and technology feedback for human-centric and experiential design processes.

# Course / Learning Objectives

2. Upon completion, participants will be able to understand what path-breaking and leading firms are doing to dramatically improve outcomes and provide innovative services to their clients and customers. These firms have transformed their practices through the immersive use of these innovative technologies and processes, thereby increasing productivity and profitability, in addition to improving building systems, materials and methods, as well as quality and integrative of design and construction documents and follow-on construction contract administration.

# Course / Learning Objectives

3. Upon completion, participants will be able to understand how the built environment, form and function of architecture, and everything from small components to entire buildings to regions and urban scale can be dramatically improved by new emerging technologies--whether it is wearable computing, cloud computing, or big data. A special focus of the presentations and interaction with attendees will be on critical building systems, materials and methods, as well as design and construction processes (codes and standards, environmental compliance, new as well as renovation and historic preservation).

# Course / Learning Objectives

4. Upon completion, participants will be able to take key ideas back to the office on Monday and create their own Innovative Technology Execution Plans for their in-house projects and firm-wide business planning. Included in the workshop is a workbook with exercises throughout the day and a process and strategy to create a personal Game-Changing Innovation Technology Execution Plan. Each attendee will select one or more of critical topic areas to address in their Execution Plan: Building systems, construction contract administration and documents, design (including urban planning), environmental and legal project constraints and opportunities, materials and methods, pre-design and historic preservation).

# Stephen R Hagan FAIA

## Stephen Hagan FAIA

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## Jonathan Widney

- Principal, Construction Data Ventures

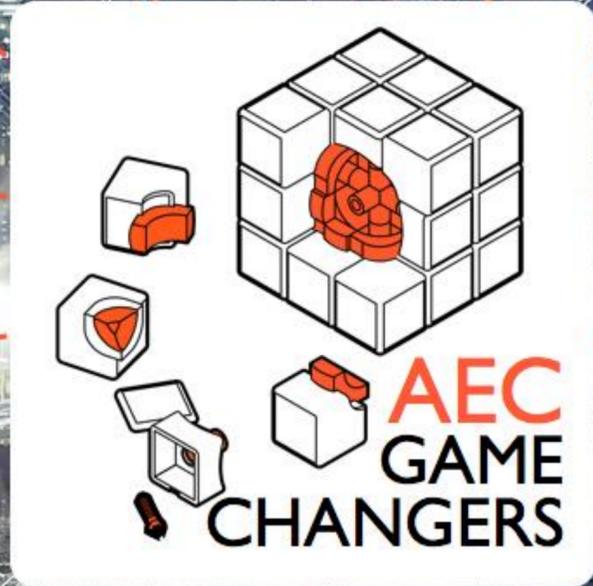
## Steve Jones

- Senior Director, Dodge Data & Analytics



# Harness the Technology Innovation Revolution

- A Tsunami of New Technologies
- Kimon Onuma
- Jonathan Widney
- Steve Jones
- Are You an *#AECGameChanger* ?
- Town Hall Discussion



# GAME CHANGING INNOVATION

Designing the Future of Architecture Construction & The Built Environment

**A'17**

AIA Conference on Architecture 2017  
April 27-29, Orlando

“ If you don’t change...you’re going to perish”

“If you want to survive, you’re going to change; if you don’t, you’re going to perish. It’s as simple as that.” —*Thom Mayne, FAIA, 2005 Pritzker Prize Winner*



# Game Changing Innovations

- What are Game Changing Innovations?
- Metrics | ROI are Key
- Focus on Data
- Game Changing Innovation Execution Plan
- AI Blockchain and the Future



# A Tsunami of Game Changing Innovations

## Model Authoring / Checking Tools

**BIM**

**CAD**

**CAFM | CMMS / IWMS**

**Clash Detection**

**Model Checking**

**Simulation**



# A Tsunami of Game Changing Innovations

## Immersive Technologies

**3D Printing**

**3D Reality Model**

**3D / Laser Scanning**

**4D Scheduling**

**Augmented Reality | Virtual Reality**

**Reality Capture**



# A Tsunami of Game Changing Innovations



## **Internet Technologies**

**Cloud Computing**

**Cybersecurity**

**Fog Computer | Edge Computing**

**Geo-Spatial | GIS | Location**

**Sensors /Sensor Web**

**Mobile**

**Platforms | Platform as a Service**

**Software as a Service**

**Web Services**

# A Tsunami of Game Changing Innovations

## Machine / Computational Technologies

**Artificial Intelligence | Machine Learning**

**Big Data | Analytics | Thick Data**

**Blockchain**

**Design Automation**

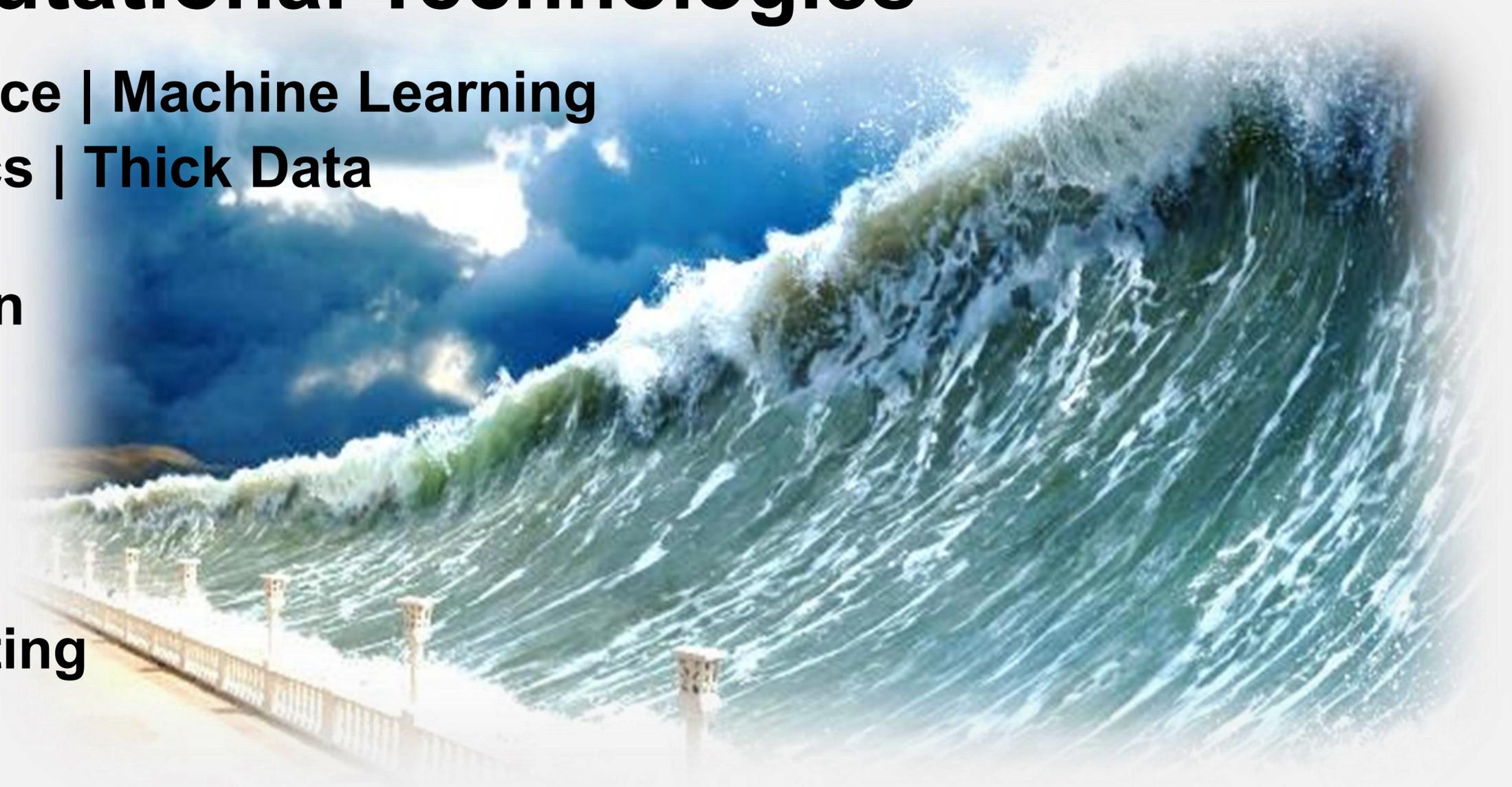
**Digital Fabrication**

**Drones**

**Internet of Things**

**Robotics**

**Pervasive Computing**



# A Tsunami of Game Changing Innovations

**Social Networking**

**Social Networking and Media**

**Wearable Computing**

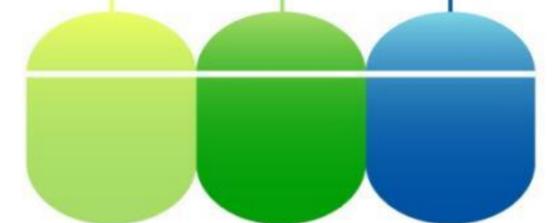
**Gamification**

**Crowd Sourcing**



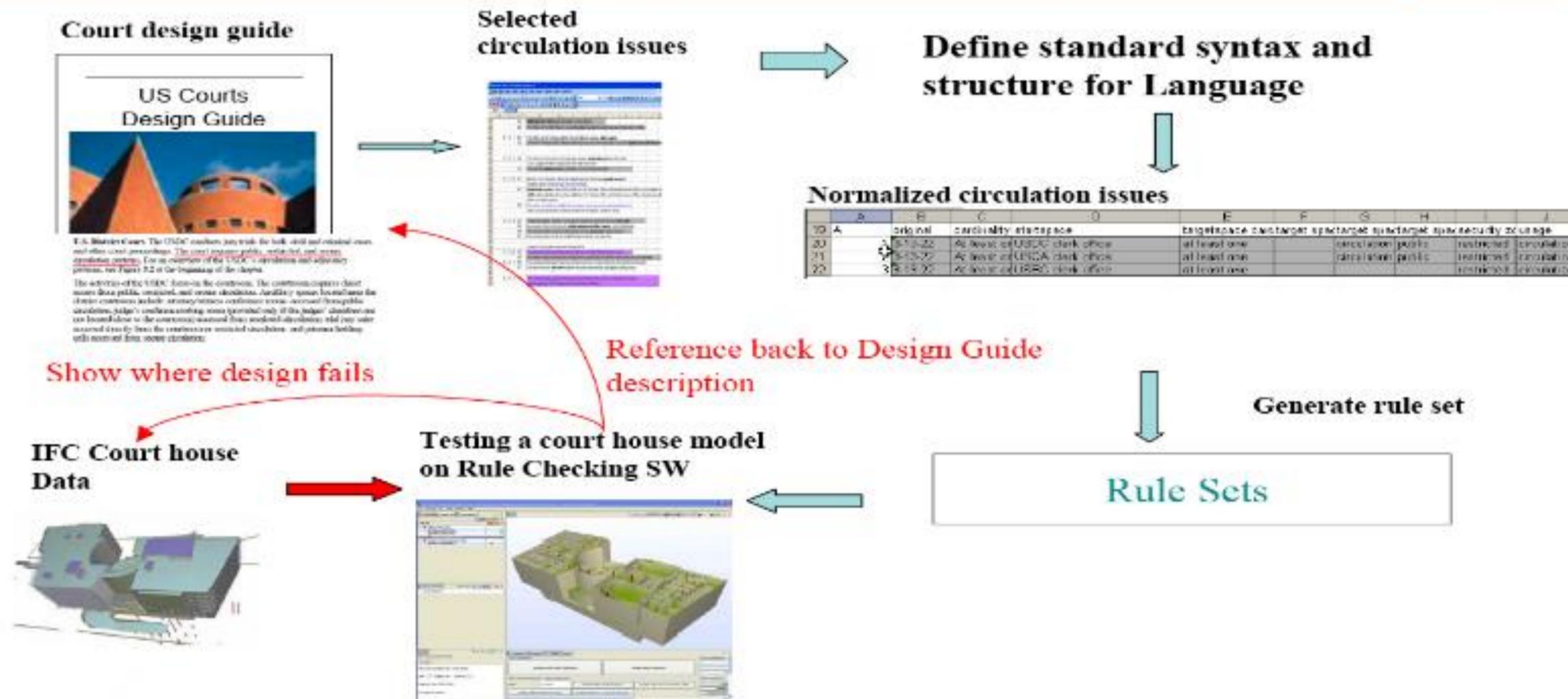
# Powerful ROI Example

## GSA Model Checking

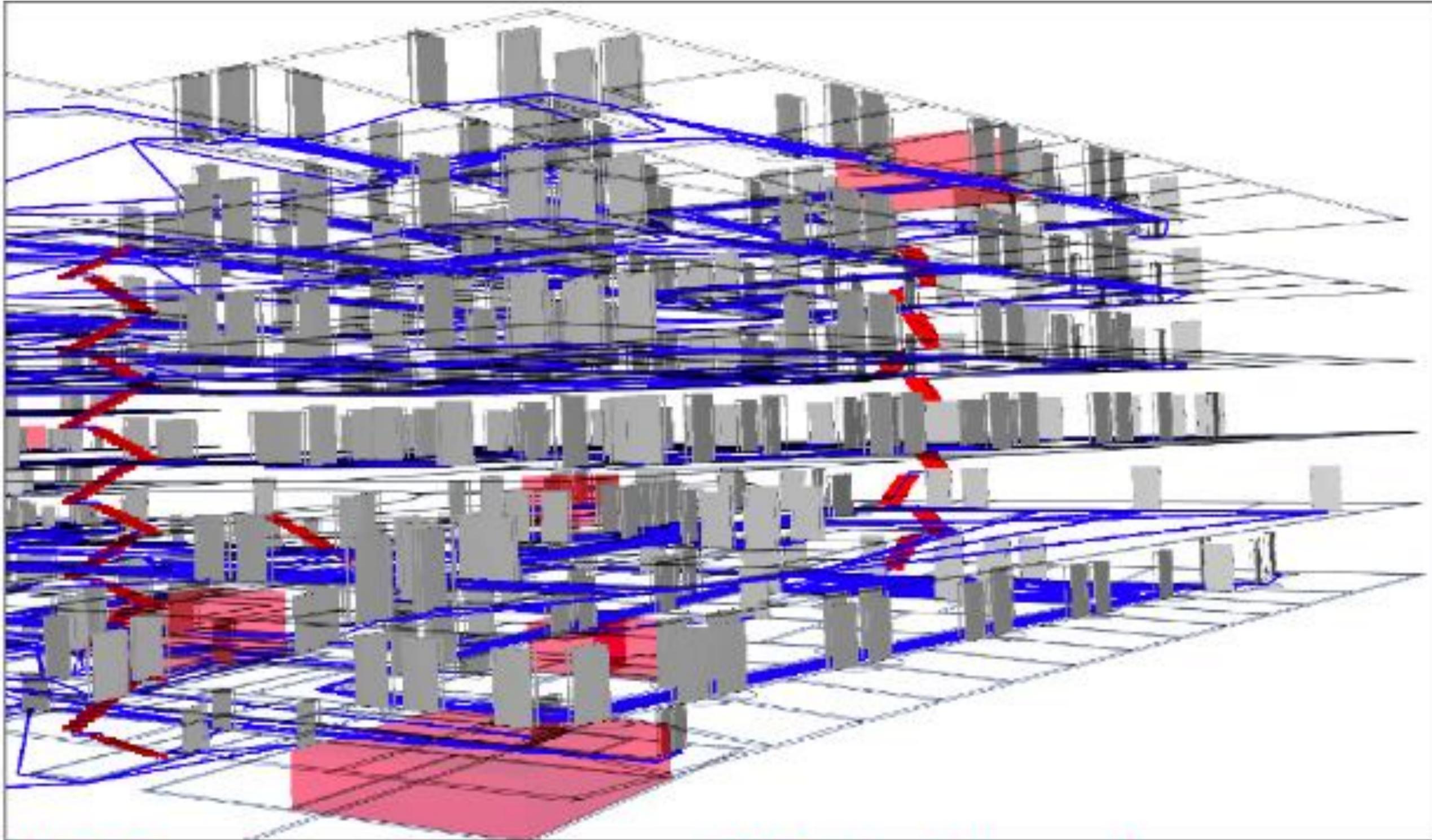
The logo consists of the letters 'S' and 'I' in a bold, blue, sans-serif font. The 'S' is on the left and the 'I' is on the right. A small blue circle is positioned above the 'I'. A thin blue line extends from the top of the 'I' to the right, and a thin green line extends from the top of the 'S' to the right. These lines merge into a single horizontal line that runs across the bottom of the slide.

# Model Checking

## Automated Circulation Validation Using BIM



# Model Checking



**27,000 routes** were tested using **302 circulation rules** in approximately **20 seconds**.

# 3D Printing



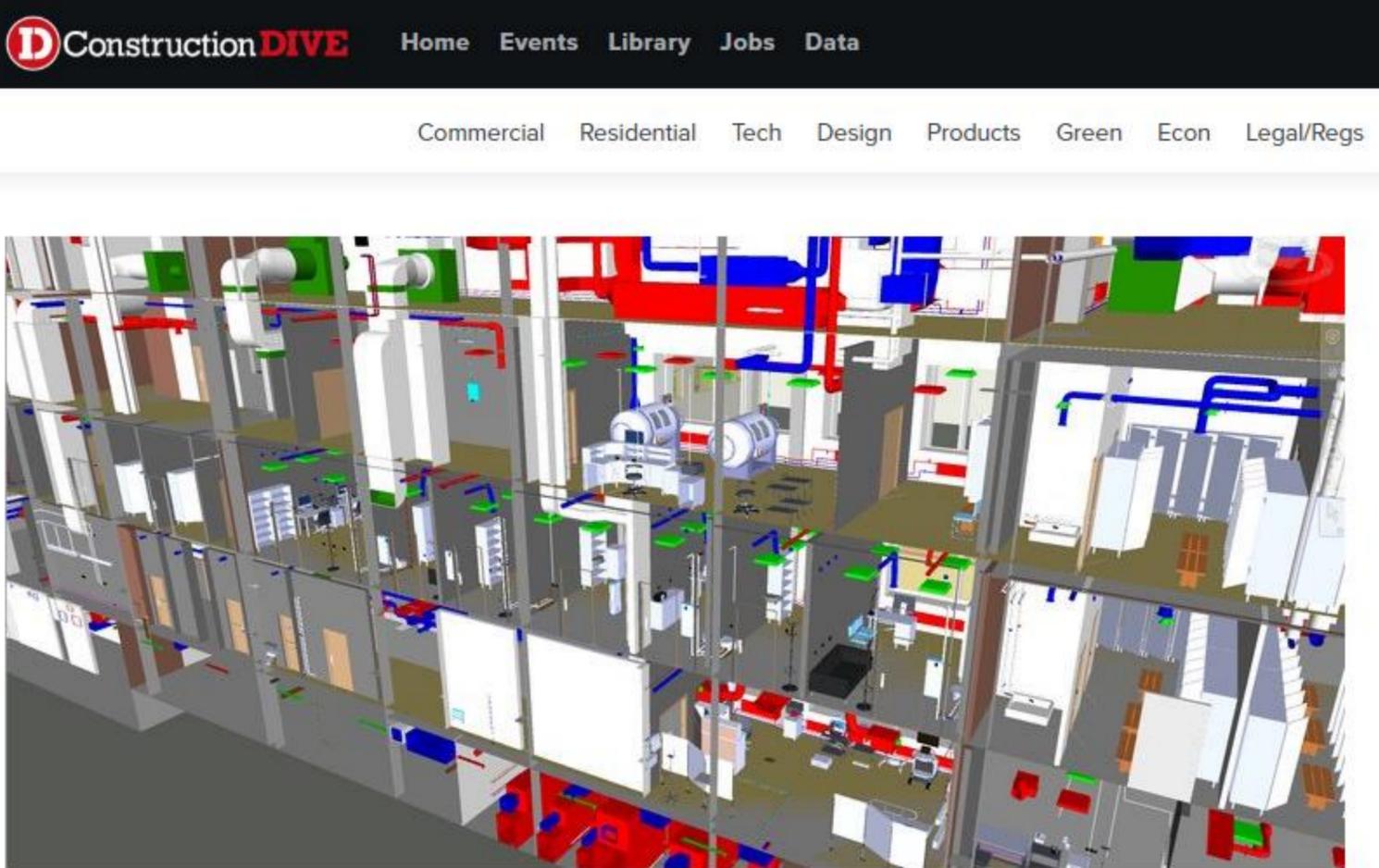
# 3D Printing



*3D-printed bridge by Heijmans*

# Contractors Are Out in Front

- Beck' Destini Estimator
- JBKnowledge SmartBid
- Assemble
- iSQFT
- DotProduct
- ProCore
- Autodesk BIM 360



**Construction DIVE** Home Events Library Jobs Data

Commercial Residential Tech Design Products Green Econ Legal/Regs

**FEATURE**

## How technology is streamlining the preconstruction process

# BlockChain and Virtual Reality

**This blockchain-based platform creates entire cities in virtual reality**

 by THECINTELEGRAPH — 14 days ago in VIRTUAL REALITY



# Mobile/Cloud/Shared Data



# Mobile/Cloud/Shared Data



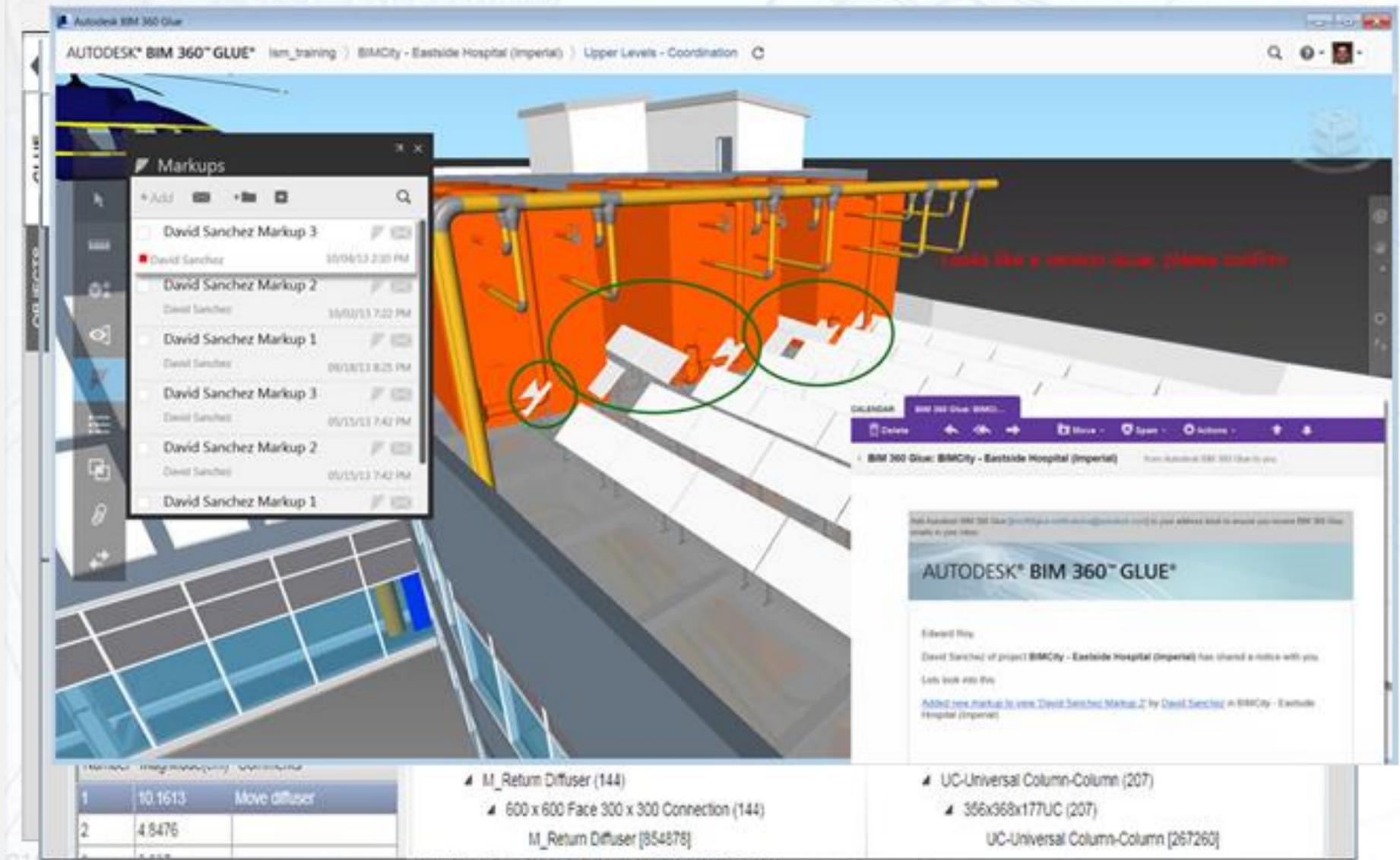
JE Dunn estimated **127,000** hours to post and draw documents manually on this project. At **\$79** per hour, it would have added an astounding **\$10,058,017** in paper-related costs.



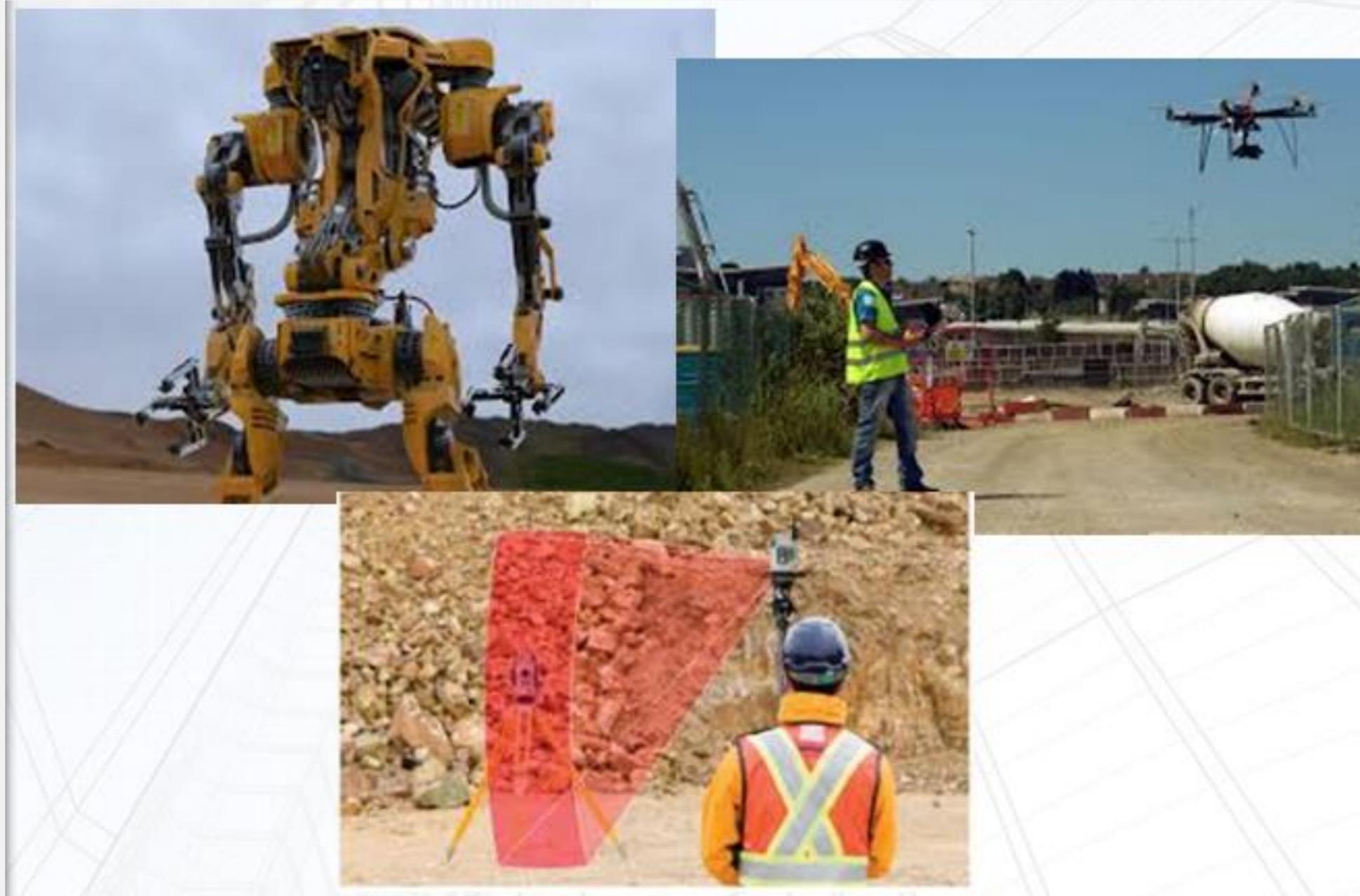
018 // 16

# Mobile/Cloud/Shared Data

*"All projects have 'conflicts' — things that don't conform or need changing," he said. "We can blow through \$100,000 in a major problem in about 5 minutes. Rich Kahn- Mortenson Construction*



# Robots / Drones / Lasers



# Robots / Drones / Lasers



# Robots / Drones / Lasers



*3,000 bricks per day machine/ 500 bricks per day human*

018 // 27



# Laser Scanning | Drones to Save Antiquities

## Hope for Palmyra's Future

After Islamic State retreated last month, a plan to rebuild an ancient city



# VR and AR are Powerful for Architects

## This Architecture Firm Is Turning VR Into The Next Great Productivity Tool

NBBJ is the first major architecture firm jumping headlong into VR—by incubating its own platform.



PRODUCTS

## Three Augmented and Virtual Reality Apps for Design and Construction

Step inside your CAD and BIM models with new software for mobile devices.

By [HALLIE BUSTA](#)



## Apple's Next Big Thing: Augmented Reality

CEO Tim Cook is betting on augmented reality, a cousin of VR that he believes will keep his company on top and may even supplant the iPhone.

by [Mark Gurman](#)

March 20, 2017, 6:00 AM EDT

# Artificial Intelligence / Machine Learning

Embracing artificial intelligence in architecture



In recent years, technology and automation in architecture have soared. But not all architects have taken advantage of emerging technologies, and there is a growing sense that if firms don't incorporate artificial intelligence into practice, they'll get left behind.

[Read more >](#)

# Architecture of the Future

Manuel Jimenez Garcia and Gilles Retsin are literally setting the foundations for an architecture of the future. They are co-founders of the Design Computation Lab at [The Bartlett School of Architecture, University College London](#), where they work with students to speculate how digitalization, automation and robotics are transforming our built environment.



# 2004 – 2018 AIA TAP Building Connections Congress – Future of Design

Building Connections Congress 2018

[Register Now](#)

When: Jan 8, 2018 from 8:30 AM to 5:00 PM (ET)

Associated with [Technology in Architectural Practice](#)



The Future of Design 8

TAP Building Connections Congress 2018

# Artificial Intelligence

*Randy Deutsch, AIA, associate director for graduate studies at the University of Illinois at Urbana-Champaign School of Architecture:*

*“We're soon going to see super intelligence enter just about every sector, market, and field,” he says. “It would behoove architects to imagine that it’s going to enter our field, and we have the opportunity now to do something about it, to look at ways it can actually improve what we're doing and make us more profitable as practitioners as opposed to being victim to somebody else taking it and running with it.”*

# It's the Data!



# “Change or Perish”

*"If you want to survive, you're going to have to change.  
If you don't change, you're going to perish. Simple as that."*

*2005, AIA National Convention*

*Thom Mayne, FAIA*



# BIM (and Innovative Technologies) Execution Planning

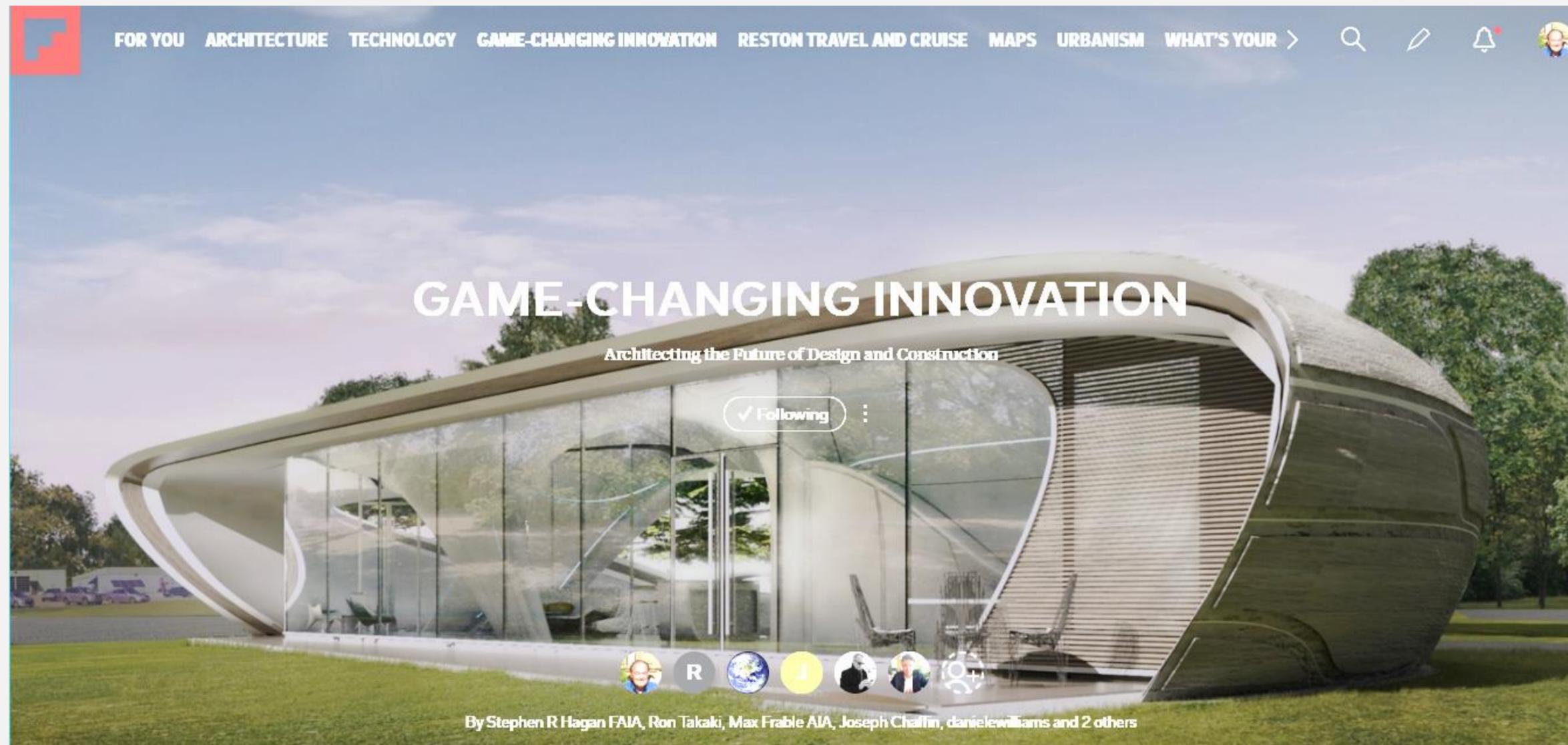
The screenshot shows the homepage of the BIM Execution Planning website. At the top, there are logos for Penn State and the Center for Computer Integrated Construction (CIC). The main title is "BIM EXECUTION PLANNING". A navigation bar includes "INTRODUCTION" (highlighted), "Introduction", "Project", "Owner", and "BIM Uses". A sidebar on the left lists "ANNOUNCEMENTS", "EVENTS", "RESOURCES", "FEEDBACK", "CIC Home", "AE Home", and "Penn State OPP". The main content area features two document covers: "BIM PROJECT EXECUTION PLANNING GUIDE VERSION 2.0 RELEASED - JULY 2010" and "BUILDING INFORMATION MODELING BIM PLANNING GUIDE FOR FACILITY OWNERS A BUILDING SMART ALLIANCE PROJECT VERSION 2.0 JUNE 2013". Below each cover is a "Click to DOWNLOAD" button. To the right, under "Announcements:", there are two text blocks: "New Uses of BIM Document Released! The Uses of BIM document is designed to communicate the BIM Uses classification system and BIM Use Purposes." and "Version 2.0 of the BIM Planning Guide for Facility Owners Released June 2013." At the bottom right, there is a "Subscribe to BIM Planning's to receive a" link.

# BIM (and Innovative Technologies) Execution Planning

- **Team Building:** Either with a project team or within a firm, gather stakeholders and discuss the goals of the plan
- **Educate:** Present a range of technologies such as the ones listed in this course. Discuss both concepts and case studies
- Discuss how **3 or 4 of these technologies** can be the initial focus for a project or for a firm's digital and innovative transformation
- **Make a specific action plan**, including goals, objectives, and tasks and a timetable to complete them
- **Award all participants** a certificate as an AEC Game Changer!
- **Iterate** as New Stakeholders Join the Project Lifecycle

# Are YOU an AECGameChanger?

**GAME-CHANGING INNOVATION FlipBoard [http://flip.it/\\_T5b84](http://flip.it/_T5b84)**



# Kimon Onuma

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# Report on integrated practice

# 10

## Information facility

# 2006

**Kristine K. Fallon** FAIA  
Kristine Fallon Associates, Inc., Chicago, IL

**Stephen R. Hagan** FAIA  
U.S. General Services Administration, Washington, D.C.



## for the life cycle

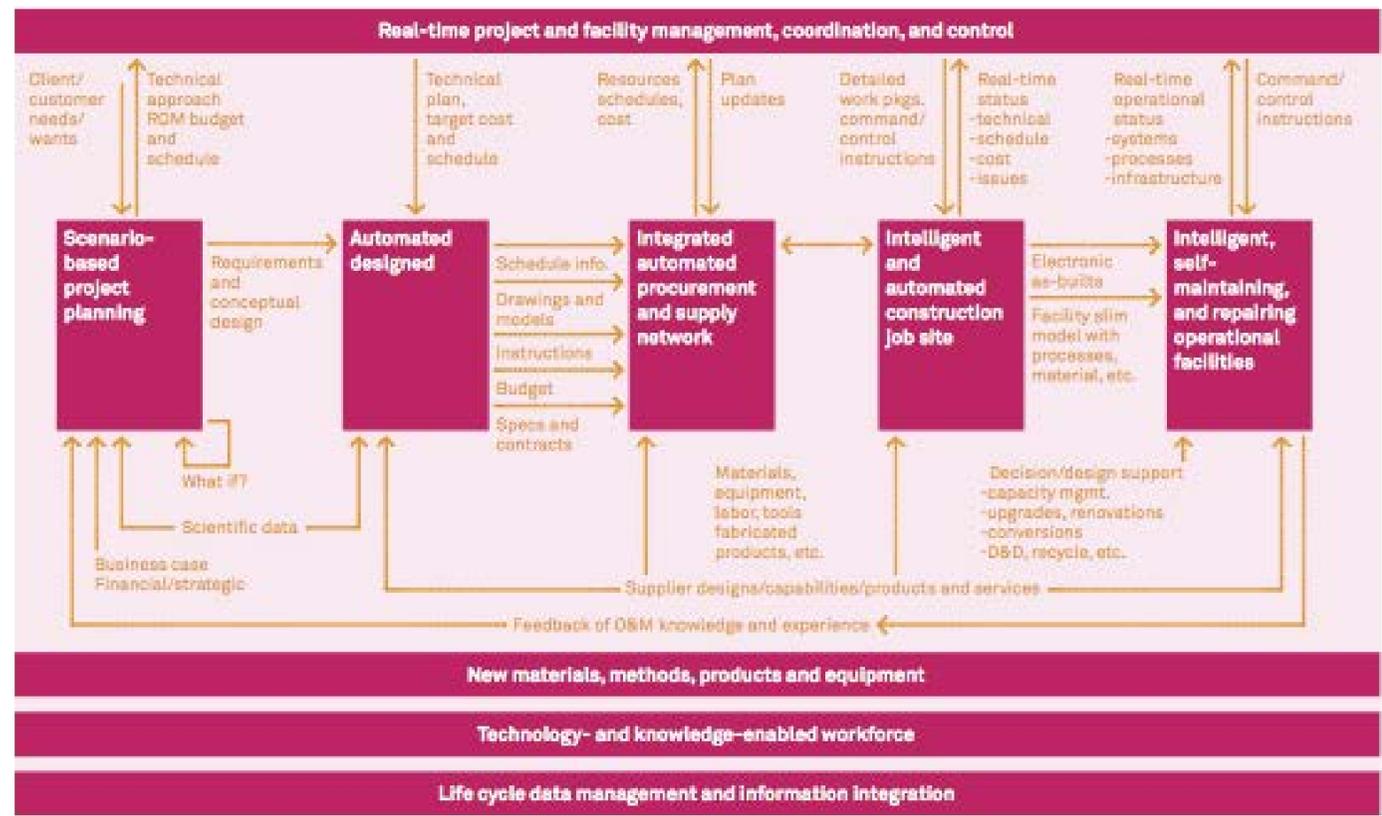


Figure 1  
The FIATECH Capital Projects Technology Roadmap Vision Model.  
(Source: FIATECH, 2004b)

Much work on these frameworks and process change diagrams remains to be done; much is well underway. What is notable and crucial for progress in this area is described in the excerpts of the Capital Facilities Information Handover Guide, Part 1, which follows: taxonomies, definitions, and the characterization of information are critical building blocks in the foundation of the Information for the Facility Life Cycle.

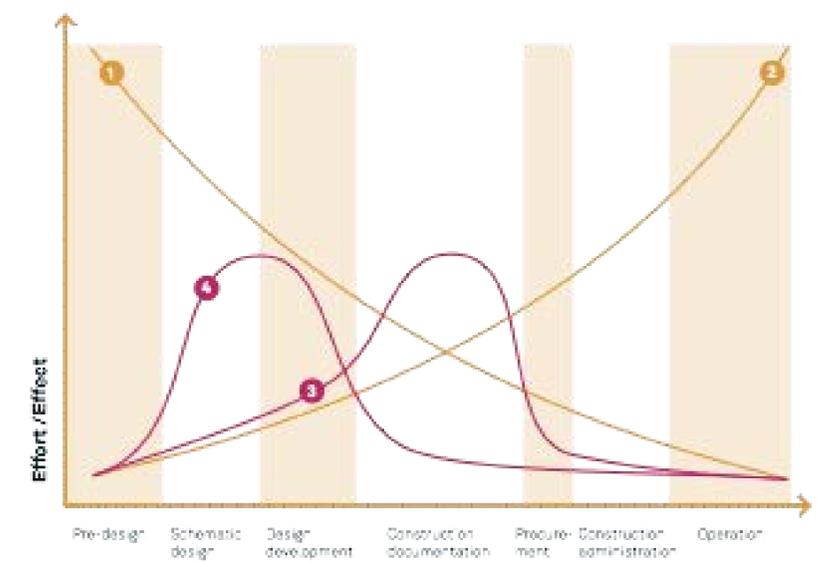


Figure 2  
Collaboration, integrated information, and the life cycle in building design, construction and operation.  
(Source: CURT, August 2004)

- 1 Ability to impact cost and functional capabilities
- 2 Cost of design changes
- 3 Traditional design process
- 4 Preferred design process

# Report on integrated practice

## The twenty-first century practitioner



# 6

### Kimon G. Onuma AIA

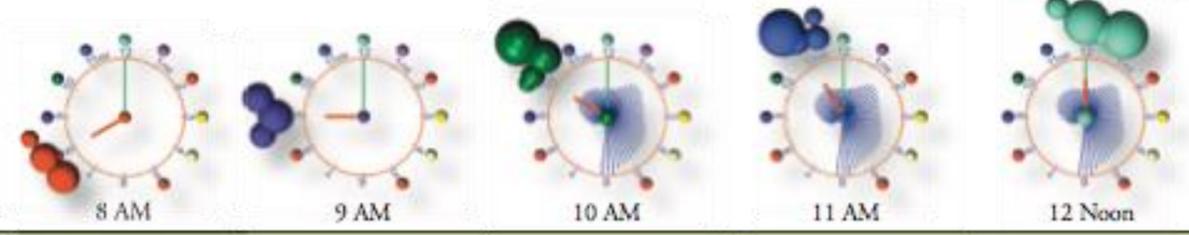
Onuma & Associates, Inc. and Pasadena, CA



Transformed  
by  
process  
not  
software

The twenty-first century practitioner: transformed by process, not software

# 2006



### The Design Charette

8 am Start Project

- Client contacts pre-qualified team in project database to start brainstorming
- Site is identified on a Google Earth™ 3D model of the Boston area
- 3D BIM model of programming requirements auto generated and placed in Google Earth™
- Easement, lien, covenant and restriction database(s) checked
- Data from historical office building BIM to accessed through the project database

9 am Site and GIS Review

- Confirm size of site and soil condition from GIS data in 2D and 3D
- Rate each footprint location and pass data of conditions to structural analysis for foundation design
- Automatically perform a preliminary code analysis by submitting the project to the city planning and zoning database
- Rate distance to transportation and housing

10 am Architectural Review

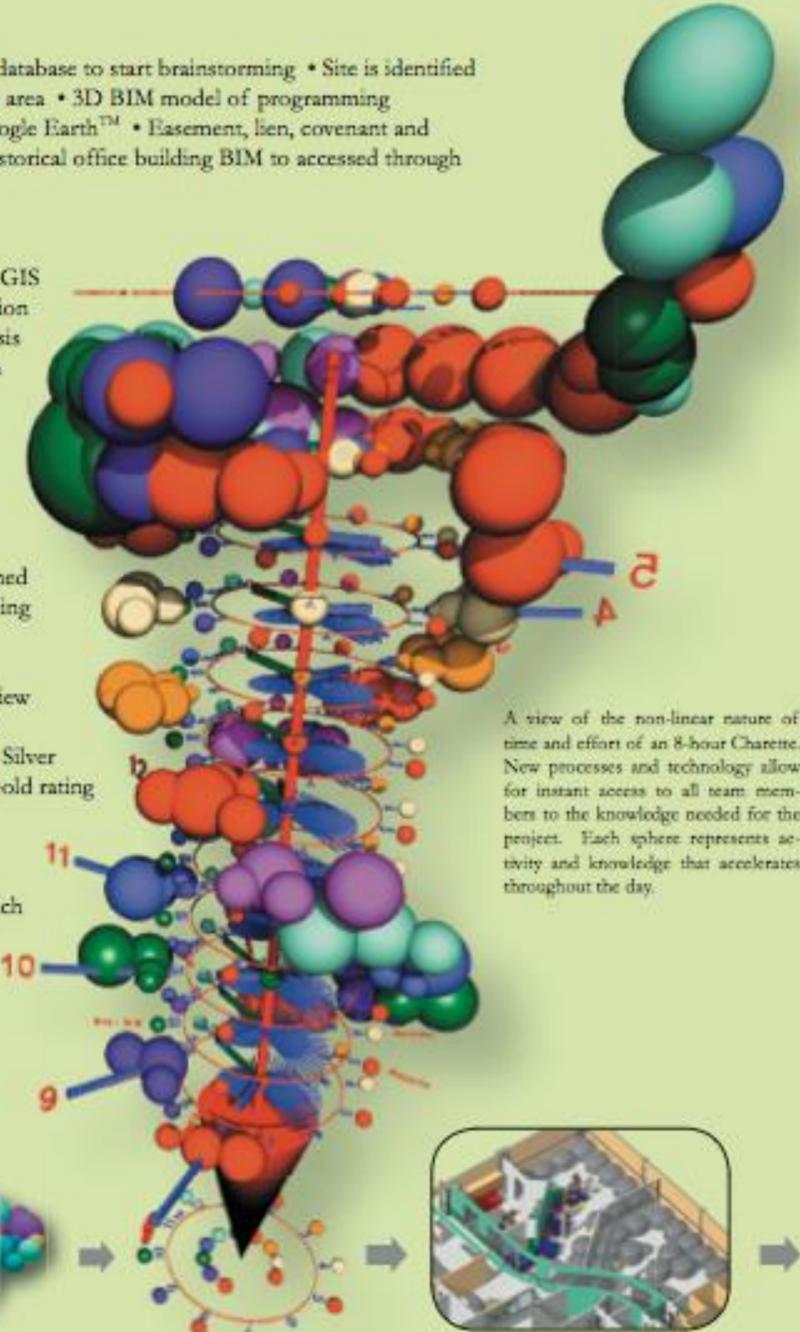
- BIM review by team members who are assigned based on availability
- Data from existing building analyzed
- Potential schemes studied

11 am Mechanical, Electrical, Plumbing Review

- Determine systems and costs
- Performance requirements defined
- Recommend to pursue Silver LEED rating on manufacturing portion and Gold rating for the rest

12 pm Structural Review

- One plan includes a multi-story building, which triggers need for underground parking
- Soil conditions from GIS dictate various foundation systems
- Review long span requirements



A view of the non-linear nature of time and effort of an 8-hour Charette. New processes and technology allow for instant access to all team members to the knowledge needed for the project. Each sphere represents activity and knowledge that accelerates throughout the day.

Item	Value
Office 1	100
Office 2	100
Office 3	100
Training	100
Meeting Room	100
Lunch Room	100
Storage	100
Mechanical	100
Storage	100

Program Requirements



BIMblobs™ of Program Requirements



Knowledge of Team Inserted into Project



Functional Requirements in BIM

# 1984



(Type 200)

## Seating Capacity

### First Class

Rows 3-5  
Seats 12

### Coach

Rows 6-30  
Seats 138

■ No Recline



ENDORSEMENTS/RESTRICTIONS (CARBON) *9-1-80*

ORIGIN: **SALT LAKE** DESTINATION: **SALT LAKE**

CONJUNCTION TICKET(S): **007 1409 006 060/061** FLIGHT COUPON: **3**

NAME OF PASSENGER: [REDACTED] NOT TRANSFERABLE

ISSUED IN EXCHANGE FOR: [REDACTED] DATE OF ISSUE: **8 APR 80**

COUPONS NOT VALID BEFORE: 1 2 3 4

COUPONS NOT VALID AFTER: 1 2 3 4

X/O	GOOD FOR PASSAGE BETWEEN POINTS OUTLINED	FARE BASIS	ALLOW	CARRIER	FLIGHT/CLASS	DATE	TIME	STATUS
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X	TO ATLANTA	YHG28		EA	699Y	18 APR	6:30	OK
	FROM ORLANDO	YHG28		EA	541Y	19 APR	12:56	OK
	TO MIAMI	YHG28		EA	892Y	23 APR	8:00	OK
	TO NEW YORK - LGA							

FORM OF PAYMENT: **CHECK**

FARE: **369.00** EQUIV. AMT. PD: [REDACTED]

TAX: **29.52** TOTAL: **398.52**

ROUTE CODE: [REDACTED] ENCODE: [REDACTED] CPN: **3** AIRLINE CODE: **00** FORM: **1409006060** SERIAL NUMBER: **5** CK: **□**

DO NOT MARK OR WRITE IN THE WHITE AREA ABOVE

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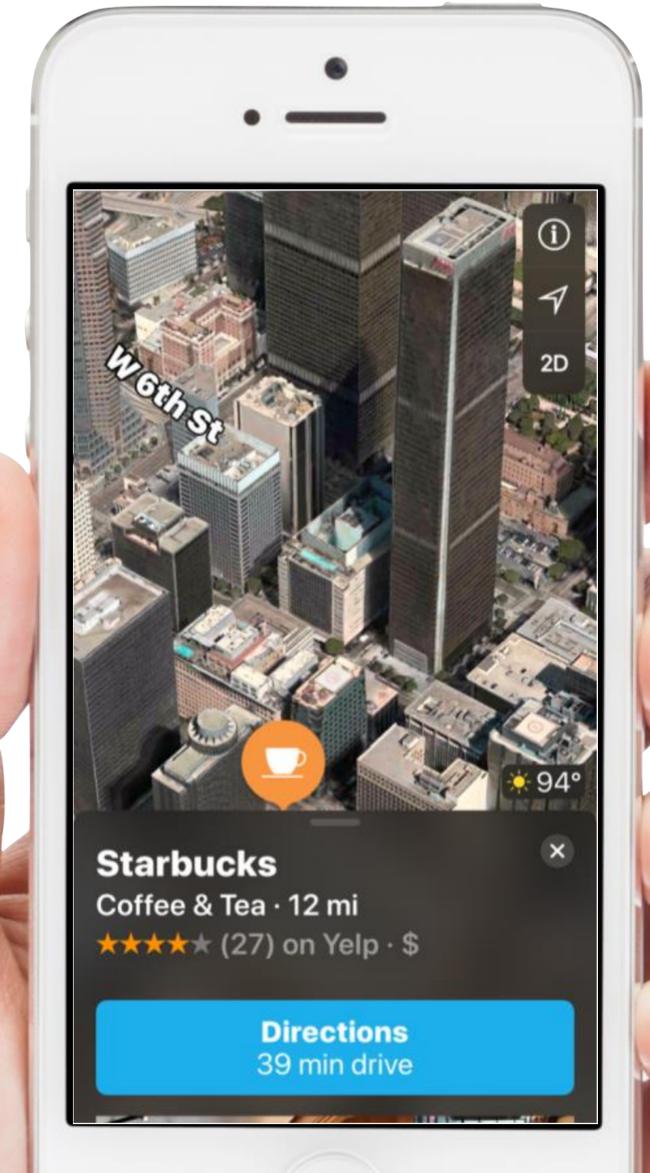
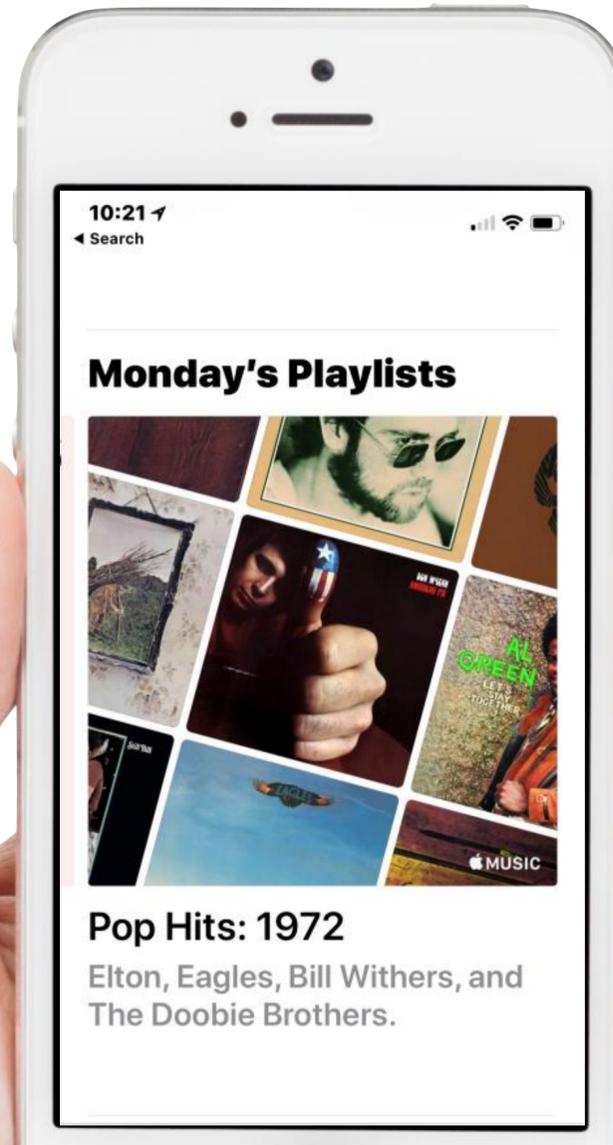
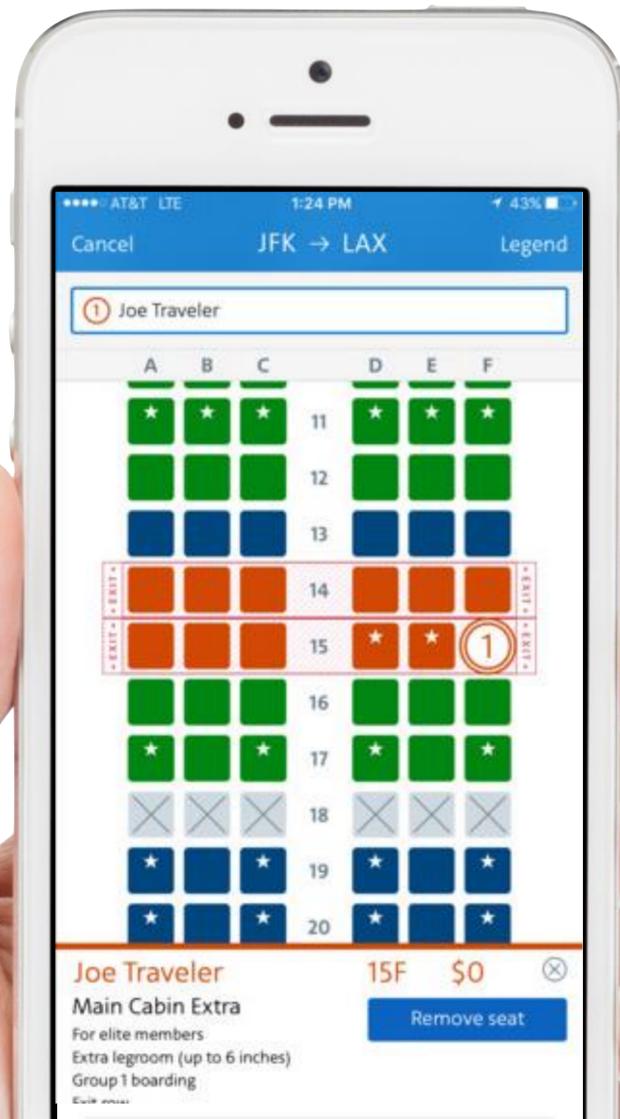
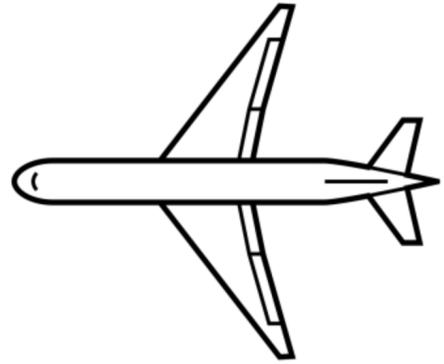
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SUBJECT TO CONDITIONS OF CONTRACT ON PASSENGERS COUPON

# More Buttons are Better....



# PLATFORM



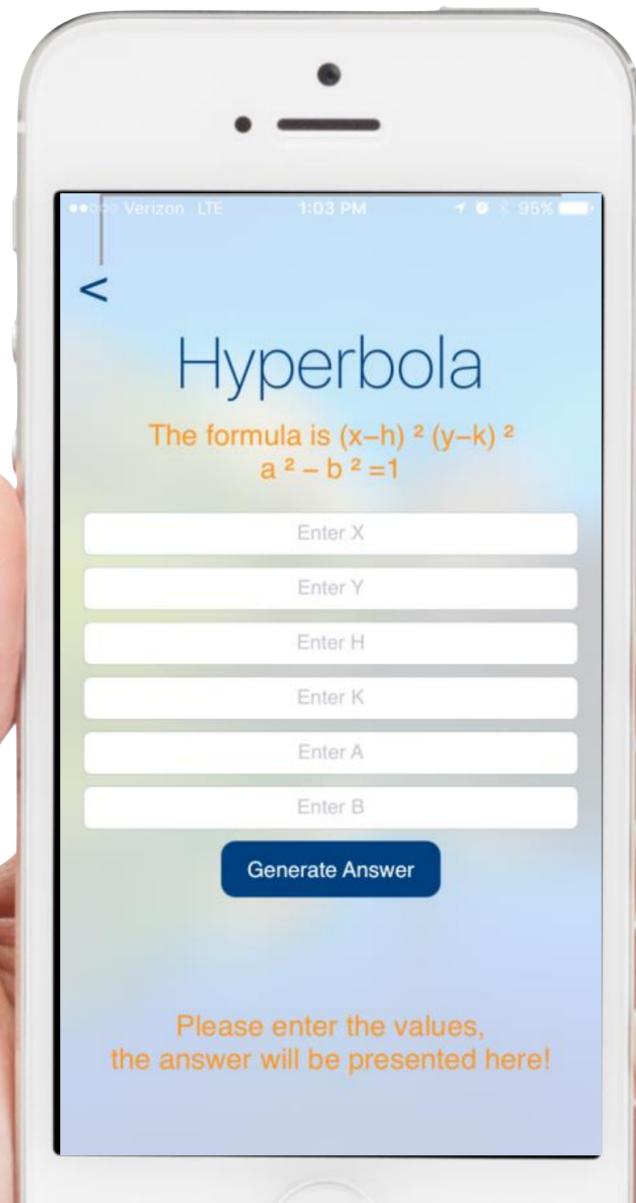
It's easier than ever  
to build software.  
**Software** is now

**a commodity.**

<https://techcrunch.com/2018/03/27/data-is-not-the-new-oil/>

**This 16-year-old kid fell behind in  
math class, so he built an **app** to do it  
for him**

Oct. 5, 2016, 4:20 PM 56,727



Amit Kalra

<http://www.businessinsider.com/amit-kalra-6284-calc-app-2016-10>



富嶽三十六景 神奈川沖浪裏

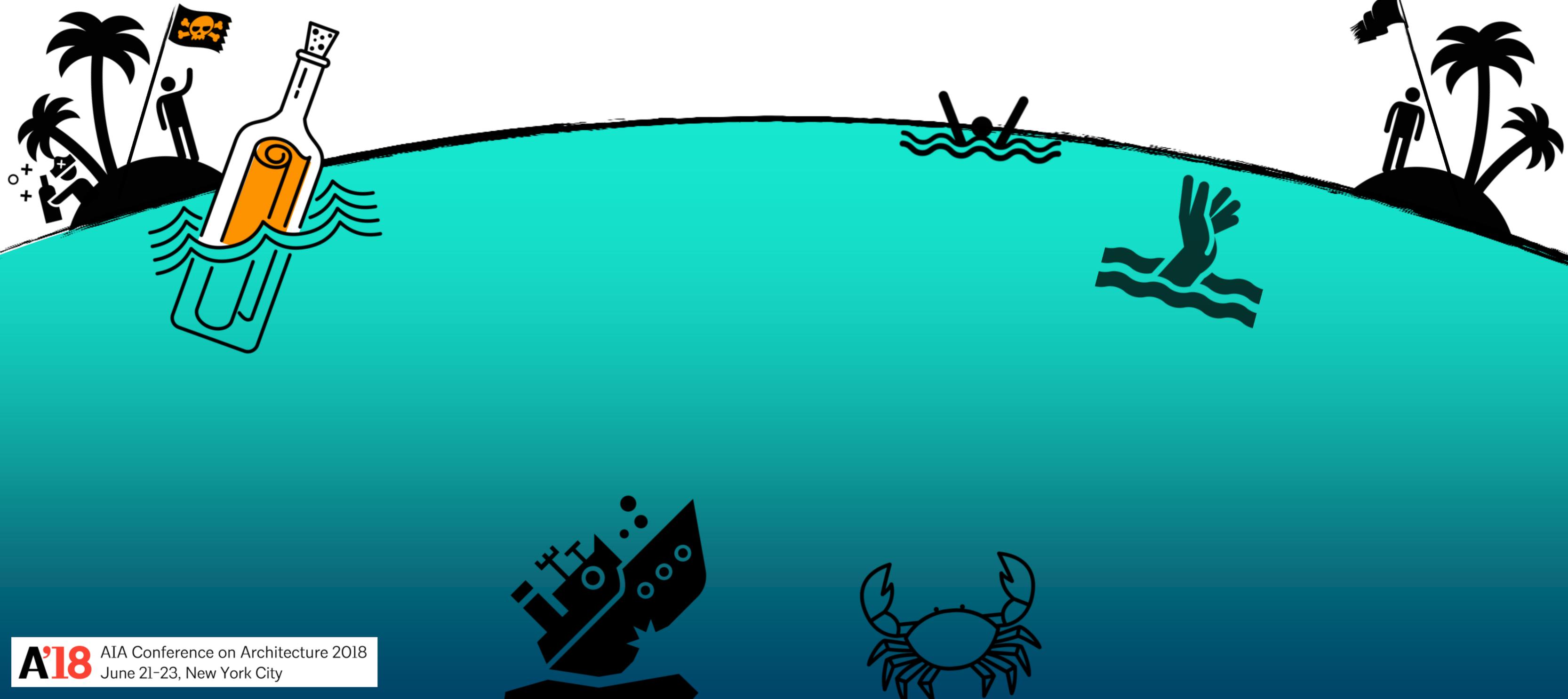
江戶時代

# TSUNAMI OF DATA

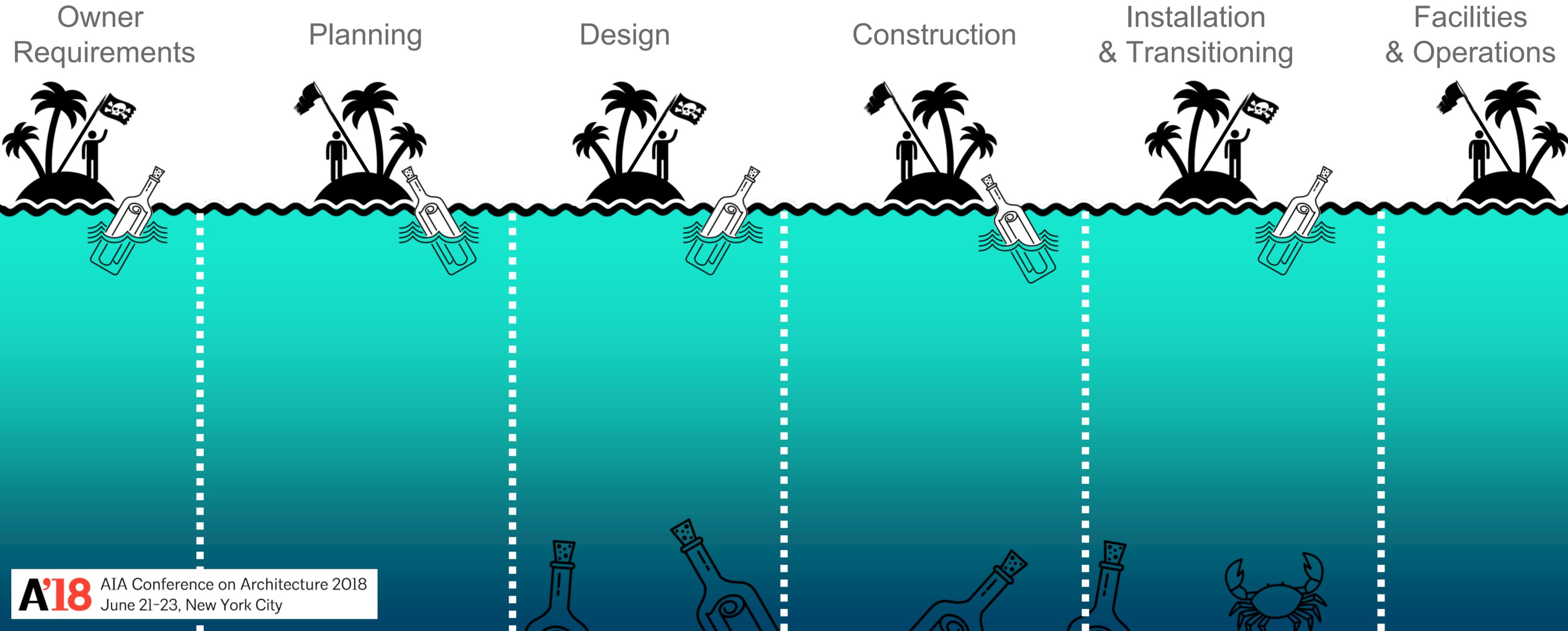
## For Architecture

# Design & Construction

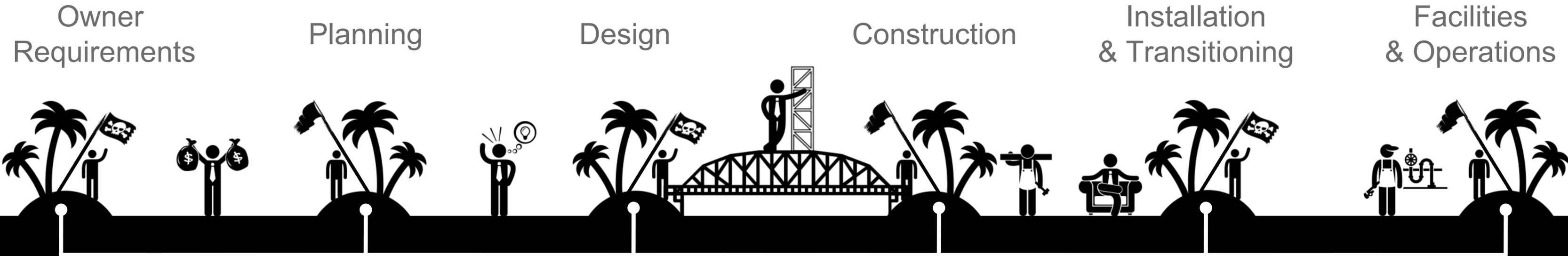
# Facilities & Operations



# SILOS



# PLATFORMS



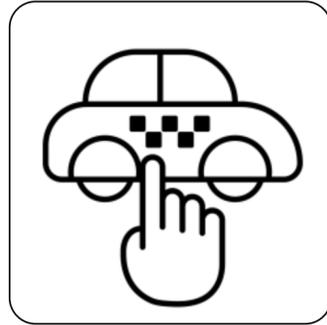
DIGITAL PLATFORM

DATA

# PLATFORMS



Mobile



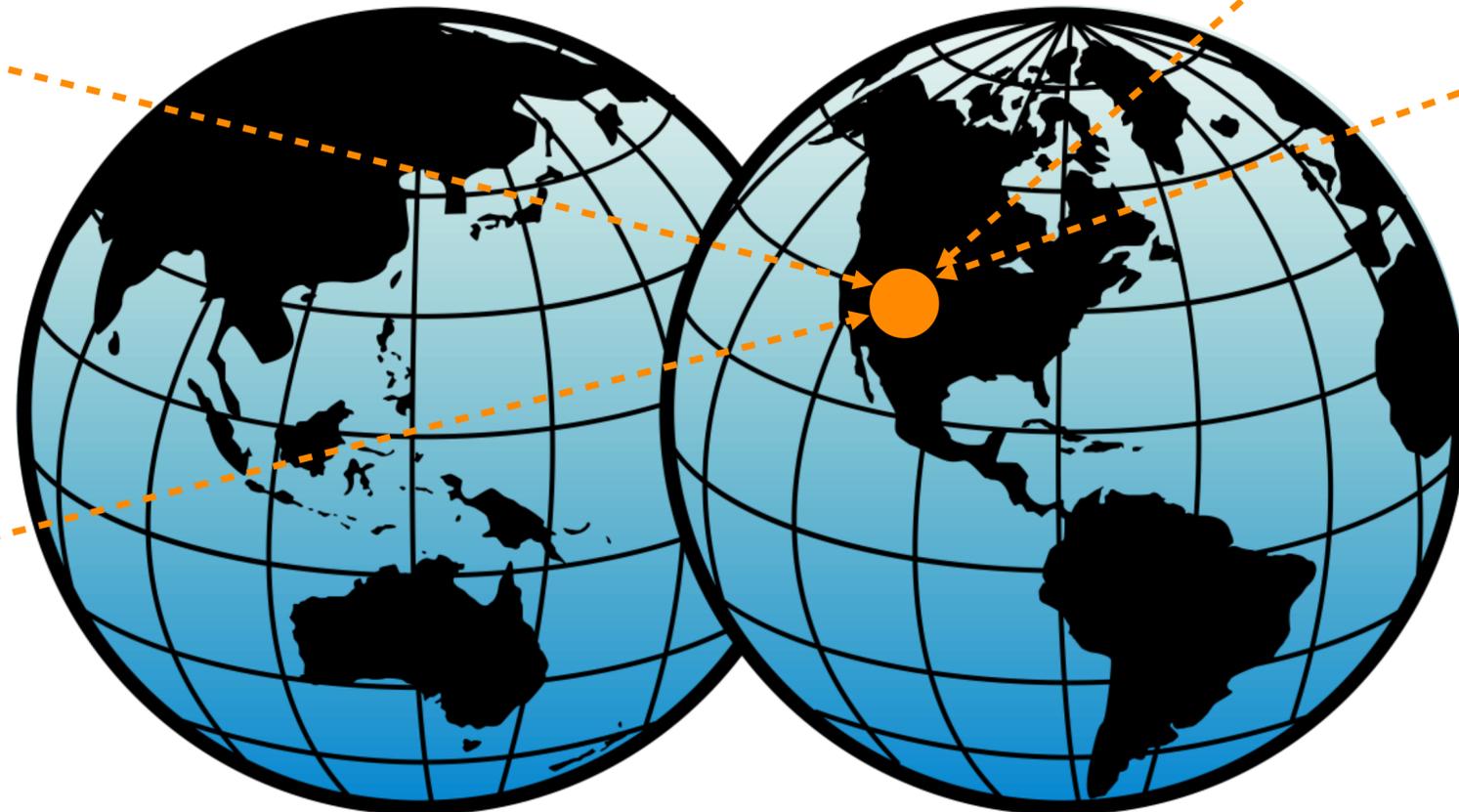
Ride



Location



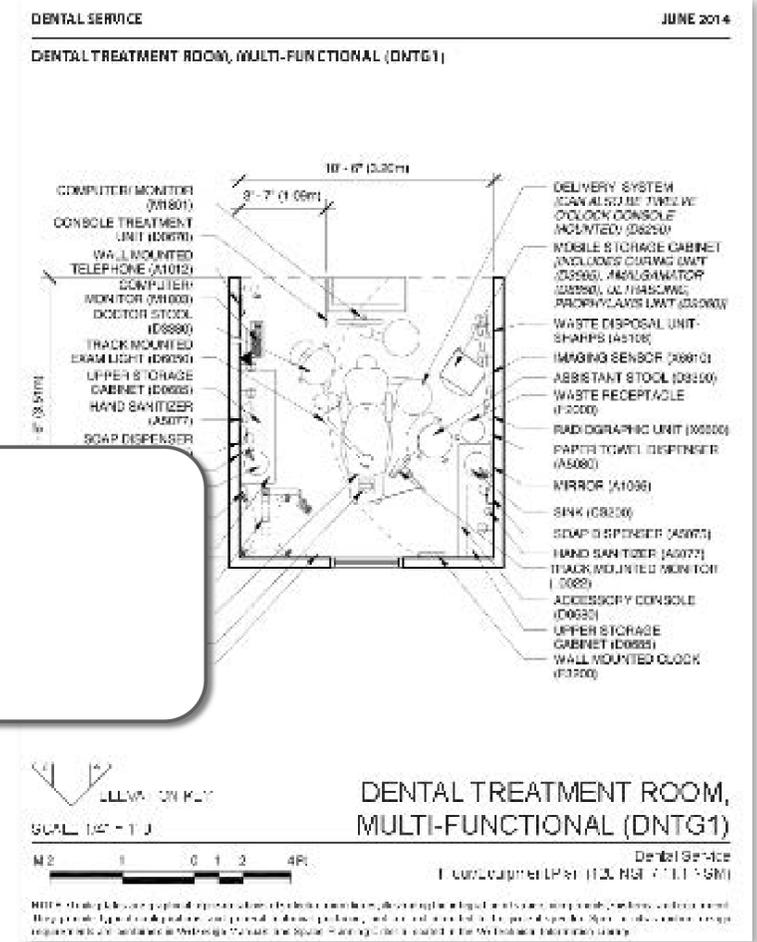
Games



# Room Data

7. Treatment Room, Maxillo-Facial (DNTG1)..... 150 NSF (14.0 M)  
 Provide one per Maxillo-Facial Treatment Room authorized if in Concept of Operations.

This room is for prosthetic treatment of patients with abnormal conditions of the face and oral structures.



Space

Equipment

JSN D0685

Ceiling Finish:T1

Ceiling Height  
102 Inches

JSN D600

JSN D0685

Wall Finish: G

JSN12345

Air Balance  
4

Filtration  
14%

Dental  
Low Vac

Power  
Outlets  
63/RC

JSN X6600

JSN D0685

JSN 9060

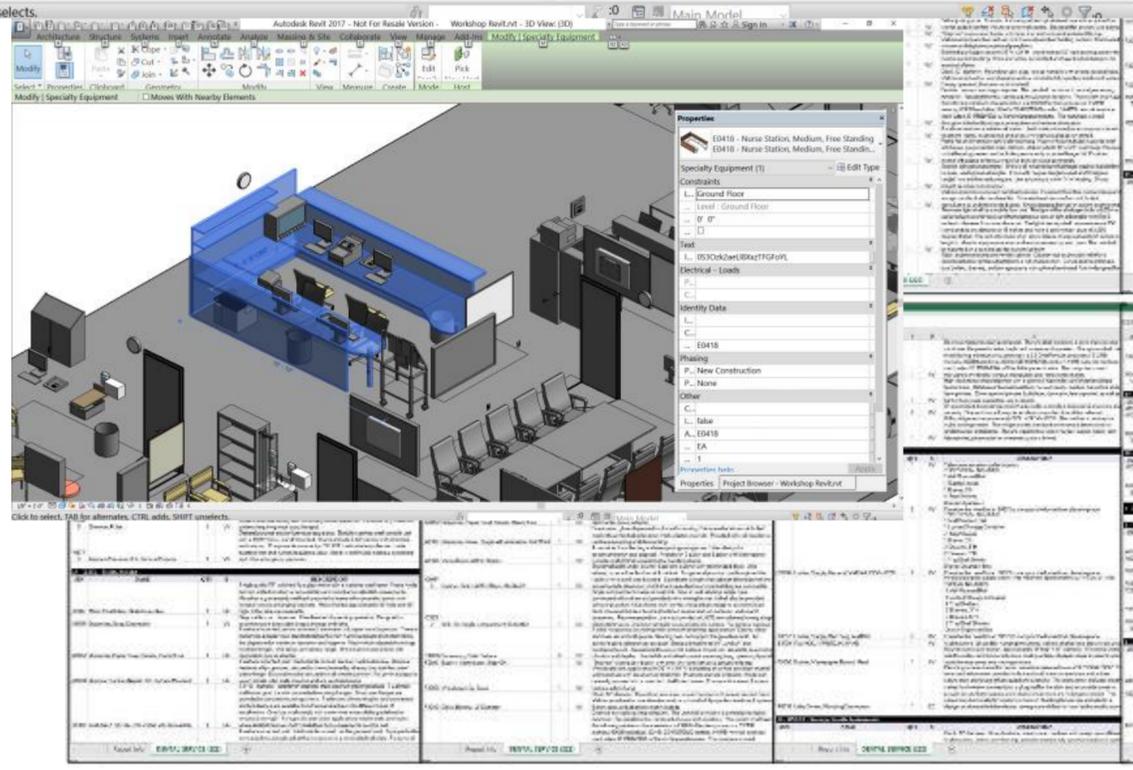
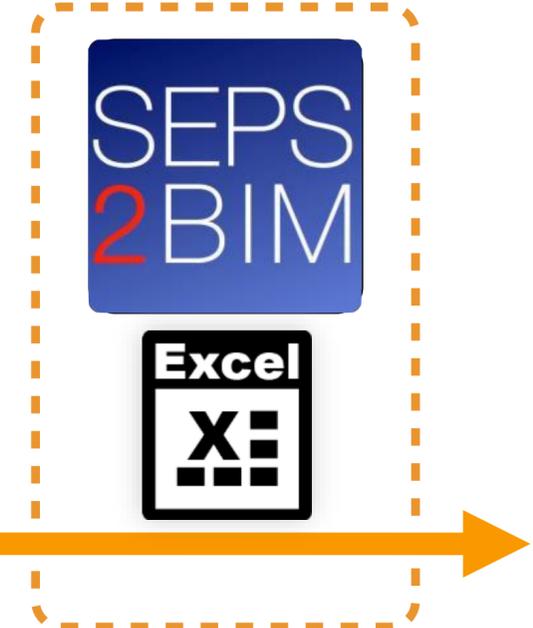
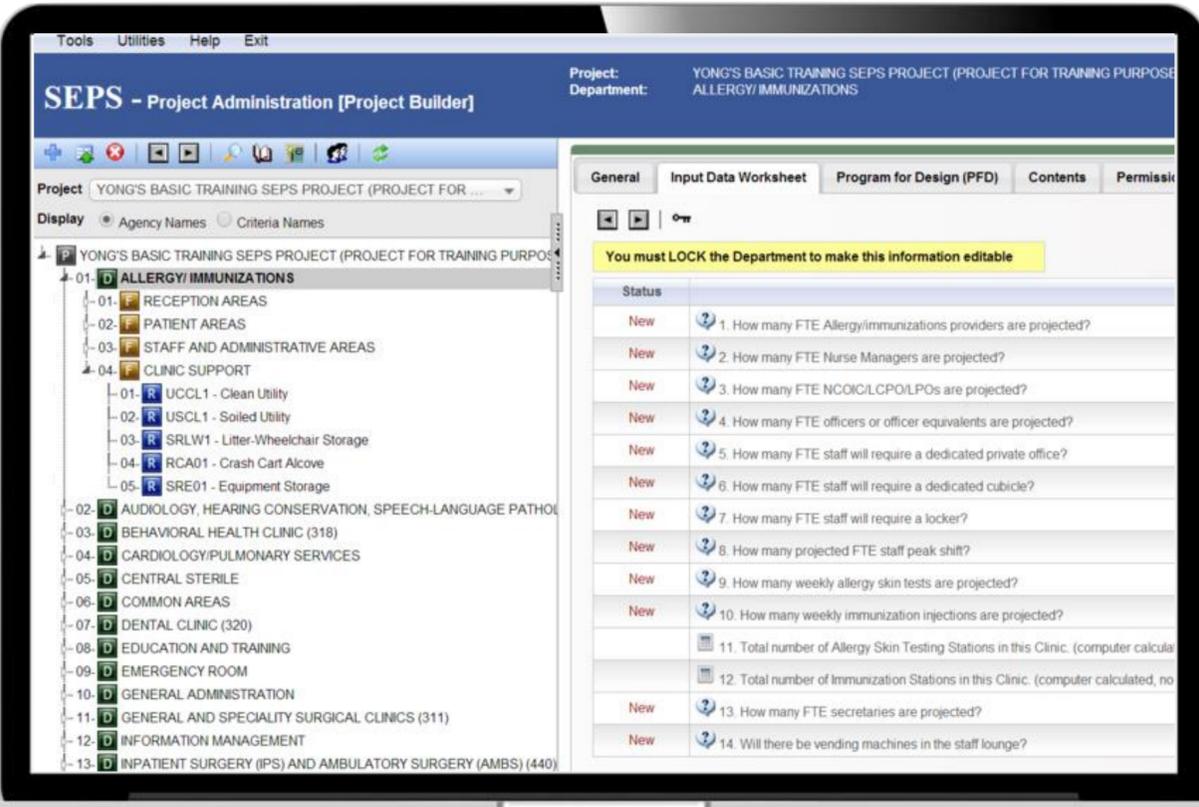
JSN D0685

JSN D9060

JSN D7090

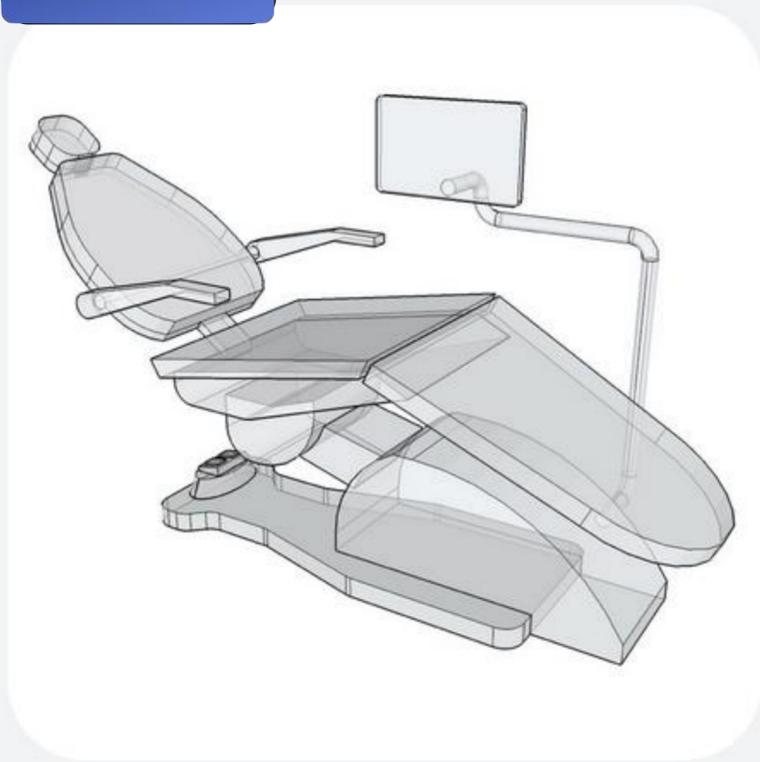


# SEPS2BIM



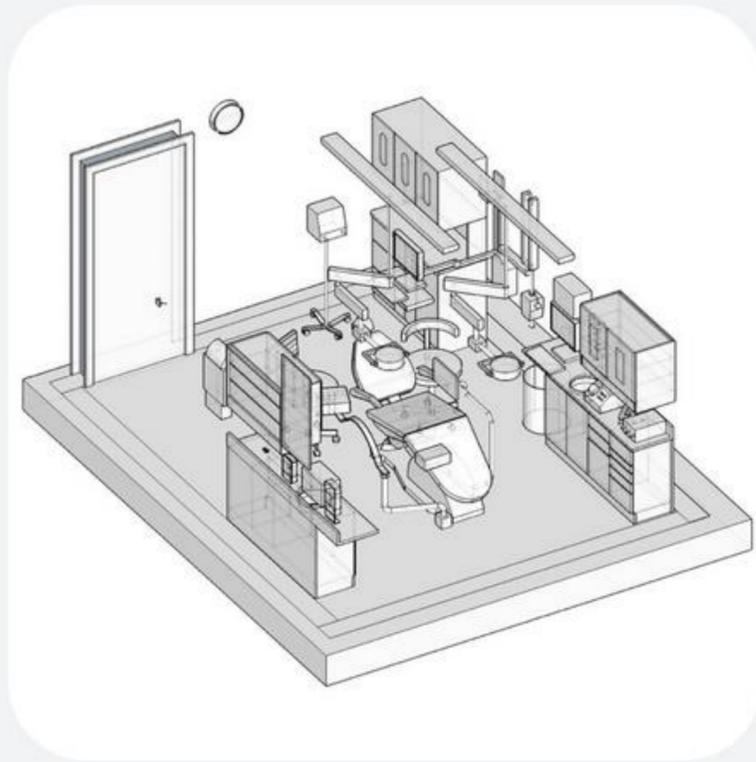
## SEPS2BIM PLATFORM

# Data: Equipment, Criteria & More



**Objects**

~2,100 Objects  
Used in Templates



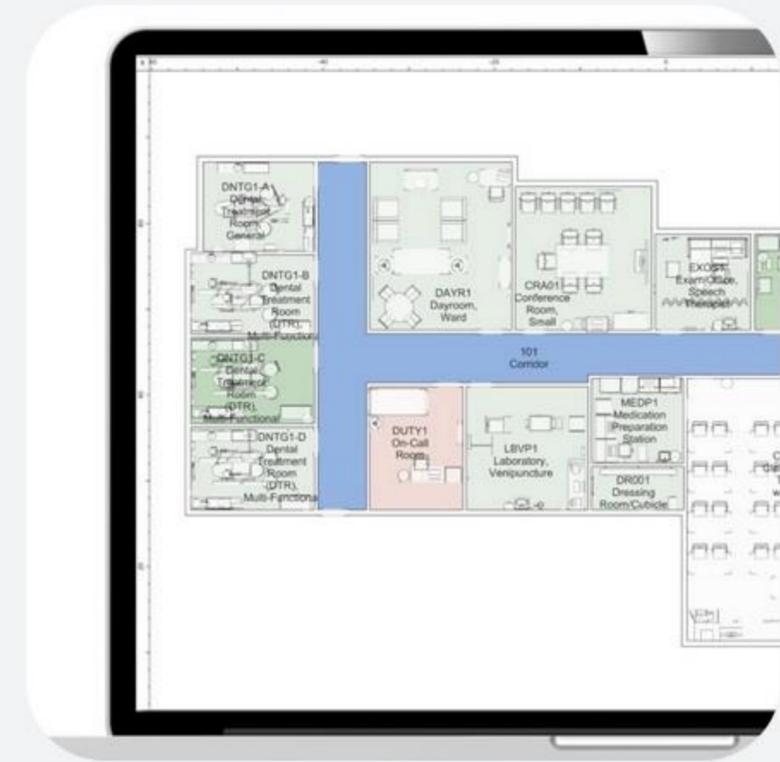
**+ Templates**

~1,100 Space Templates  
Used in Departments



**+ Departments**

Multiple Departments  
Used in Projects



**= Projects**

Generate Infinite Variations  
for Facility Projects

# SEPS2BIM PLATFORM

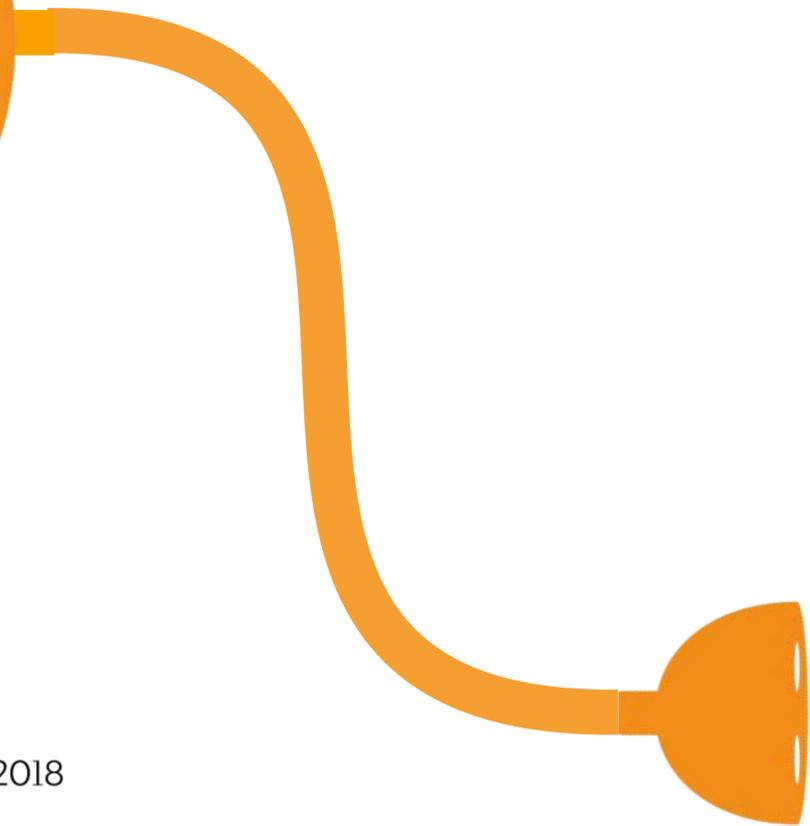
## Data: Equipment, Criteria & More

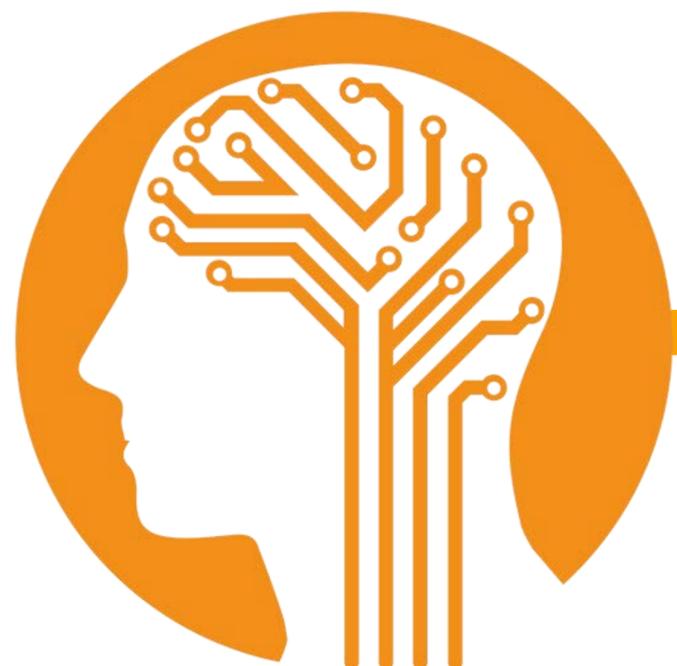


# Owner's Data

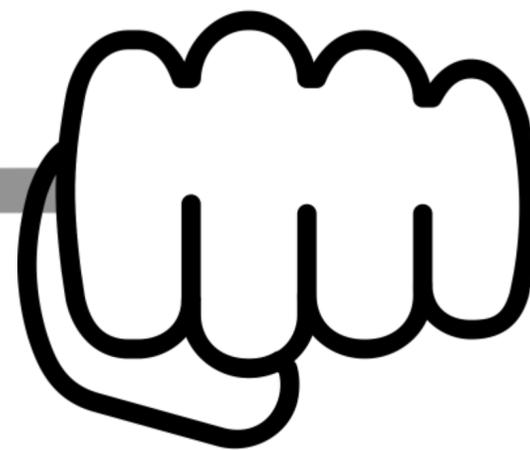


# Owner's Data

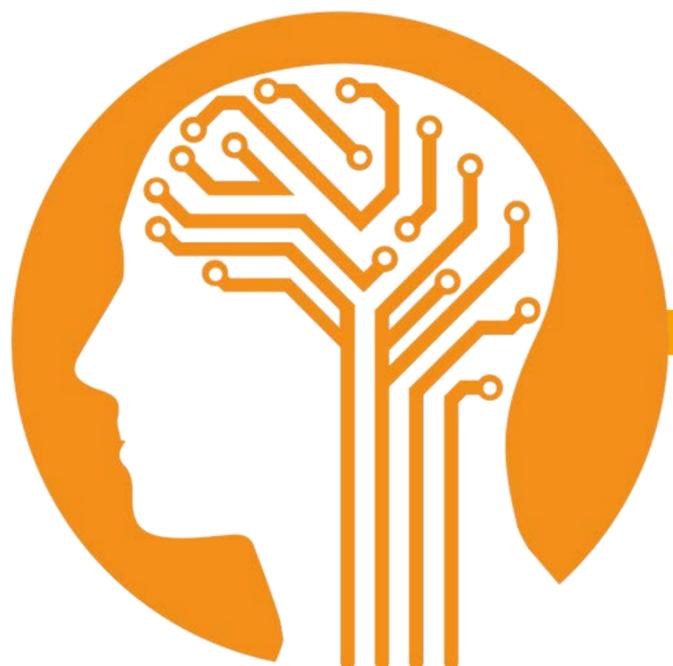




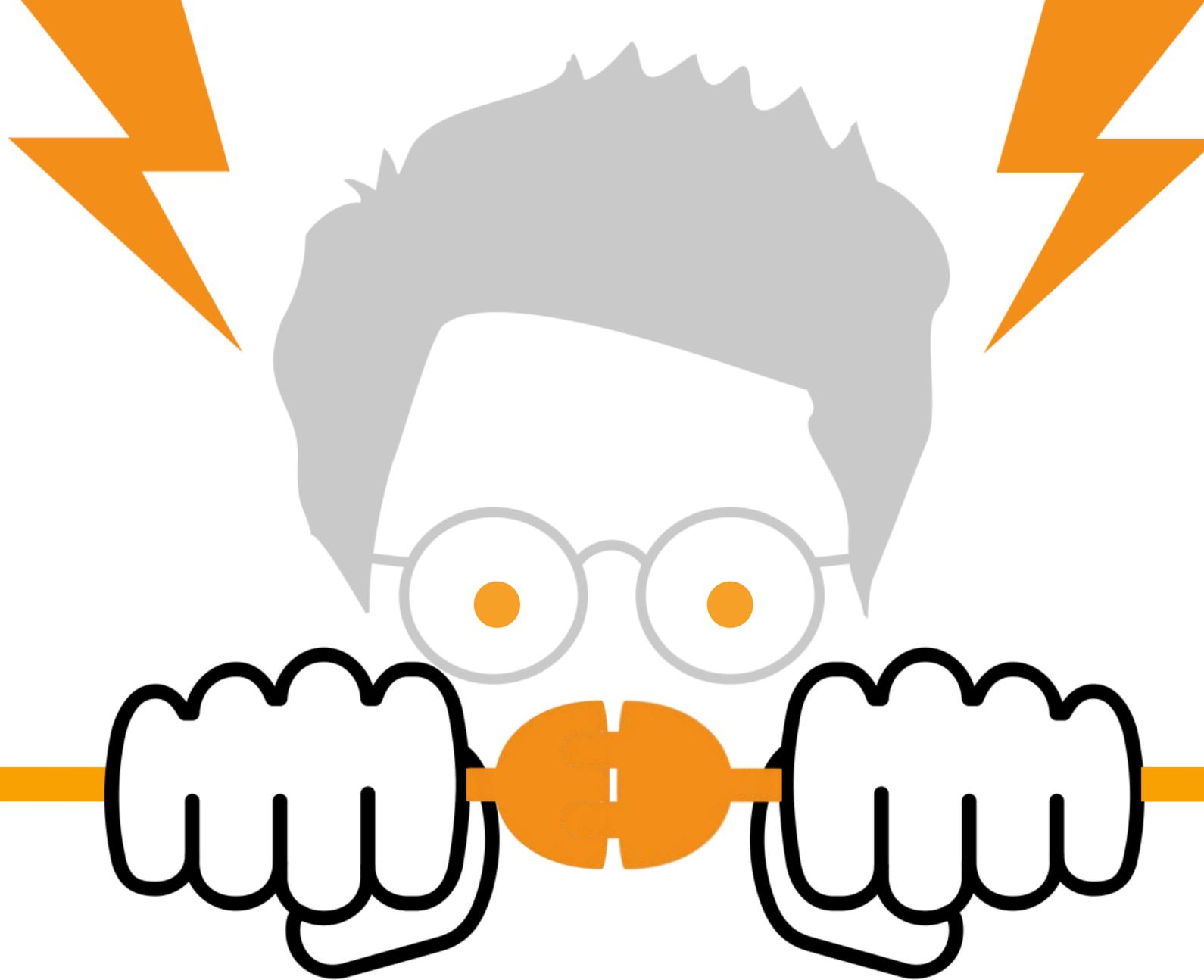
Owner's  
Data



Project  
Design

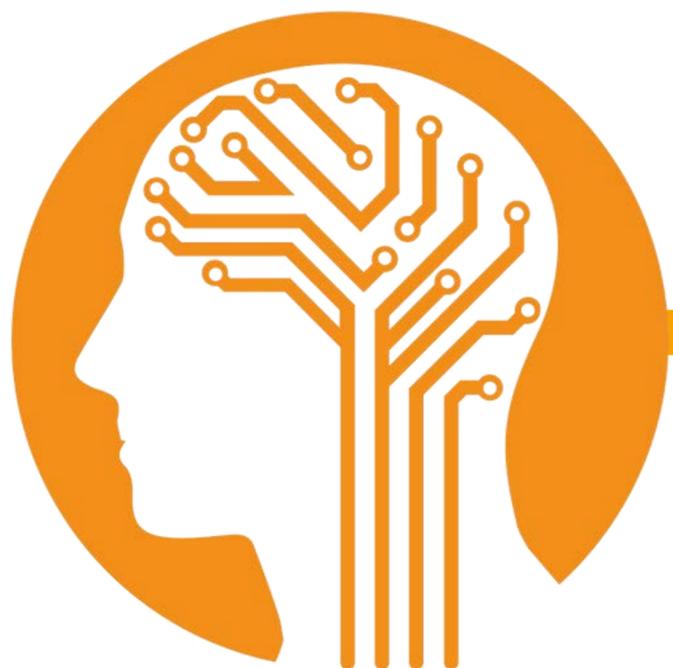


Owner's  
Data

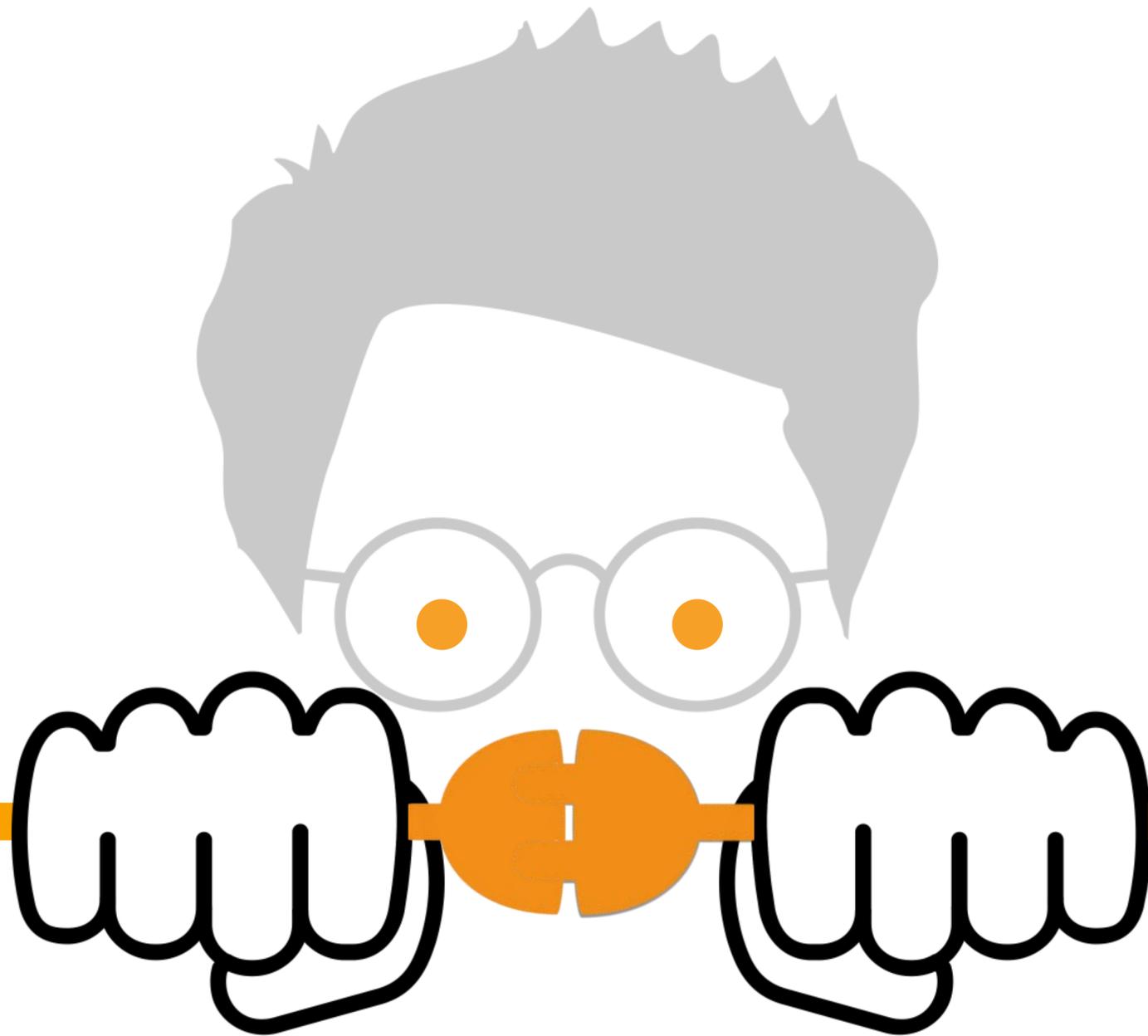


Project  
Design





Owner's  
Data

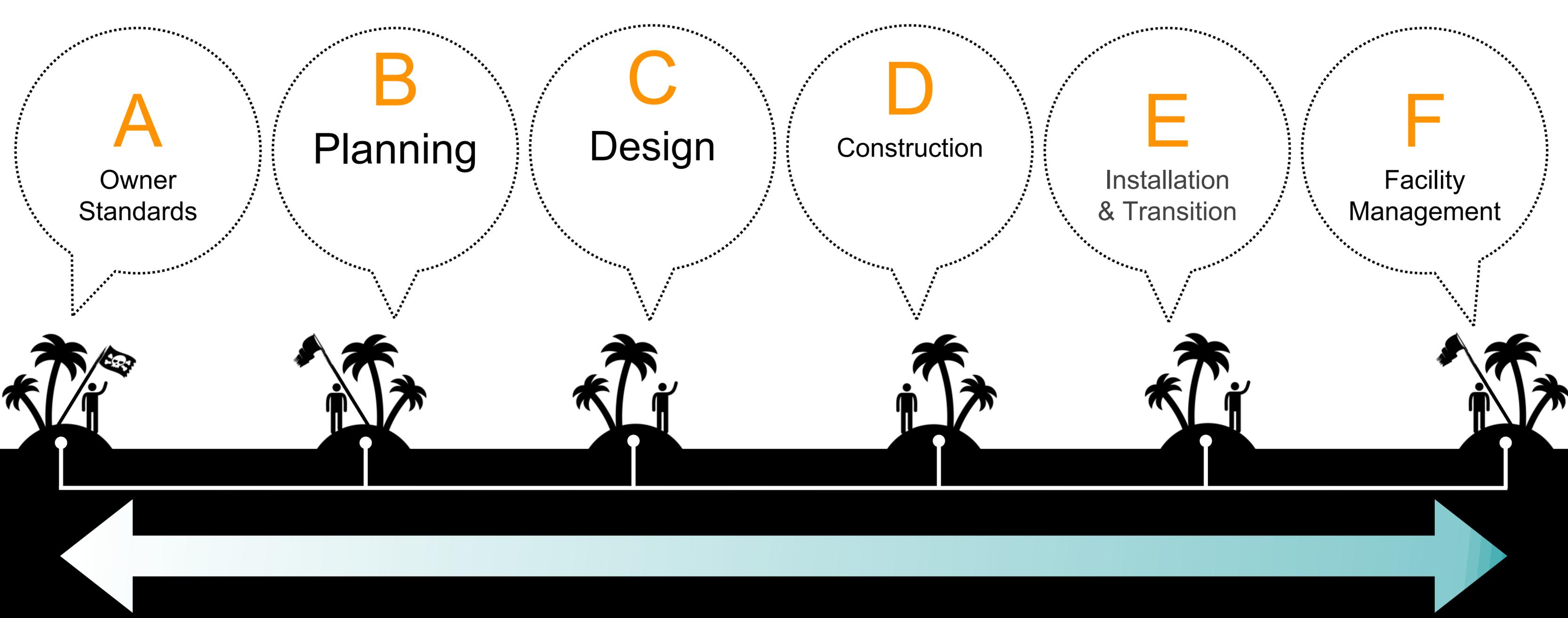


BIM  
Ecosystem

# ECOSYSTEM

A healthy ecosystem does not have an end date, it just supports itself and adjusts to change.





# Life Cycle Platform



Photo by: [Luis Urrego @LuisUrrego\\_PMP](#)



# 15 Minutes: 2,727,676 SF

BIMStorm Data Independence Owner: Thomas Dalbert

Project: Space & Equipment Aggregator / Scheme: (S177\_822) AC-01,AC-01,AC-01-03,AC-01-03 and others

Estimated Building Cost: \$485,472,394

Building Areas	
# of Floors	1
Net Calculated (=modelled spaces)	509,653 sqft
Gross Calculated	739,874 sqft

Building Occupancy	
Occupancy (aggregated from space attributes)	596

Utilities Summary	
Electricity Use(kWh / Year)	13,983,624
Energy Use (kBtu/Year)	66,588,688
Steam (MLB/Year)	14,797
Water (Gal/Year)	14,797,486
Natural Gas (CUFT/Year)	369,937
Waste Water (Gal/Year)	11,098,115
Solid Waste (Lbs/Year)	66,589

O & M Cost Summary	
Custodial	\$1,827,490
Energy	\$2,108,642
Grounds	\$184,969
M&R	\$2,101,243
Management	\$1,768,300
Pest Control	\$96,184
Refuse	\$59,190
Road Clearance	\$7,399
Security	\$362,538
Telecom	\$184,969
Water / Sewer	\$288,551

**A'18** AIA Conference on Architecture 2018  
June 21-23, New York City



7.12.17  
Alexandria, VA



Create Space  
Templates

11.7.17  
San Diego, CA



1,044,924 sf

11.14.17  
Washington DC



2,373,306 sf

2.14.18  
Chandler, AZ



627,959 sf

3.1.18  
Denver, CO



1,610,266 sf

3.20.18  
San Antonio, TX



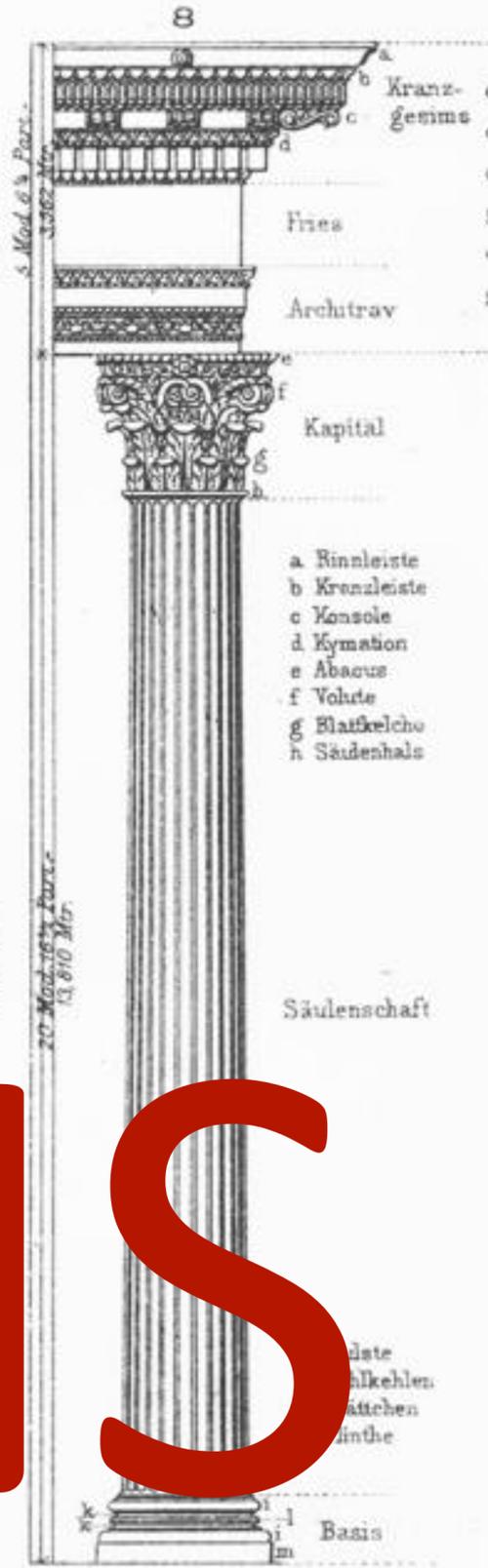
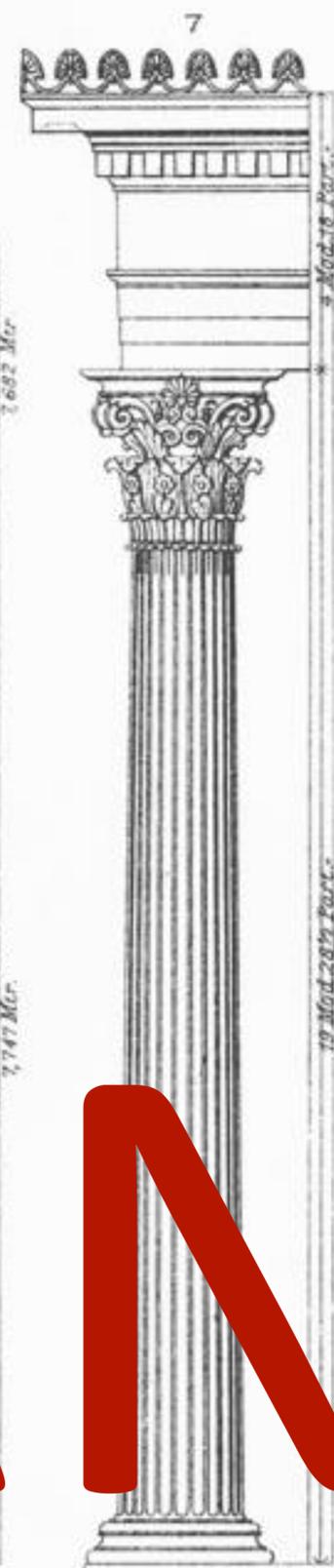
2,727,676 sf

**Total: 8,384,131 sf**

Korinthische Ordnung

Jonische Ordnung

Korinthisch Römisch-Korinthisch.



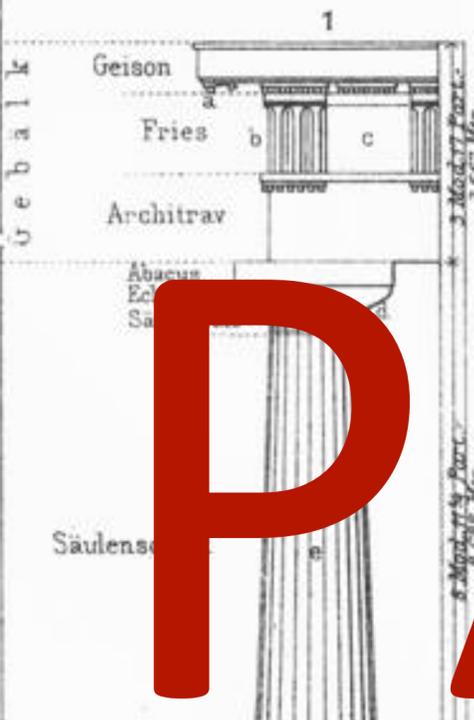
Kapital u. Basis vom Monument des Lysikrates zu Athen.

Kapital u. Basis vom Tempel der Athene zu Athen.

Kapital vom Tempel der Athene zu Priene.

Kapital vom Tempel am Ilissos zu Athen.

- Zu 1. 2. 3.
- a Mutuli (Dielenköpfe)
  - b Triglyphen (Dreischlitze)
  - c Metopen
  - d Riemchen
  - e Kannelirungen
  - f Sima (Rinneleiste)



- a Kranzgesimse
- Fries
- Architrav
- Kapital
- a Rinneleiste
- b Kranzleiste
- c Konsole
- d Kymation
- e Abacus
- f Volute
- g Blattkelche
- h Säulenhals

PATTERNS

Parthenon in Athen

Vom Tempel des Nemeischen Zeus

Vom Tempel am Ilissos in Athen

Vom Tempel d. Athene Polias in Priene

Vom Tempel d. Athene Polias in Athen

Vom Monument des Lysikrates in Athen.

Vom Tempel d. Jupiter-Stator in Rom.

600 BC



480 BC



340 BC



# PATTERNS

TH403 6/21/2018 9:45 AM - 11:15 AM

ARCHITECTURE

AS A  
PLATFORM

FOR THE NEW  
URBAN  
AGENDA

# Jonathan Widney

Stephen Hagan FAIA

- President | CEO, Hagan Technologies
- Principal, Construction Data Ventures

Kimon Onuma FAIA

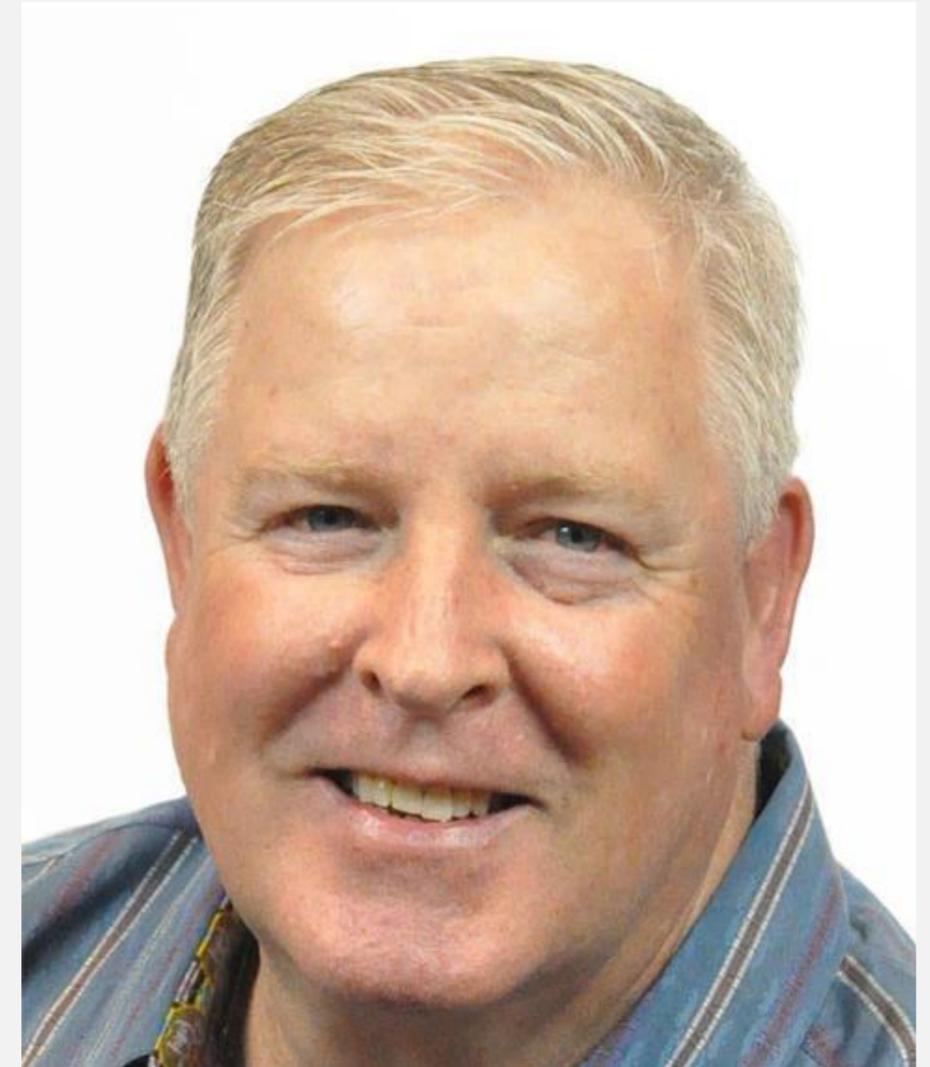
- President, Onuma, Inc.

Jonathan Widney

- Principal, Construction Data Ventures

Steve Jones

- Senior Director, Dodge Data & Analytics



# Game Changers in Architectural Practice

## A Discussion of Perspective & Observations

1. What is happening today within the AECO Sector?
2. Chaos, concern or confusion – what about confidence?
3. Adoption – what is really impacting the decision to change?
4. Evolution – why should we really change? What about risk?
5. Reality – why isn't there more DEMAND for higher Quality?

# Game Changers in Architectural Practice

## A Discussion of Perspective & Observations

Observations from the past 25+ years and what has been done to try to make a difference. Discussion will include the practical application of current capabilities, specifically in the area of Measuring Design (Model) Quality and compliance with company, project or owner requirements. I will also touch on automation, while maintaining consistency. Finally, recognition that momentum is critical to industry adoption.

# Game Changers in Architectural Practice

## Questions to ask Ourselves

1. Who is controlling the evolution of technology innovation?
2. What happened to commitment to continuous improvement?
3. What BIM Use Cases can be supported TODAY?
4. Introduction of logic and behavior 'checks' that are possible TODAY
5. Where are the bottlenecks that are impacting the potential of BIM workflows
6. Why is consistency of Quality not the #1 driver?

# BIM Use Cases – a Small Sampling

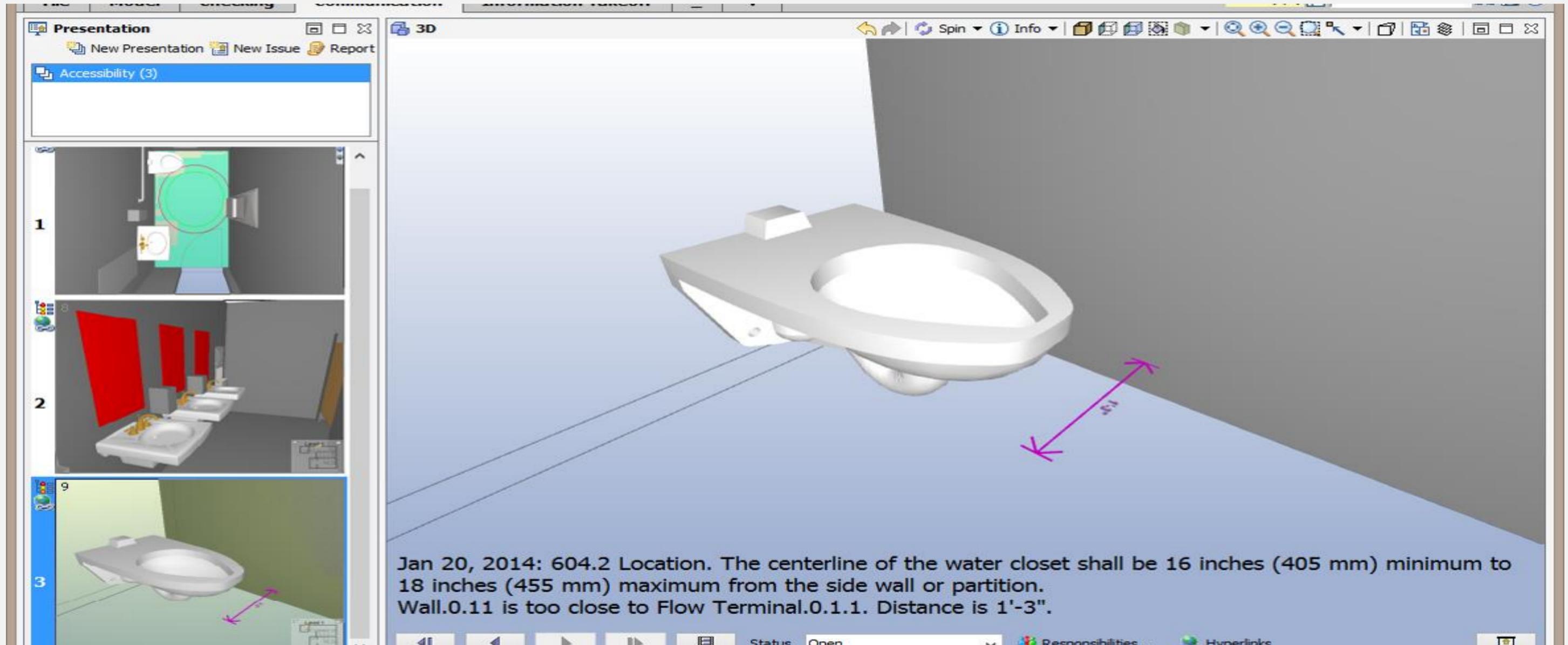
- Code Compliance
- Model QA/QC
- COBie
- LoD Verification
- Government Requirements
- Space Audits
- Coordination
- Site Safety
- Risk Management & Mitigation
- BIM Validation

# Information at our Fingertips – TODAY Code Compliance - Occupancy and Egress

The screenshot displays a software interface for egress analysis, likely Revit's egress tool. The interface is divided into several panels:

- Checking Panel:** Lists various rules for egress analysis. The "Escape Route Analysis" rule is highlighted in blue. Other rules include "Fire Compartment Area Must Be within Limits", "Fire Walls Must Have Correct Wall, Door, and Window Types", "Spaces Must Be Included in Fire Compartments", "Model Should Have Stairs", "Model Should Have Exits", "Door Minimum Dimensions", "Doors and Windows Must Be Connected to Spaces", and "If Space Is Set to Be Fire Exit Space, It Has to Have Fire Exit Door".
- Results Panel:** Shows the results of the "Escape Route Analysis". It indicates "No routes to exits [2/2]" for the "1. First floor [1/1]" and "2. Second floor [1/1]". It also shows "8 Technical Equipment" for each floor.
- Info Panel:** Provides a description of the "Escape Route Analysis" rule: "This rule checks that it is possible to exit safely in case of fire or other emergency. The building must have sufficient amount of suitable located exit passageways that have sufficient capacity, so that exit time is not dangerously long." It also includes the date "(Solibri, Inc. - 2014-10-14)" and the support tag "SOL/179/4.2".
- Tools Panel:** Contains visualization options for the egress analysis. The "Show Routes" option is checked and set to 30% (To Final Exit) with 2 routes. Other options include "Show Shared Route Parts" (0%), "Show Fire Compartments" (30%), "Show Exits", and "Show Occupancies".
- 3D View:** Shows a floor plan with blue lines representing escape routes. The routes are numbered 1, 2, and 3. The routes start from a central area and lead to exits on the perimeter. The routes are shown in blue, and the fire compartments are shown in light blue.

# Code Compliance – (604.2) Toilet Rooms



# Code Compliance: ADA

The screenshot displays a software interface for checking code compliance. The main window is divided into several panels:

- Checking Panel:** Shows a tree view of rulesets. The selected rule is "603.2.1 Turning Space" under "603 Toilet and Bathing Rooms".
- Results Panel:** Lists several violations for "Space. 1.161 : BATH". The selected result is "Space. 1.161 : BATH".
- Info Panel:** Provides details for the selected violation: "Space. 1.161 : BATH has not enough room for wheelchair turning space with diameter of 5'. Largest possible space diameter is 4'-9 3/8\".
- 3D View:** Shows a 3D rendering of a bathroom. A red circle highlights a specific area on the floor, indicating the location of the non-compliant turning space.

# Code Compliance: Mirror Heights



# LOD

## Measuring Compliance – No Fire Rating

**Ruleset**

- AIA Document E202 - 2008
  - Requirements for Required LOD
    - B1010 Floor Construction
    - B1020 Roof Construction
    - B2010 Exterior Walls
    - B2020 Exterior Windows
    - B2030 Exterior Doors
    - C1010 Partitions
    - C1020 Interior Doors
    - Requirements for LOD100
    - Requirements for LOD200
    - Requirements for LOD300
      - Required Properties** (Warning)
      - Required Property Sets

**Results**

No Filtering Automatic

Results

- Door [0/1]
  - Wrong value of Property - Pset\_DoorCommon.FireRating:** (Warning)
  - Door.0.1
  - Door.0.2

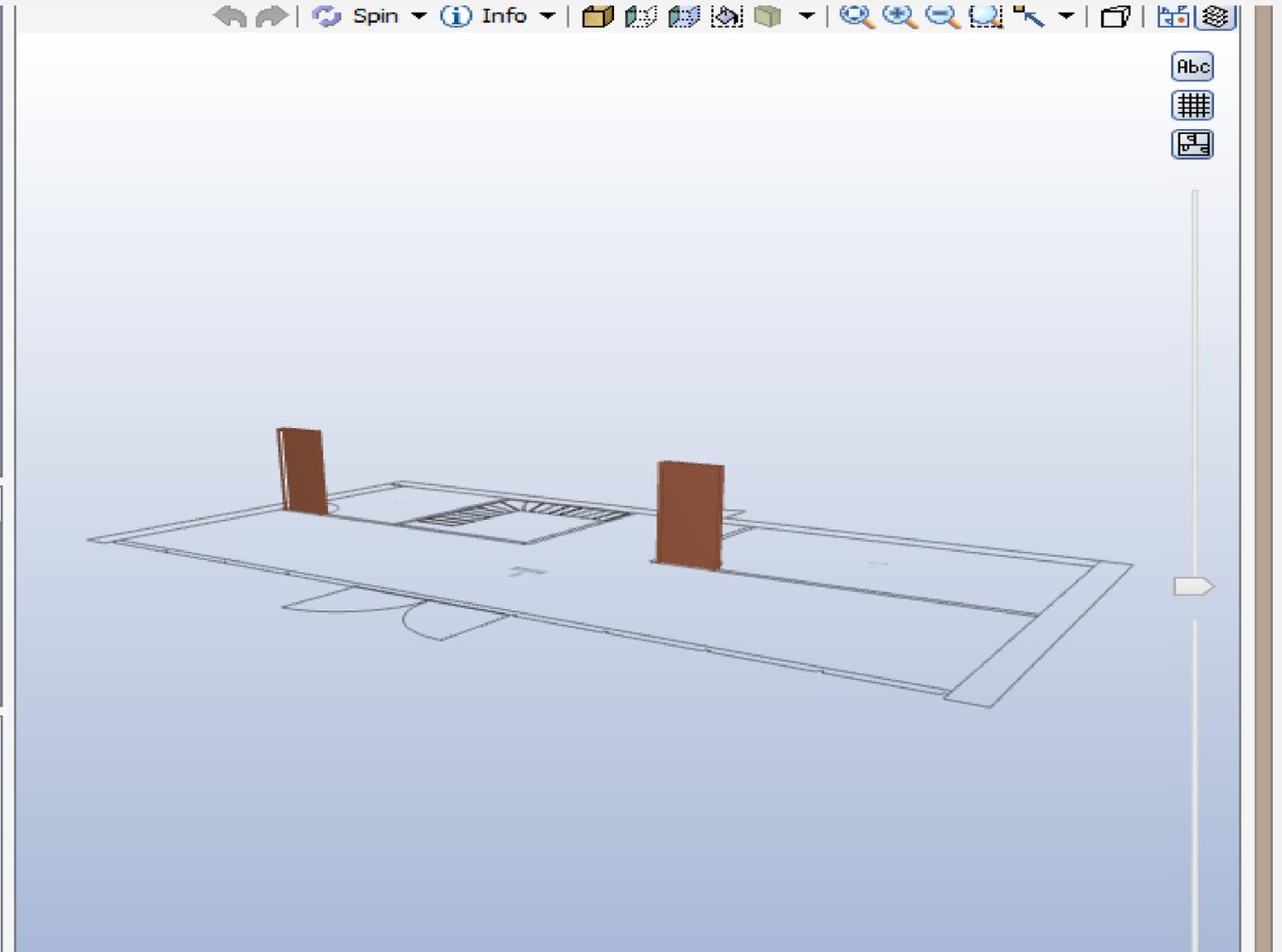
**Info**

Wrong value of Property - Pset\_DoorCommon.FireRating:

Description Hyperlinks

Door component(s) have wrong value. The actual value of Property: Pset\_DoorCommon.FireRating is undefined. Operators.IsDefinedOperator .

Location:



# Area and Space Calculations Customized for the Owner or Project

**Note:** The perimeter of the *Usable Area* is defined according to the 'Standard Method for Measuring Floor Area in Office Buildings, ANSI/BOMA Z65.1-1996'.

There are two main properties associated with the *Usable Area Visualization* tool:

- 1) A set of three numbers: the first is the room number, the second is the *GSA BIM Area* in black, and the third is the *Usable Area* in red.
- 2) A dashed red line that shows the perimeter of the *Usable Area*. There is no dashed line to represent the *GSA BIM Area*.



# COBie

## Huge Amounts of Object Data

The screenshot displays a BIM software interface with a 3D model of a building interior on the right and a COBie data table on the left. The 3D model shows a room with various elements like walls, doors, windows, and furniture. The COBie table lists object data for various building components, including their names, quantities, and properties.

COBie	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
133	Fixed Window	n/a	n/a	Wood Fixed Window	B203	Fixed Window	n/a	Window	110GAJRT...	Available	n/a	2012	n/a	Available	n/a	n/a	1.65
134	Floor Deck	n/a	n/a	Floor Deck	n/a	Floor Deck	n/a	Slab	1hOSvn6d...	Available	n/a	2012	n/a	Available	n/a	n/a	59.23
135	Floor Deck	n/a	n/a	Floor Deck	n/a	Floor Deck	n/a	Slab	1hOSvn6d...	Available	n/a	2012	n/a	Available	n/a	n/a	59.33
136	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	1CZILmCa...	Available	n/a	2012	n/a	Available	n/a	n/a	25.42
137	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	1CZILmCa...	Available	n/a	2012	n/a	Available	n/a	n/a	25.42
138	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	2O2Frst4X...	Available	n/a	2012	n/a	Available	n/a	n/a	64.78
139	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	2O2Frst4X...	Available	n/a	2012	n/a	Available	n/a	n/a	64.91
140	Roof	n/a	n/a	Structural Roof Deck	R301	Roof	n/a	Roof	3L3pnQ1qL...	Available	n/a	n/a	n/a	Available	n/a	n/a	132.54
141	Single - Flush	n/a	n/a	Flush Wood Door	A101	Single - Flush	n/a	Door	1hOSvn6d...	Available	n/a	2012	n/a	Available	n/a	n/a	2.93
142	Single - Flush	n/a	n/a	Flush Wood Door	B101	Single - Flush	n/a	Door	1hOSvn6d...	Available	n/a	2012	n/a	Available	n/a	n/a	2.93
143	Single - Glass	n/a	n/a	Wood Door	A102	Single - Glass	n/a	Door	1s1jVhK8z...	Available	n/a	2012	n/a	Available	n/a	n/a	2.41
144	Single - Glass	n/a	n/a	Wood Door	B102	Single - Glass	n/a	Door	1s1jVhK8z...	Available	n/a	2012	n/a	Available	n/a	n/a	2.41
145	Skylight	n/a	n/a	Roof Window	R301	Skylight	n/a	Window	0fsiDr_ifE...	Available	n/a	2012	n/a	Available	n/a	n/a	0.76
146	Skylight	n/a	n/a	Roof Window	R301	Skylight	n/a	Window	2HqtVcwR...	Available	n/a	2012	n/a	Available	n/a	n/a	0.76
147	Sofa	n/a	n/a	1830mm	A102	Sofa	n/a	Furniture	2OBrcmyk...	Available	n/a	2012	n/a	Available	n/a	n/a	n/a
148	Sofa	n/a	n/a	1830mm	A102	Sofa	n/a	Furniture	2OBrcmyk...	Available	n/a	2012	n/a	Available	n/a	n/a	n/a
149	Sofa	n/a	n/a	1830mm	B102	Sofa	n/a	Furniture	2OBrcmyk...	Available	n/a	2012	n/a	Available	n/a	n/a	n/a

# Safety

## How Many Portalets are Enough?

The screenshot displays a software interface for safety checking. The 'Checking' panel on the left lists various rulesets and their status. The 'Results' panel at the bottom left shows a failure for the rule 'Number of Portalets on Site based on Manpower' on the 1st floor. The 3D view on the right shows a construction site with a red cube highlighting a specific area.

Ruleset	Status
SiteSafety_NYCDOB_Excavation	Warning
SiteSafety_NYCDOB_Superstructure	Warning
Model Should Have Required Superstructure Elements	Warning
Edge Protection Required - Slab Distance Check	Warning
Slab Opening Covering Required - Dimension Sorting <12"	OK
Slab Opening Edge Protection Required- Dimension Sorting	OK
Fall Protection Guardrails to be 42" Min	OK
Each floor should have edge protection	Warning
Site Safety_NYCDOB_Fire	Warning
Model Should Have Required Fire Safety/Egress Componen	OK
Material Storage Distance to Fire Hydrants	OK
Material Storage Distance to Building	OK
Turner Site Safety Rulesets - General Conditions	Warning
Model Should Have Components: General Conditions	OK
Number of Portalets on Site based on Manpower	Failure
Site Area - Is Erosion & Sedimentation Control Plan required	OK
SafetyLogistics - Egress&Emergency	Warning
Turner Site Safety Rulesets - Safety Logistics - Equipment	Warning
Confirm Fire Extinguishers Exist in the Model	OK
Confirm Fire Extinguishers Exist on Each Floor	OK
75' Maximum Distance between Fire Extinguishers	Warning
10' Maximum Distance to Elevator or Hoist	Warning
TurnerSiteSafetyRulesets - SafetyLogistics - MusterPoint	Warning
Model Should Have Components	OK
Space Area	Warning
TurnerSiteSafetyRulesets - SafetyLogistics - TempBarriers	Warning
Exists - Cones	Warning
Component Distance	Warning
Exists - Bollard	Warning
Exists - SafetyBarricade	Warning
Exists - SafetyCable	Warning

**Results**

Results	Status
(B) 1st FLOOR [1/1]	Warning
(B) Space.0.1 : CONSTRUCTION SITE[1083651] [1/1]	Warning
Not enough 'Portalet'-components (2/8)	Failure
(B) Object.0.30	Failure
(B) Object.0.31	Failure
(B) Space.0.1 : CONSTRUCTION SITE[1083651]	OK

**Info**

Not enough 'Portalet'-components (2/8)

Description [Hyperlinks](#)

There are only 2 'Portalet'-components in (B) Space.0.1 : CONSTRUCTION SITE[1083651] and there should be at least 8.

Location:  
(B) 1st FLOOR  
(B) Space.0.1 : CONSTRUCTION SITE[1083651]

# Safety

## Ensuring Fire Extinguishers are Present

The screenshot displays the Solibri Model Checker interface for a project named "Site\_Safety\_Example". The software is running on a Windows operating system, as indicated by the taskbar at the bottom.

**Checking Panel:** This panel on the left lists the ruleset being used: "OSHA - 1926 - SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION". Under "1926 Subpart F - Fire Protection and Prevention", the rule "1926.150(c) Portable firefighting equipment" is expanded to show "Model Should Have Fire Extinguishers". A specific rule, "75' Maximum Distance Between 2a+ Fire Extinguishers", is highlighted in blue and shows a warning icon (yellow triangle with exclamation mark).

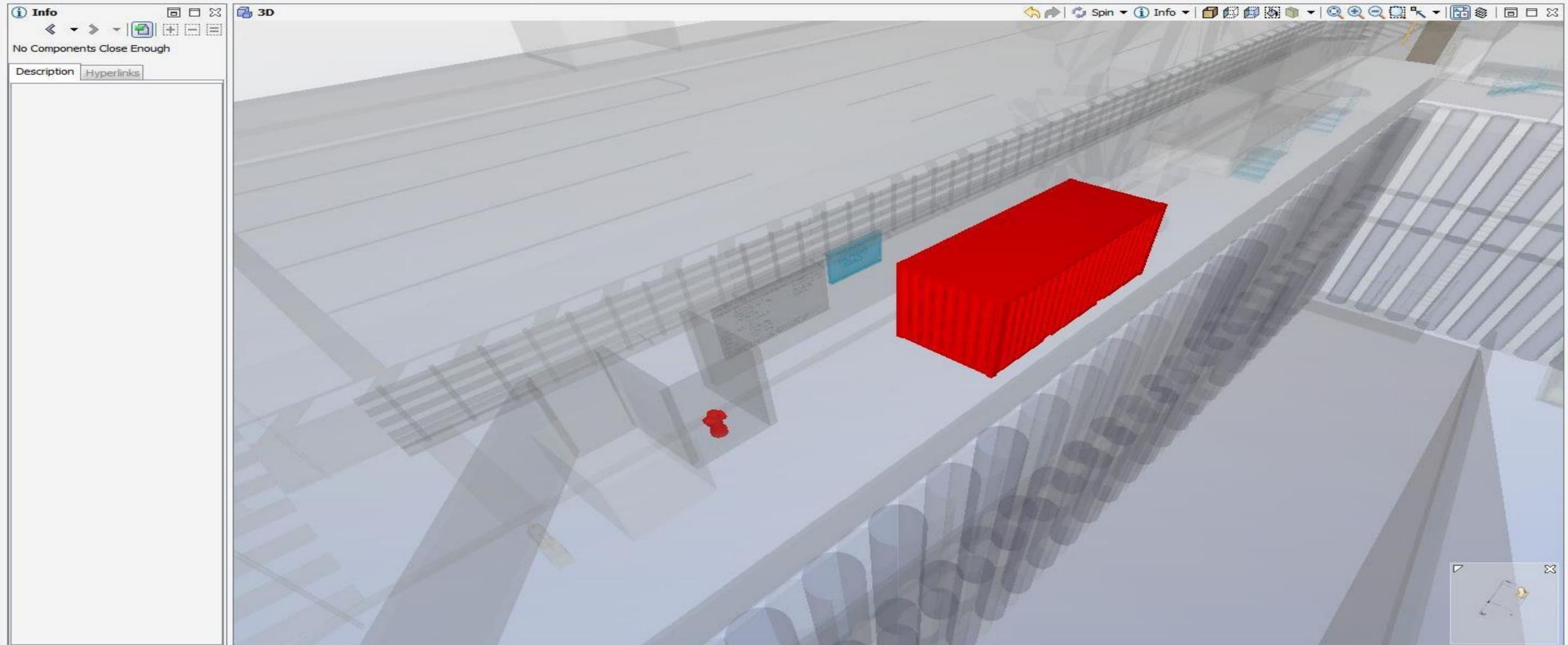
**Results Panel:** This panel shows the results of the check. Under "Results", there are two items: "(C) Second Floor [2/2]" and "No Components Close Enough [2/2]". The "No Components Close Enough" item is expanded to show two specific violations: "(C) Object.0.1" and "(C) Object.0.2", both marked with red 'X' icons.

**Info Panel:** This panel provides details for the selected violation "(C) Object.0.1". The description states: "There are no components closer than 75' to '(C) Object.0.1' that match the given requirements. - (C) Object.0.2 Distance: 145'-7 7/8\"". The location is identified as "(C) Second Floor".

**3D View:** The main 3D view shows a wireframe model of a building's second floor. Two red circular areas are overlaid on the model, representing the 75-foot search radius for fire extinguishers. A purple double-headed arrow indicates the distance between two points, labeled "145'-7 7/8\"".

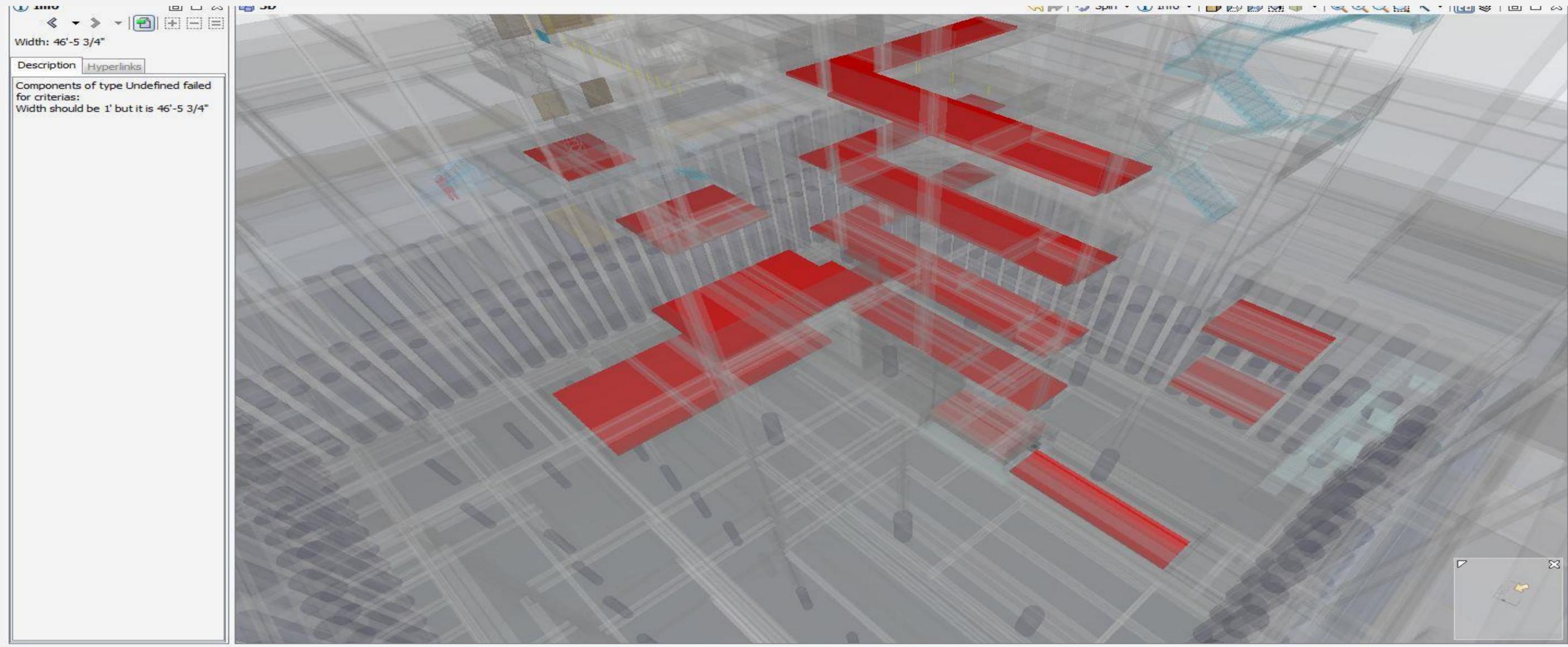
**Footer:** The bottom of the window displays the role "COBie-US OmniClass 2012" and the number of selected items "Selected: 0".

# Safety Material Storage Proximity to Hydrant



# Safety

## Modeled Slab Edge Protection



# Summary

- What are we waiting for?
- Innovation requires US to embrace change
- Evolution requires US to advance our Industry
- Better Model Consistency = Better ROI
  
- If we ask for it...they will develop it

# Steve Jones

Stephen Hagan FAIA

- President | CEO, Hagan Technologies
- Principal, Construction Data Ventures

Kimon Onuma FAIA

- President, Onuma, Inc.

Jonathan Widney

- Principal, Construction Data Ventures

Steve Jones

- Senior Director, Dodge Data & Analytics

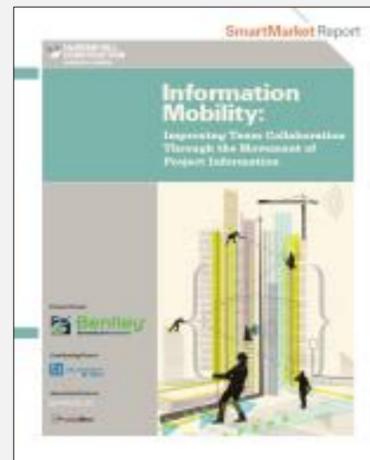


# Dodge Data & Analytics Research on Trends

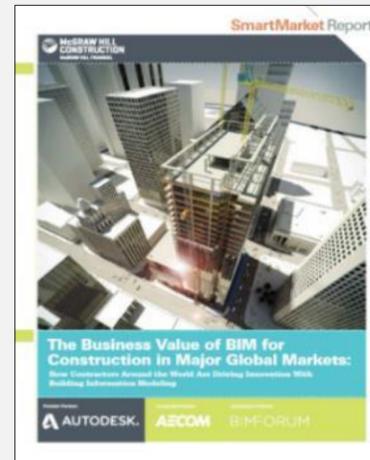
free at:  
[construction.com/toolkit](http://construction.com/toolkit)

## TECHNOLOGY/INNOVATION

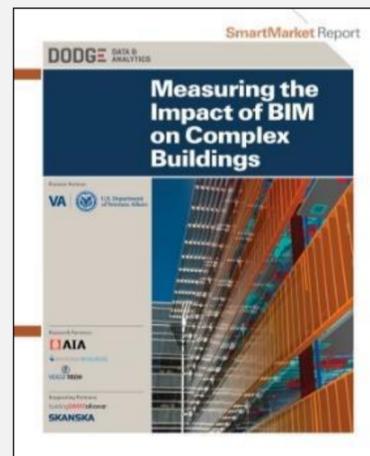
Information Mobility



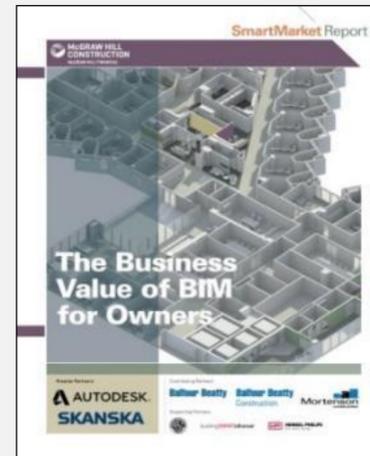
BIM for Contractors



Measuring BIM

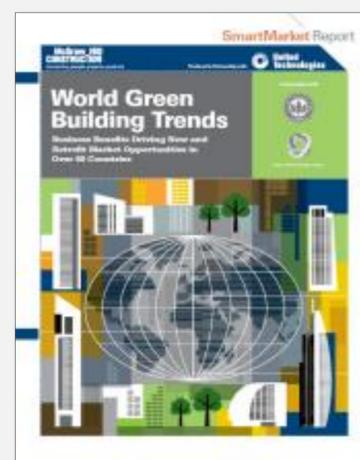


BIM for Owners

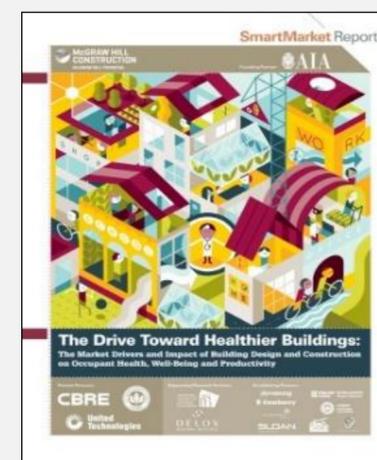


## SUSTAINABILITY

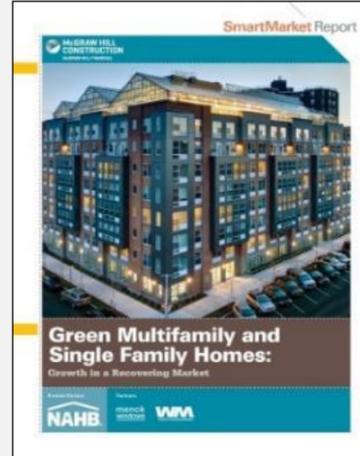
World Green Trends



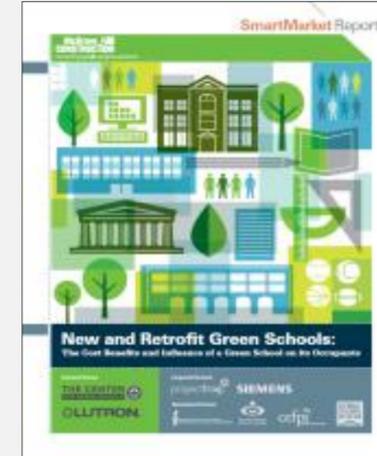
Design for Health



Green Homes

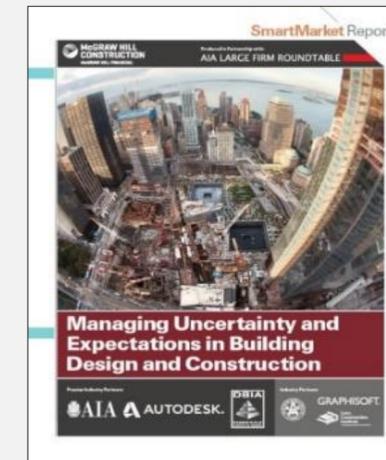


Green Schools



## PRACTICES/PROCESSES

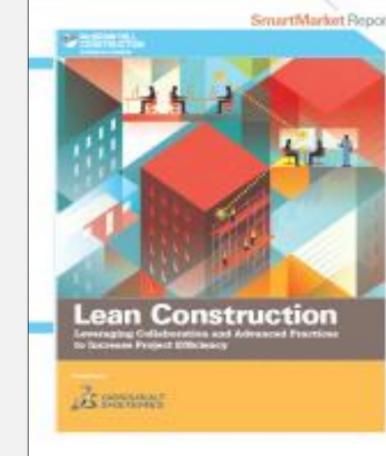
Managing Uncertainty



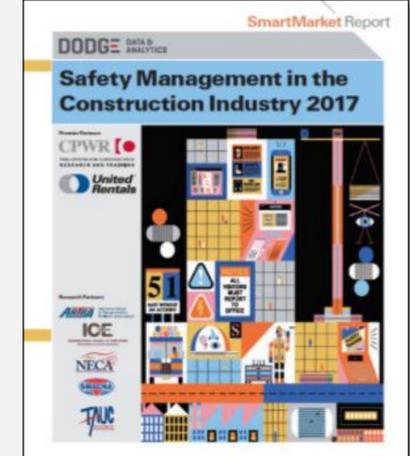
Project Delivery Systems



Lean



Safety (3x)



# Dodge Data & Analytics Research on Trends

free at:  
[construction.com/toolkit](https://www.construction.com/toolkit)

- What are people doing that generates value\*, improves outcomes\*\*
  - *\*Meaningful, Reliable, Repeatable, Scalable*
  - *\*\*How much better is it than previous methods?*
- What's keeping people from doing it (or doing more of it)?
- What do people believe will:
  - *Drive more use*
  - *Add more value*

What can/should people do to move forward?

# Harnessing the Technology Innovation Revolution

The ***NOW***

The ***NEW***

The ***NEXT***

## **Harnessing:**

Taking control of something powerful  
and driving for results

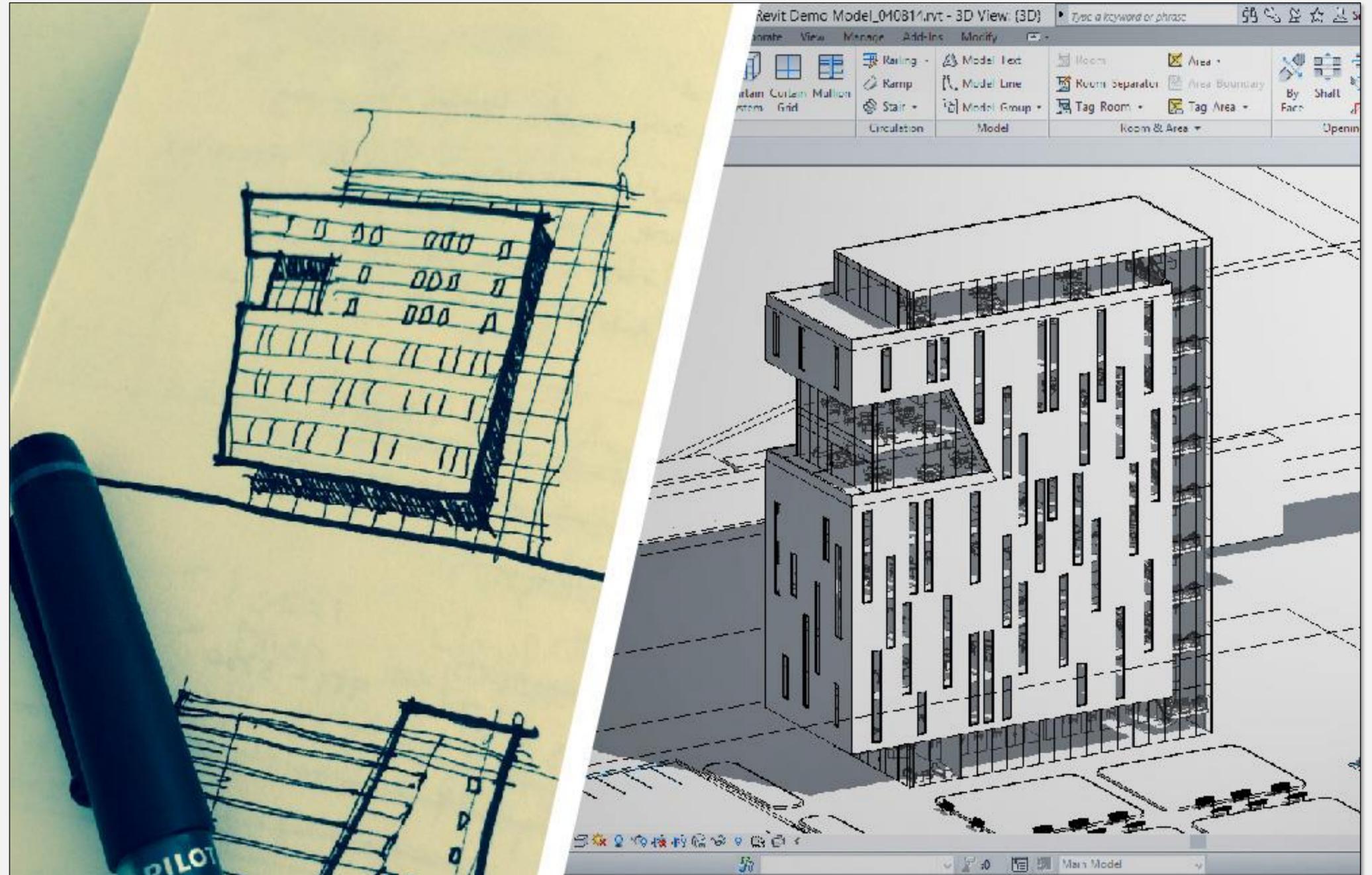


# Harnessing the Technology Innovation Revolution

The **NOW**

The **NEW**

The **NEXT**



# Harnessing the Technology Innovation Revolution

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## 1. Get more out of BIM

How many of you are currently using BIM?

# Harnessing the Technology Innovation Revolution

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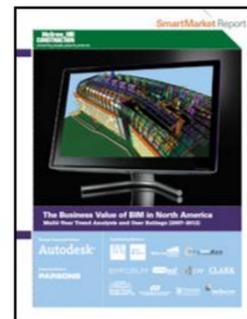
1. **Get** ~~more out of~~ **BIM!!!**

*free at:*

[construction.com/toolkit](http://construction.com/toolkit)

## REGIONAL STUDIES

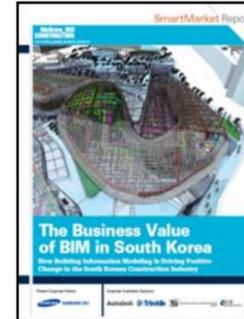
BIM in North America (3X)



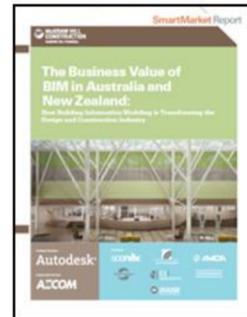
BIM in Europe



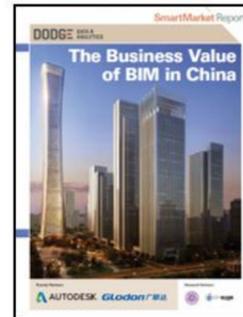
BIM in Korea



BIM in Australia/NZ



BIM in China



BIM in The Middle East



## VERTICAL STUDIES

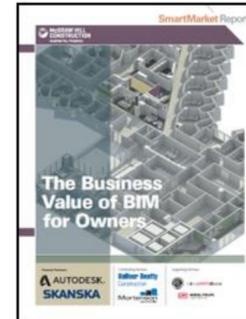
BIM for Infrastructure (2X)



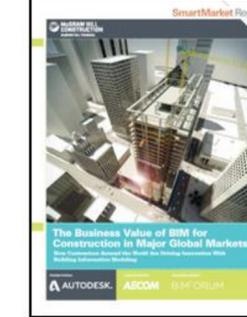
Green BIM



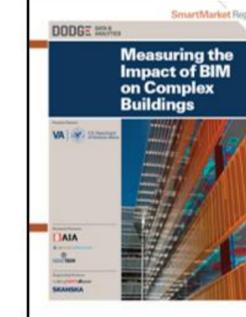
BIM for Owners



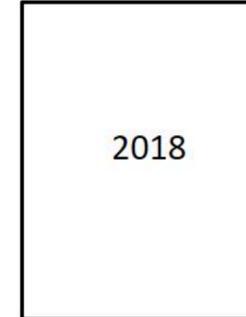
BIM for Contractors



BIM Metrics



BIM for Water



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## 1. Get more out of BIM

- Stop thinking of BIM as something used IN YOUR FIRM
- Start thinking of BIM as something used ON YOUR PROJECTS

# Harnessing the Technology Innovation Revolution

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The **NEXT**

## 1. Get more out of BIM

*“Silos of Excellence” do not help*

Multiple Analyses from Single Model

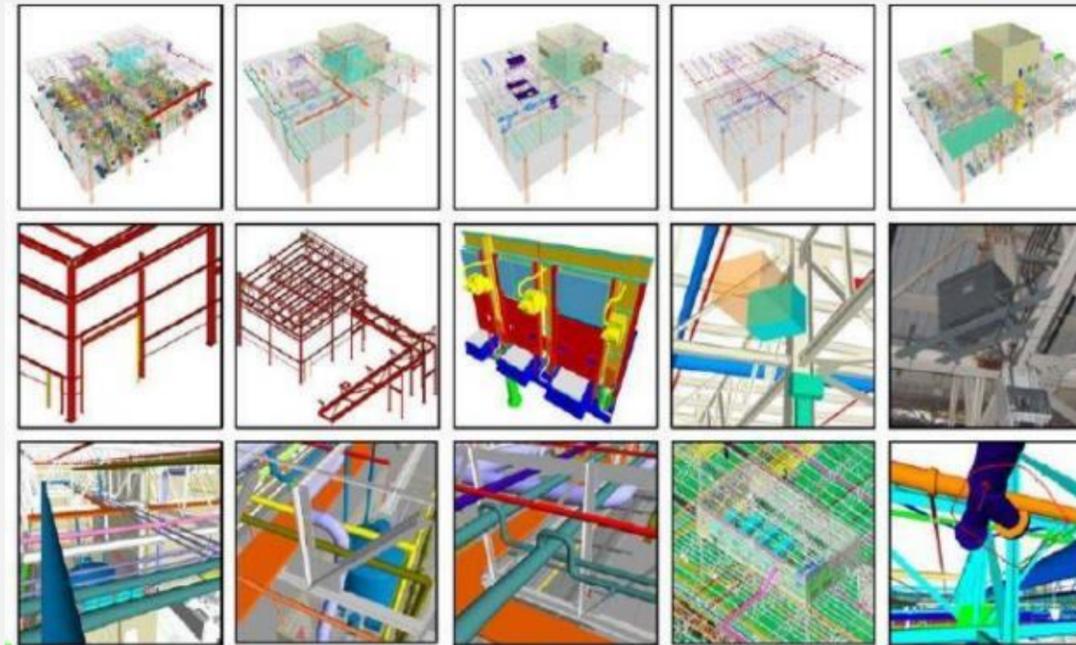


Image Source: eQ NOVA

# Harnessing the Technology Innovation Revolution

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The **NEW**

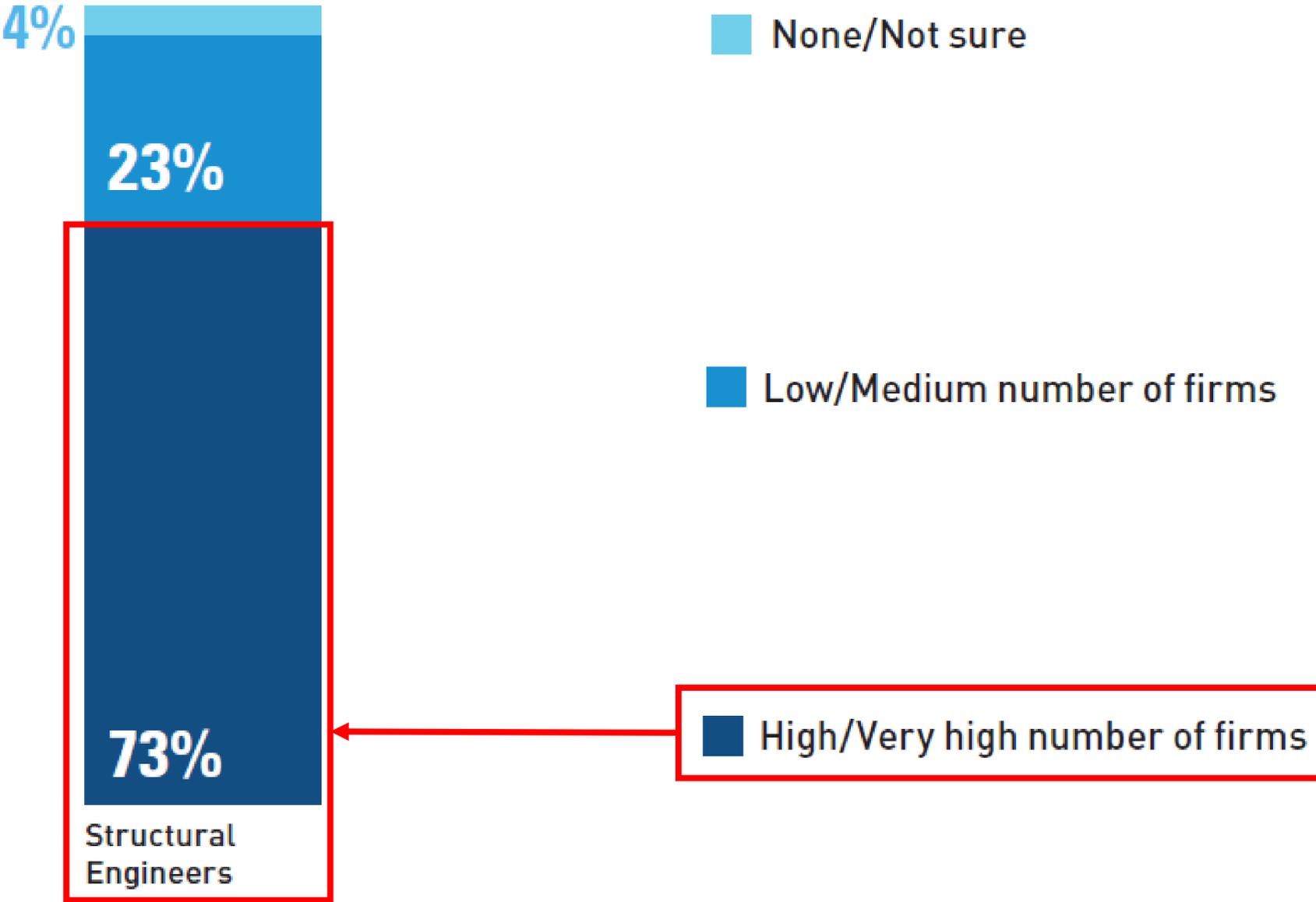
The **NEXT**

## 1. Get more out of BIM

- Drive more adoption and use among your project team members
- Where are we now re: engineers BIM adoption?

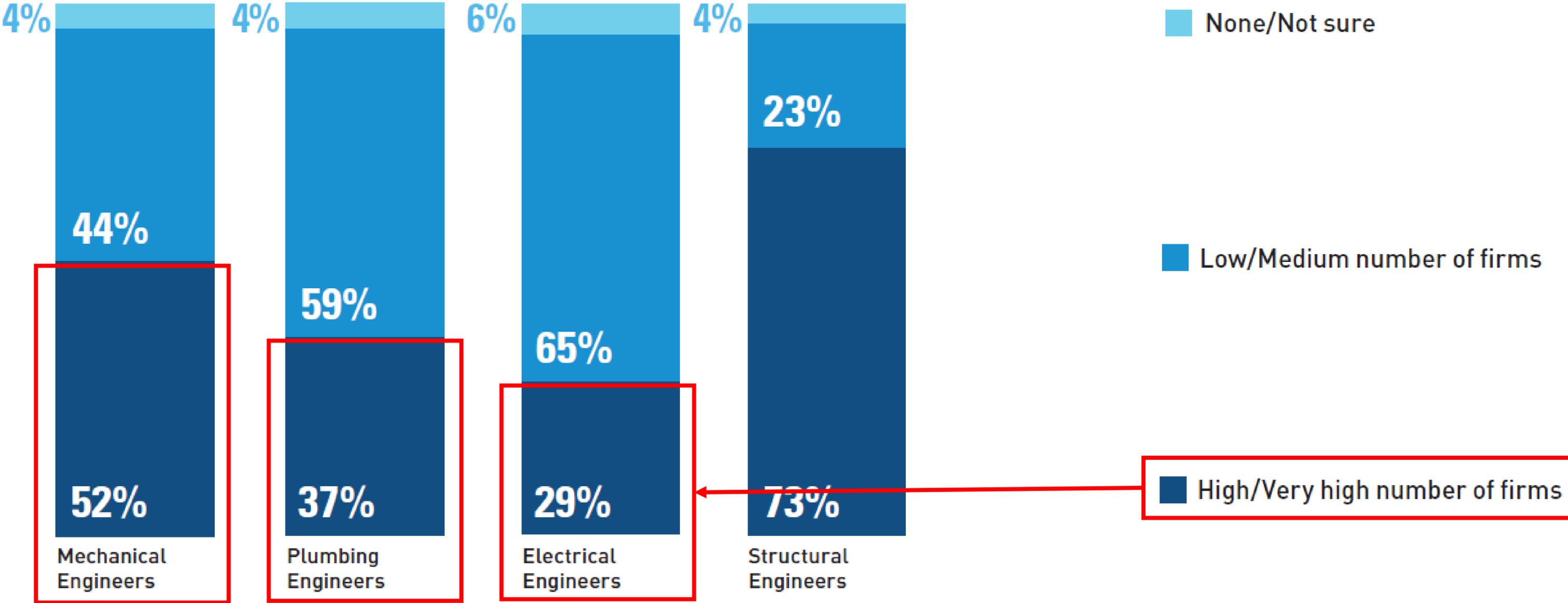
# Architects' Perception of BIM Adoption by Engineers

Percentage of architects who perceive each of three levels of BIM adoption in their market among five types of engineering firms



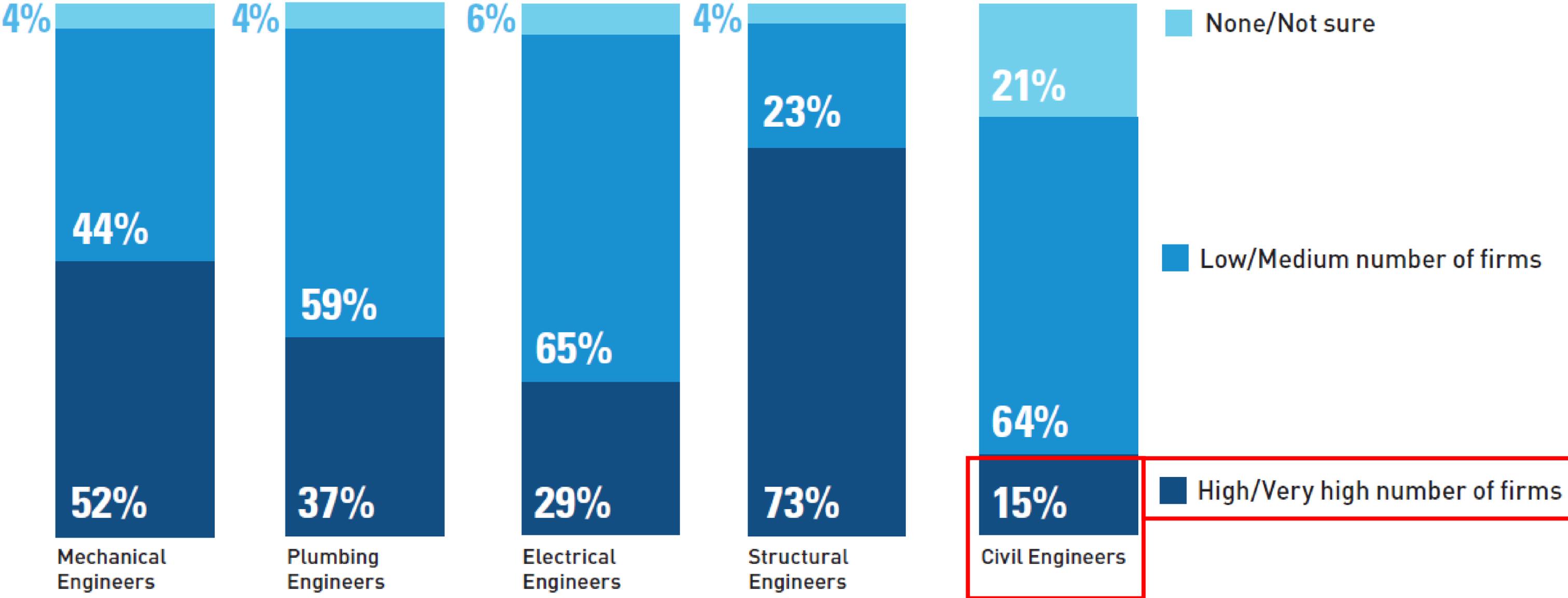
# Architects' Perception of BIM Adoption by Engineers

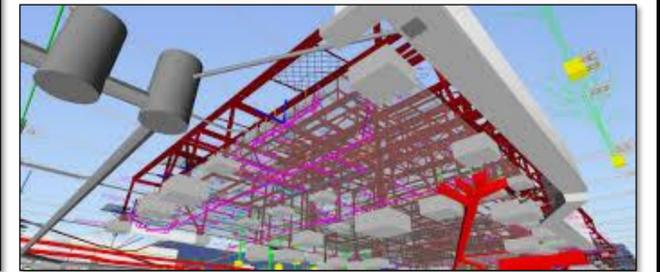
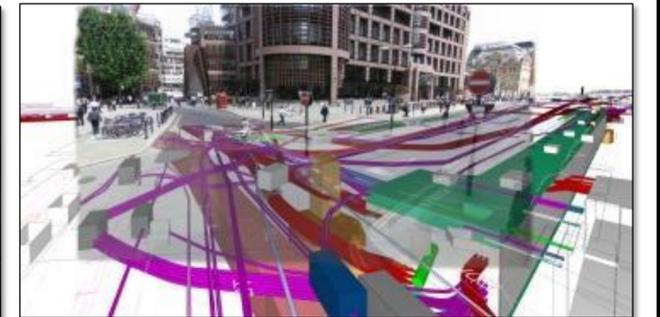
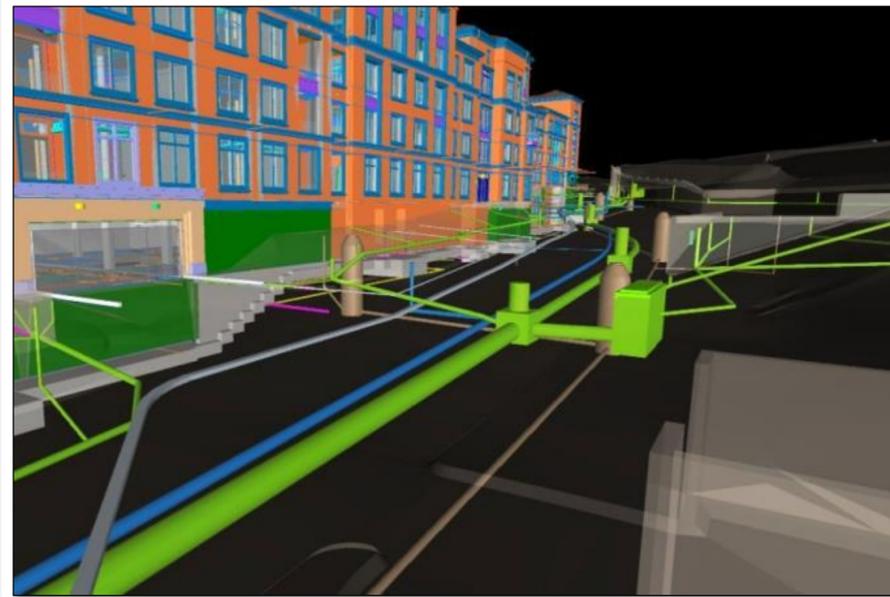
Percentage of architects who perceive each of three levels of BIM adoption in their market among five types of engineering firms



# Architects' Perception of BIM Adoption by Engineers

Percentage of architects who perceive each of three levels of BIM adoption in their market among five types of engineering firms





# Reality-informed design



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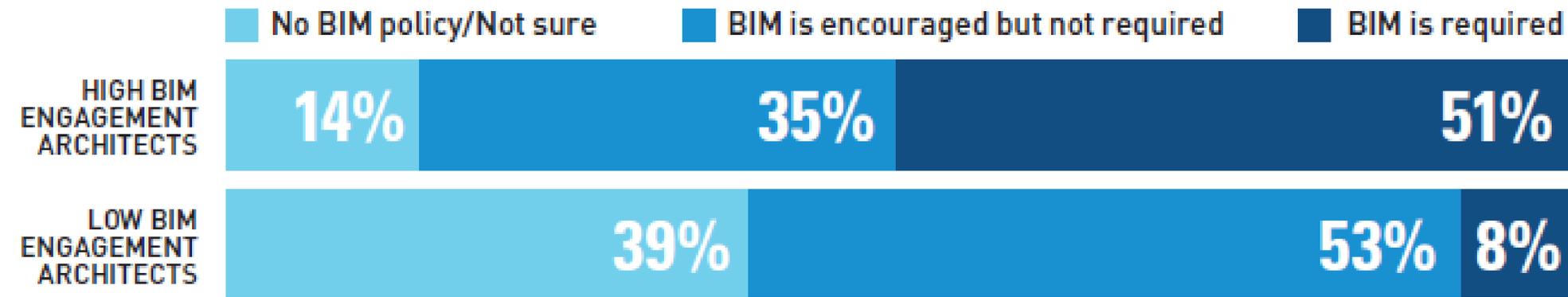
The **NEXT**

## 1. Get more out of BIM

- Drive more adoption and use among your project team members
  - **HOW?** BIM Requirements
-

## Architects' BIM Policies for Engineers

Percentages of architects reporting each of three levels of BIM requirements policy for engineering firms on their project teams

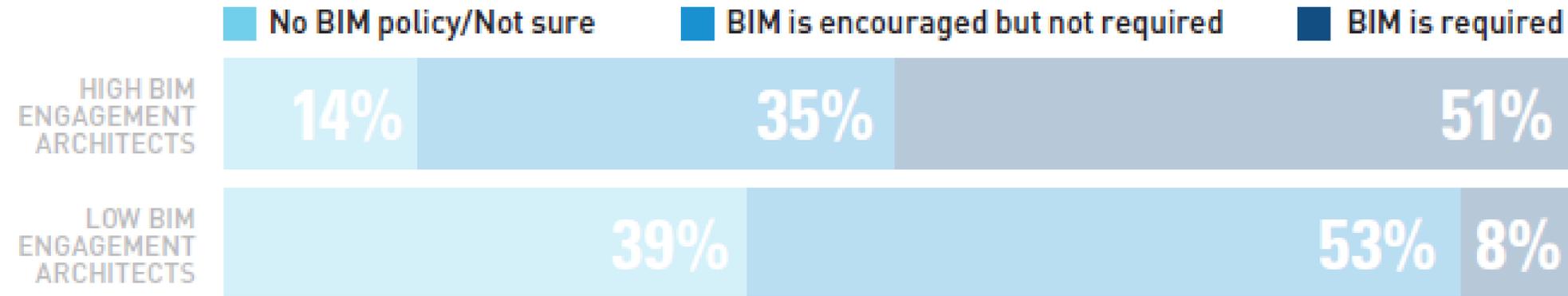


Architects' BIM policy for MEP engineers

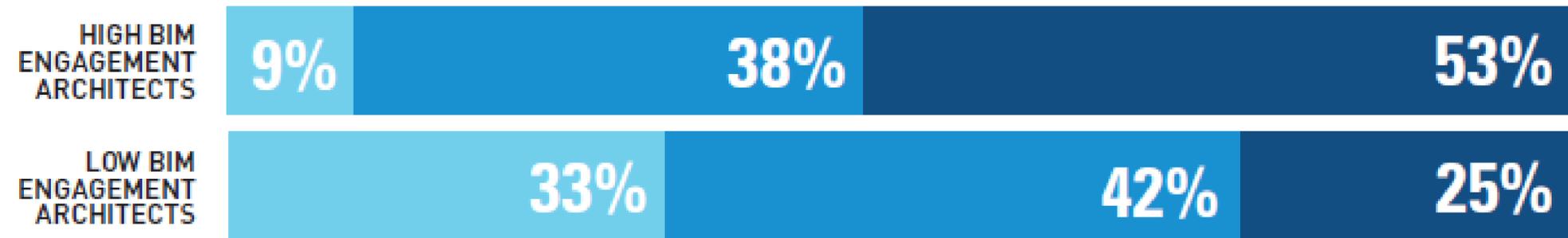
Dramatic differences between High and Low Engagement BIM users.

# Architects' BIM Policies for Engineers

Percentages of architects reporting each of three levels of BIM requirements policy for engineering firms on their project teams



Architects' BIM policy for MEP engineers

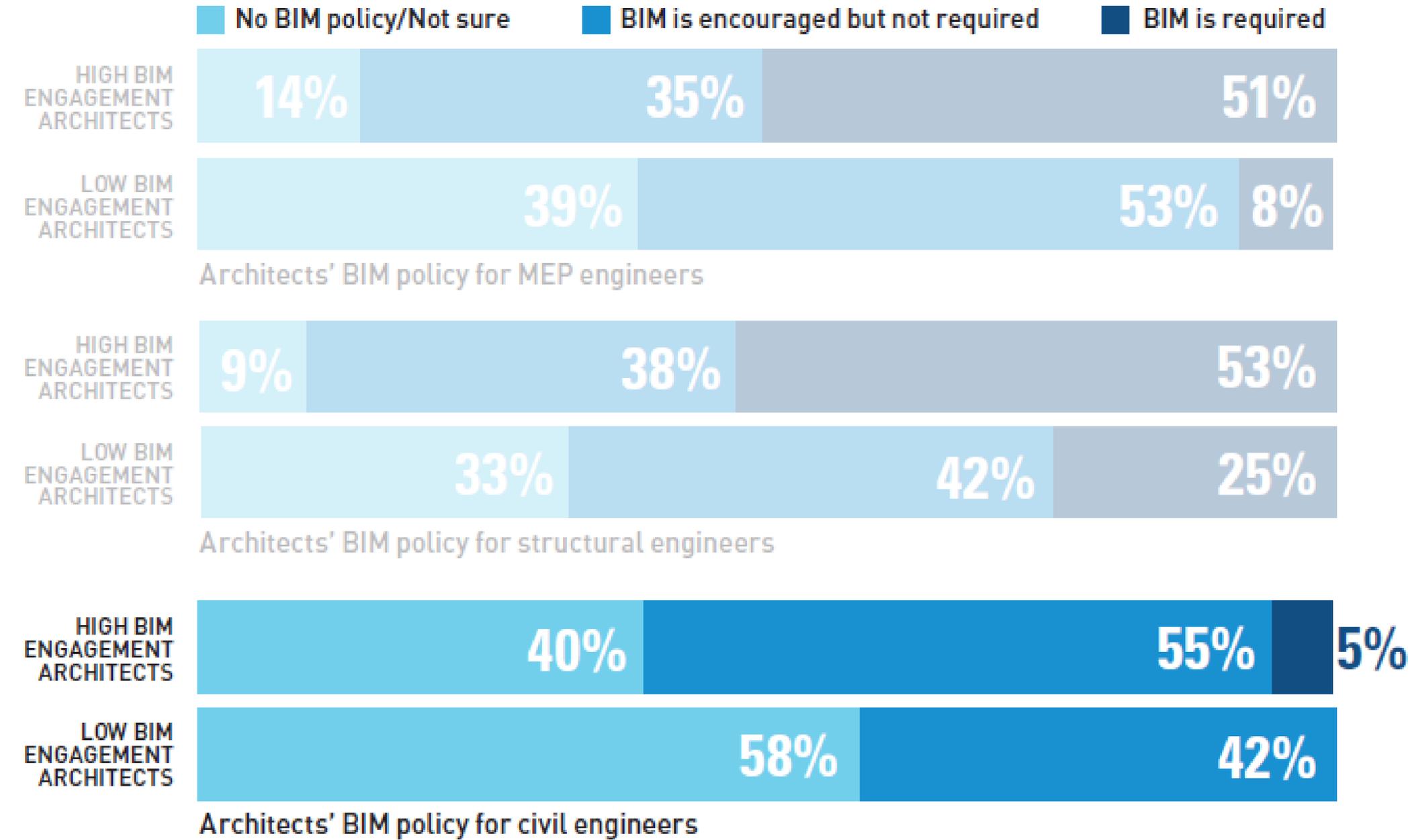


Architects' BIM policy for structural engineers

More of the Low Engagement users report having BIM requirements for structural engineers.

# Architects' BIM Policies for Engineers

Percentages of architects reporting each of three levels of BIM requirements policy for engineering firms on their project teams



BIM requirements for civil engineers is still developing among all users.

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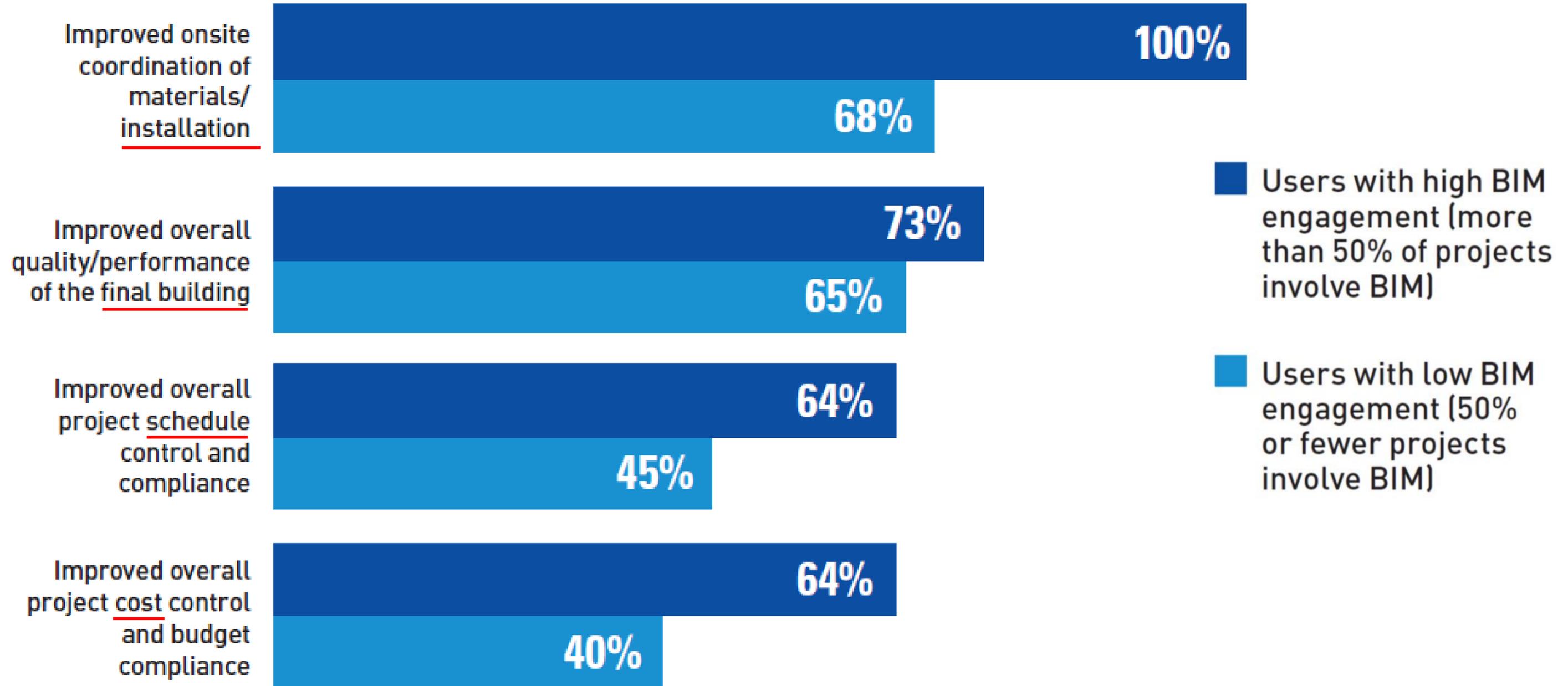
The **NEXT**

## 1. Get more out of BIM

- Drive more adoption and use among your project team members
  - **WHY?** Better Outcomes
-

# Improved Project Outcomes When BIM is Used by Engineers and Trades

Percentage of BIM users who cite each of four benefits generated by having key team members engaged with BIM





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## 2. Drive integrated digital workflows

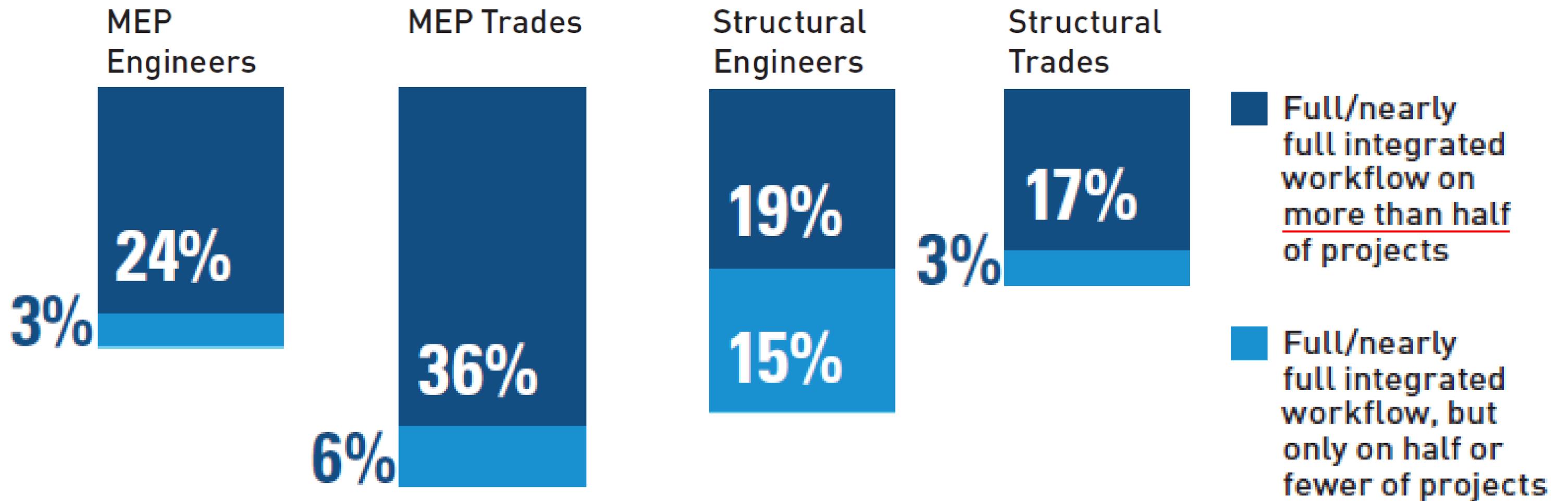
### Continuous multi-party flow of digital data

- **Designers** – create model, code check, analyze/optimize
- **Detailers** – shop drawings, install/erection plans
- **Fabricators** – bring model data into fabrication systems
- **Installers** – Transfer data back into design model to validate accuracy and confirm installation in the field

Connecting design+fabrication+installation

# Frequency of Integrated Workflow

Percentage of structural and MEP engineers and trades who report participating in an integrated digital workflow on current and recent projects



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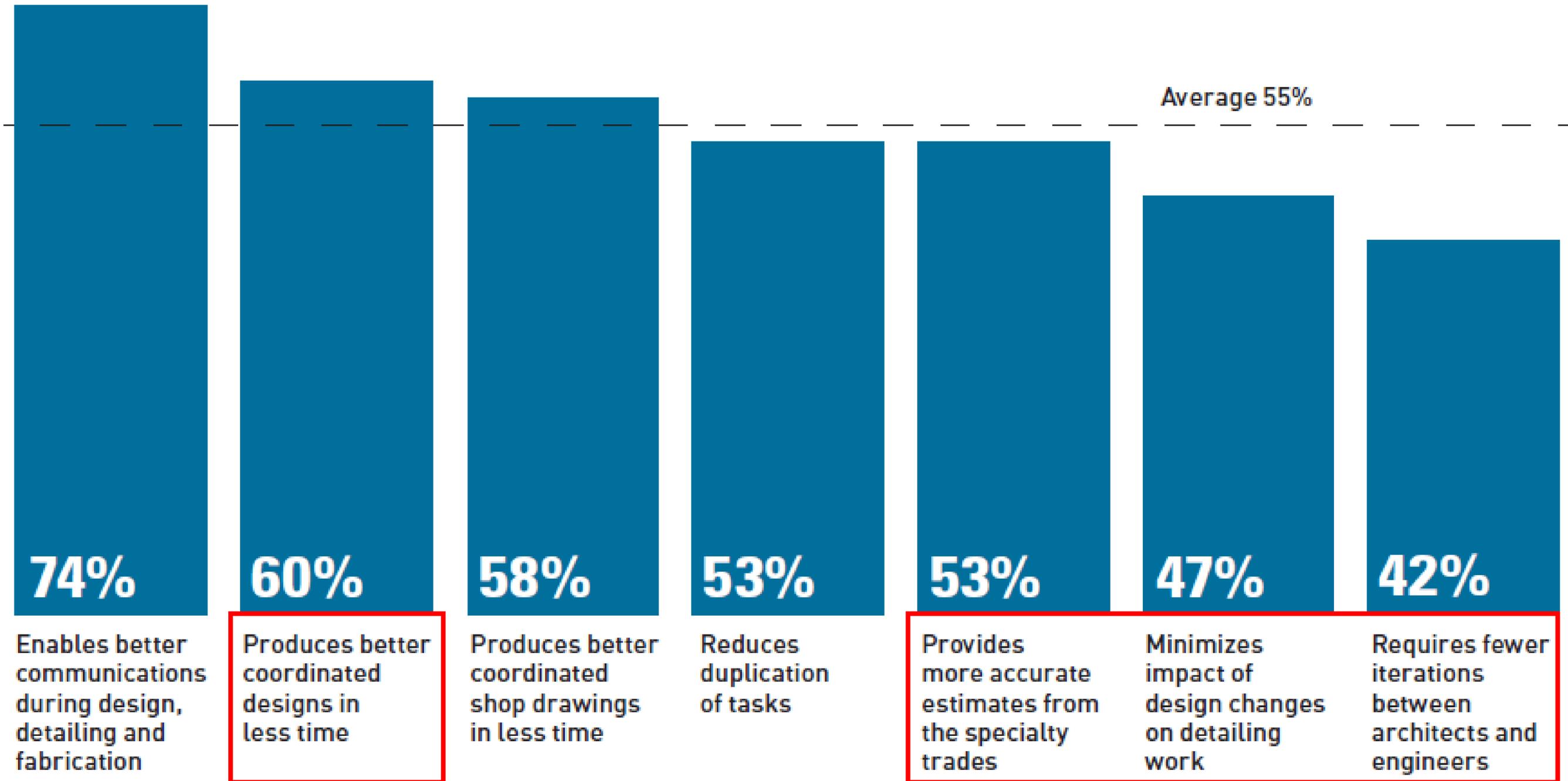
The *NEXT*

## 2. Drive integrated digital workflows

- WHY? Better Outcomes
-

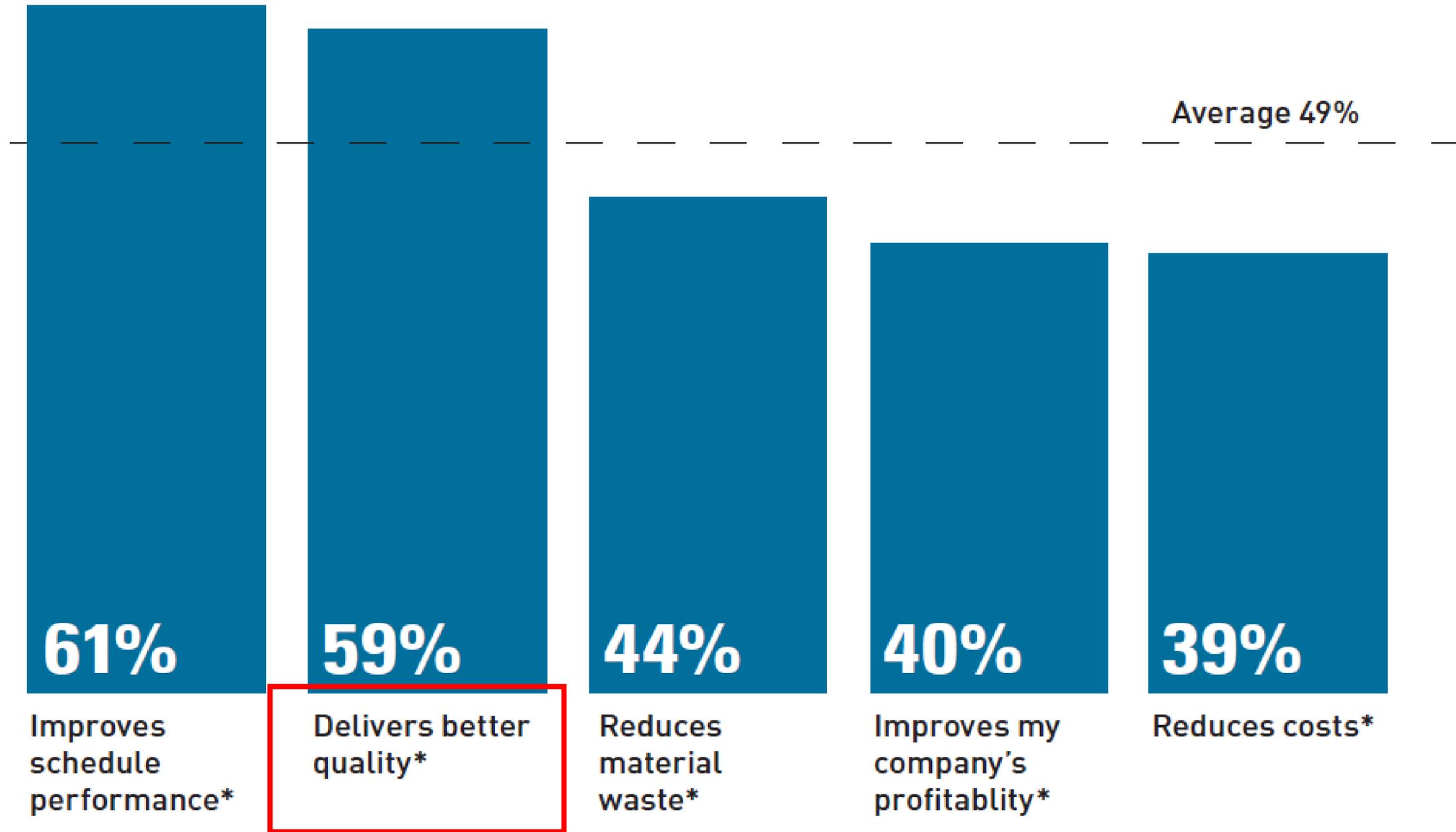
# Impact on Design, Detailing and Fabrication

Percentage of high or very high impact ratings for seven positive impacts of the integrated workflow on design, detailing and fabrication



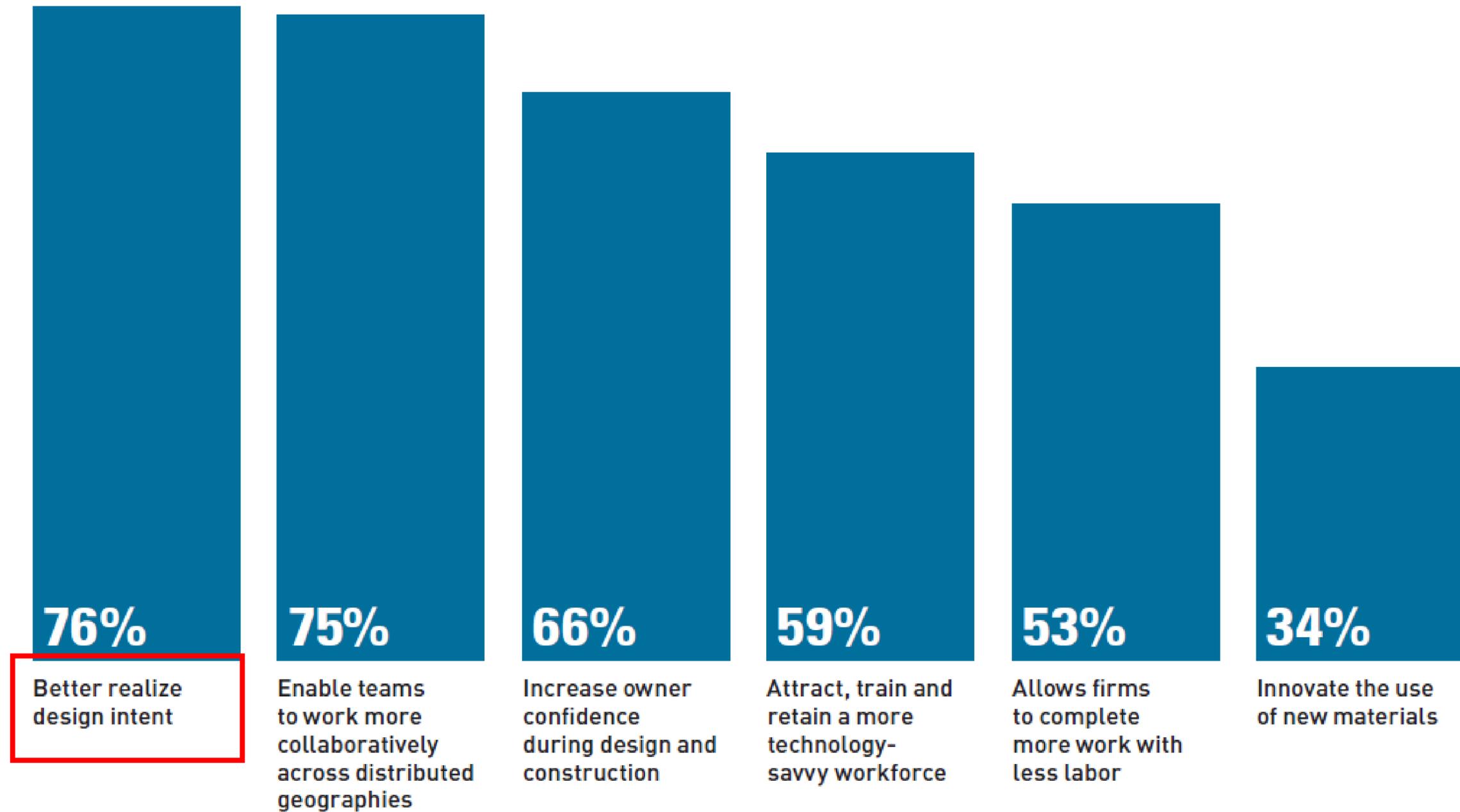
# Impact on Project Outcomes

Percentage of high or very high impact ratings for 5 positive impacts of the integrated workflow on project outcomes



## Predicted Future Benefits of Integrated Workflow

Percentage of respondents who predict high or very high impact in the future for each of 6 positive impacts of the integrated workflow



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## Most Impactful BIM Trends and Capabilities in the Next 5 Years

Percentages of each discipline that predict high or very high positive impact for emerging BIM trends or capabilities over the next five years

	Architects	Structural Engineers	MEP Engineers	GC/CMs	Structural Trades	MEP Trades
Tools that allow visual and creative insight to produce better design alternatives in less time	83%	78%	45%	70%	70%	76%
Intelligent models that lead to more consistent and coordinated contract deliverables	77%	72%	52%	67%	67%	73%
BIM-based processes that produce better coordinated shop deliverables in less time	77%	72%	48%	73%	70%	67%
Single source of truth of project data, accessible anytime, anywhere in the office, shop or field	73%	66%	55%	53%	73%	70%
Integration of analysis and code-based design with 3D models*	63%	66%	48%	47%	53%	61%
Ability to visually simulate project delivery timelines for estimation and coordination	52%	63%	39%	53%	57%	61%

# Harnessing the Technology Innovation Revolution

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3. Embrace generative and computational design

# Harnessing the Technology Innovation Revolution

Commonly used in product design

- *set parameters and constraints*
- *the computer analyzes 1000's of feasible options*

Optimize the solution  
within parameters  
and constraints



## Insight Capabilities for Generating Design Options

<b>1</b>	Early-stage sketching that connects conceptual design to BIM with smart objects that flow into later stages of design
<b>2</b>	Early-stage sketching that uses constructability constraints and building-code requirements to drive geometry and behavior of design models
<b>3</b>	Creating visual logic to explore parametric conceptual designs and automate tasks
<b>4</b>	Using generative design to cycle through thousands of design choices, testing configurations and developing more sophisticated solutions through multiple iterations
<b>5</b>	Incorporating reality capture to document existing conditions more accurately
<b>6</b>	Integrating design options with GIS data to more fully represent the contextual environment



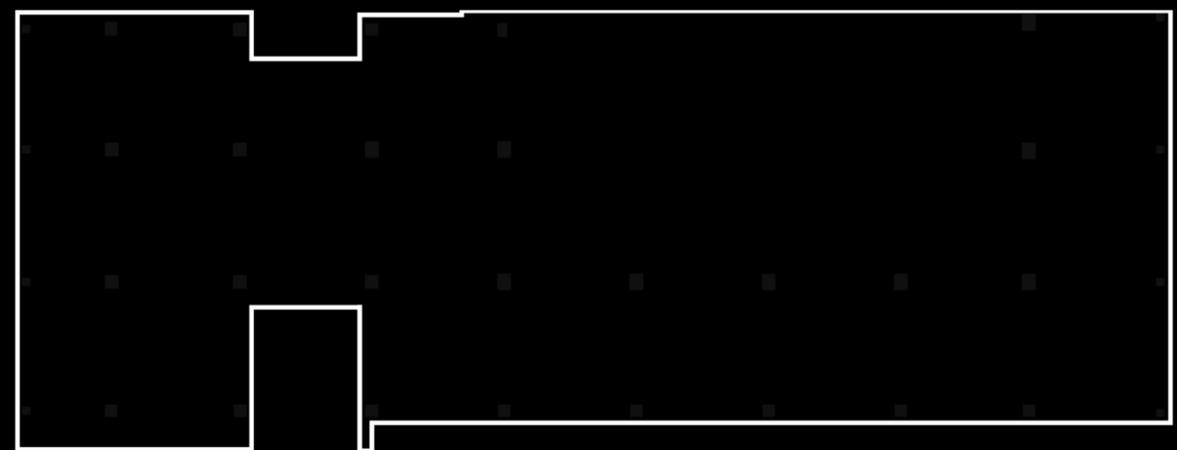
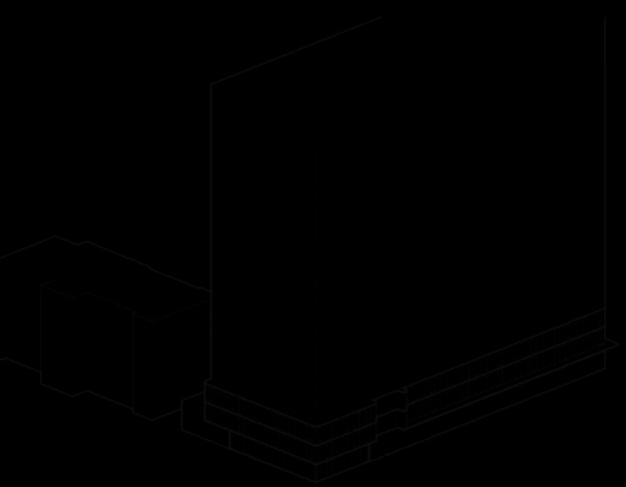
Dynamo



Filter

-  **Creased Tower + Plinth** a week ago
-  **Grid of Panels** a week ago
-  **Helix Parking Structure** Thu Nov 26 21:32:56 2015
-  **Twisting Denver Tower** Wed Nov 25 12:27:39 2015
-  **Rotated Twister** Tue Nov 24 22:01:47 2015
-  **Circle Wall Arc** Sat Nov 21 10:40:05 2015







**MTHøjgaard**

**Computational Design & Construction**

**Parking Garage Configurator**



**Sale | Client | Concept model**



**Explore | Alternatives | Optimization**



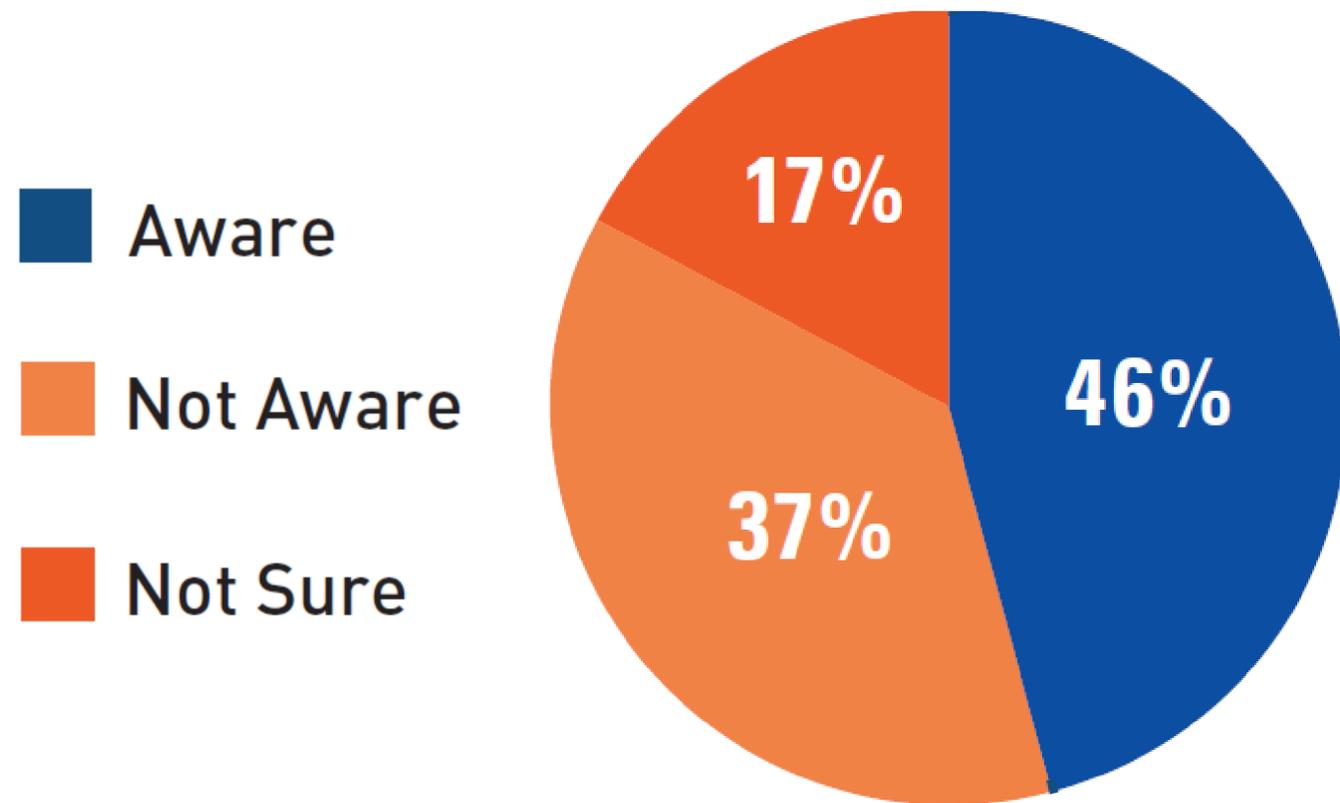
**Documentation | Detail | BIM model**



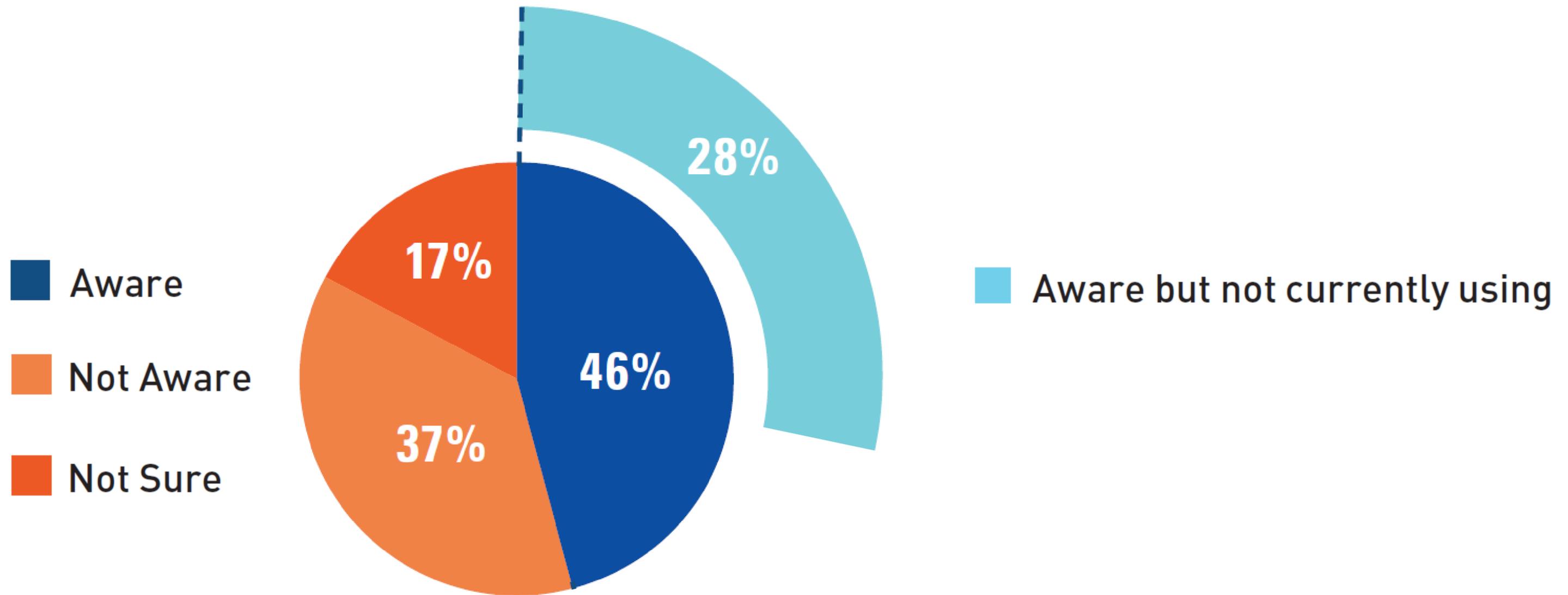
## **Construction Planning & Execution**

# Awareness and Use of Generative Design

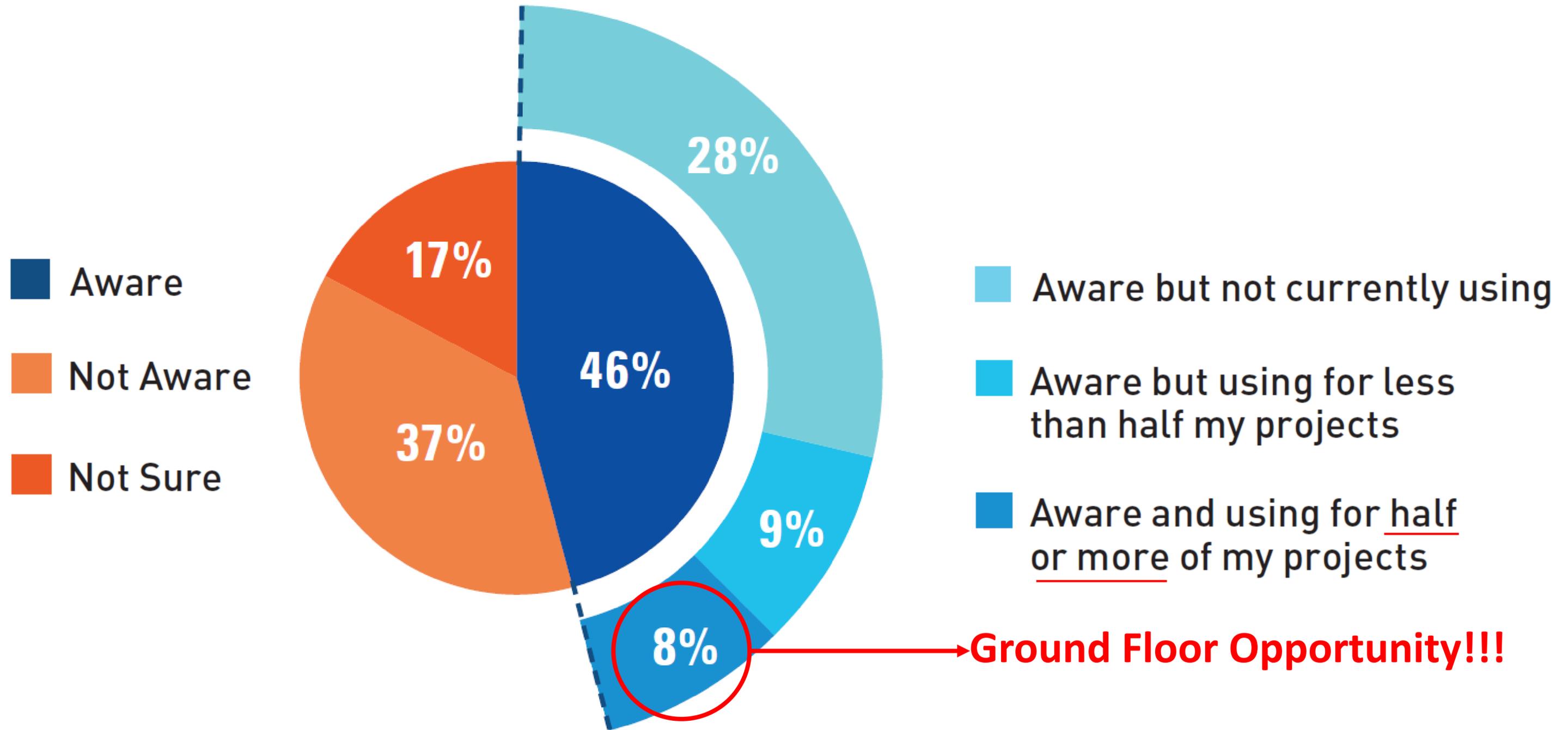
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# Awareness and Use of Generative Design



# Awareness and Use of Generative Design



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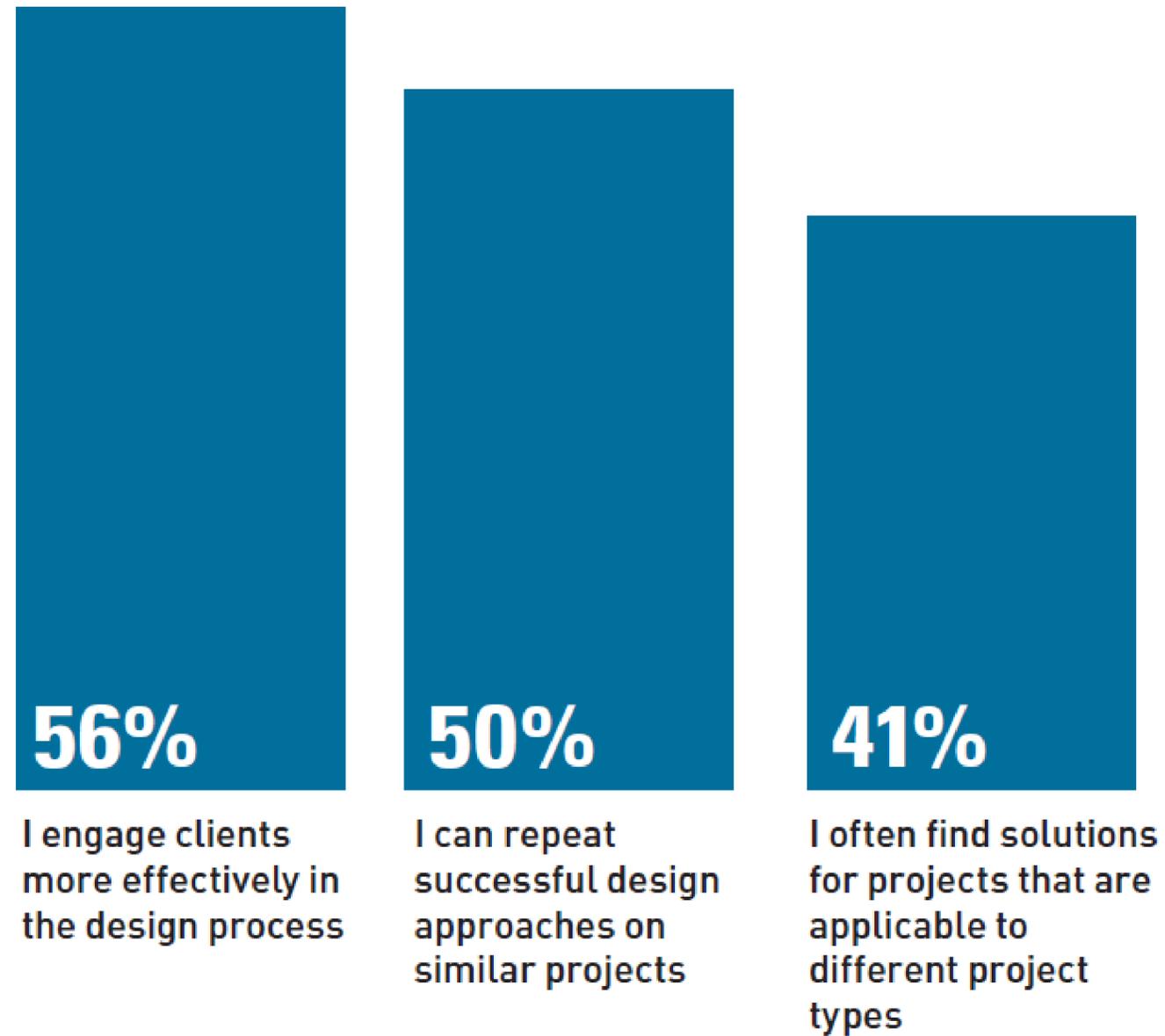
## 3. Embrace generative and computational design

- WHY? Better Outcomes
-

## Impact on Design Process

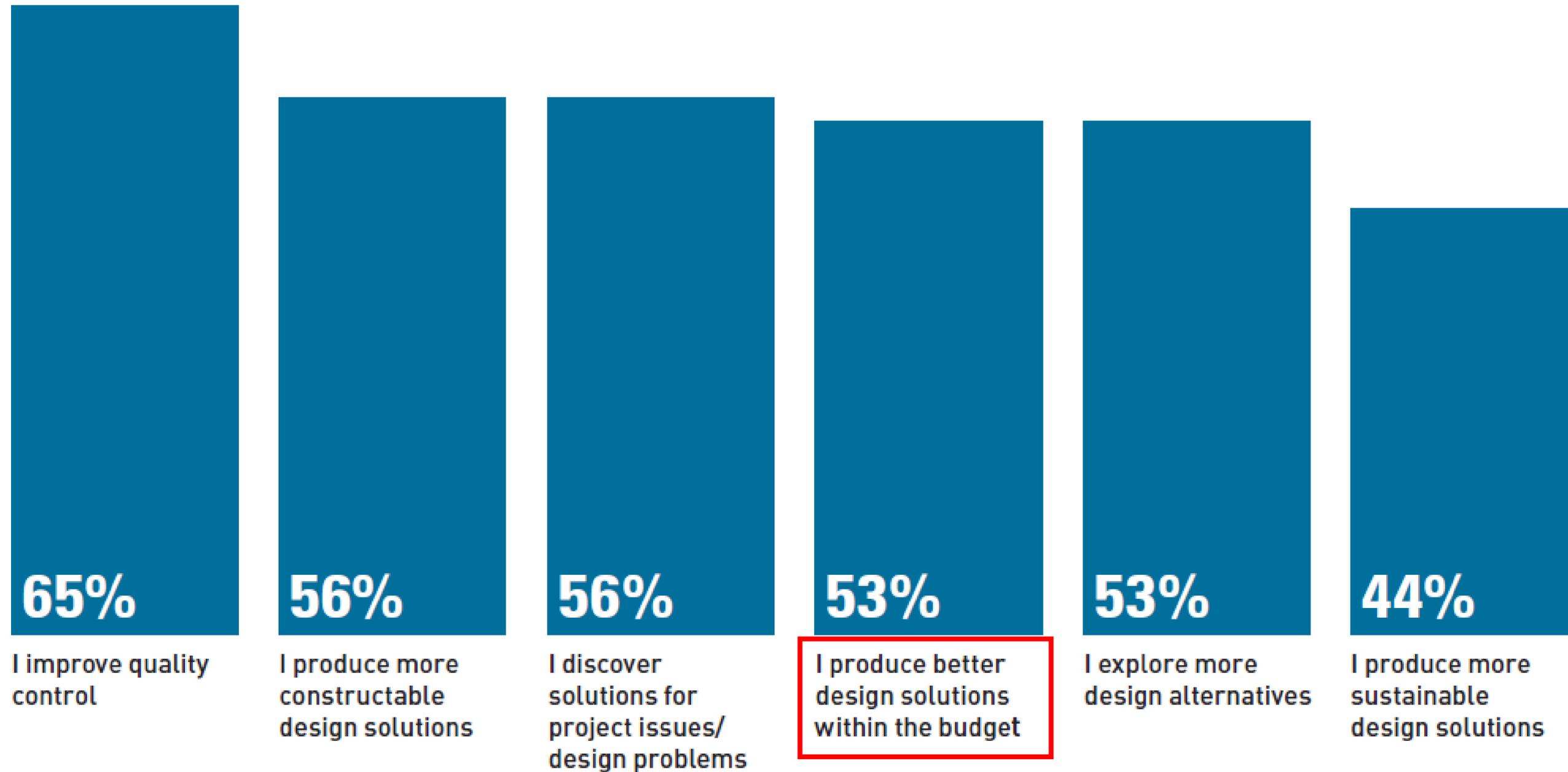
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Percentage of users reporting high or very high level of benefit



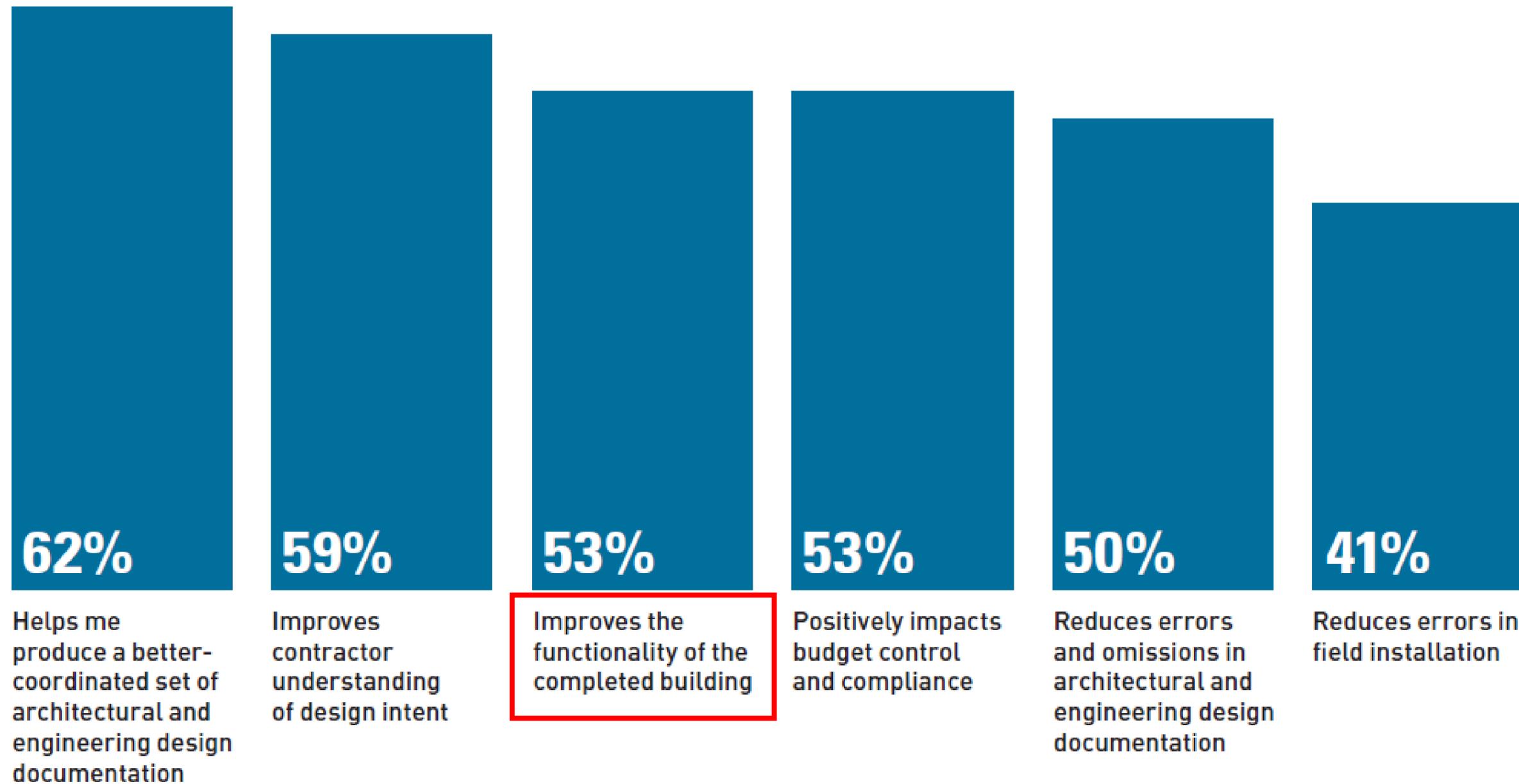
## Impact on Design Solutions

Percentage of users reporting high or very high level of benefit



## Impact on Production, Construction and Operation

Percentage of users reporting high or very high level of benefit



# Harnessing the Technology Innovation Revolution

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BIM teams & requirements

**60%**

The ***NEW***

Integrated digital workflows

**30%**

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Generative design

**10%**

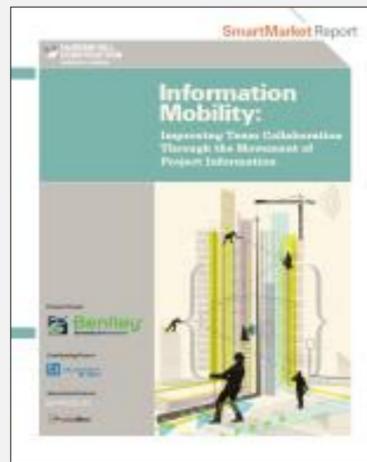
**Resources  
and  
Attention**

# Dodge Data & Analytics Research on Trends

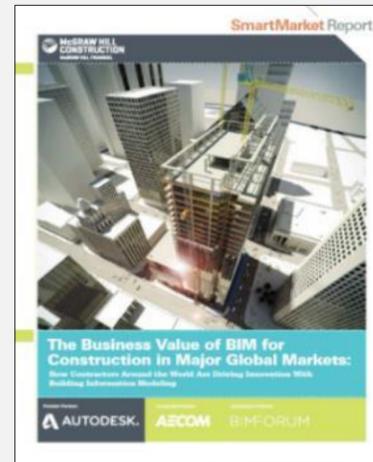
free at:  
[construction.com/toolkit](http://construction.com/toolkit)

## TECHNOLOGY/INNOVATION

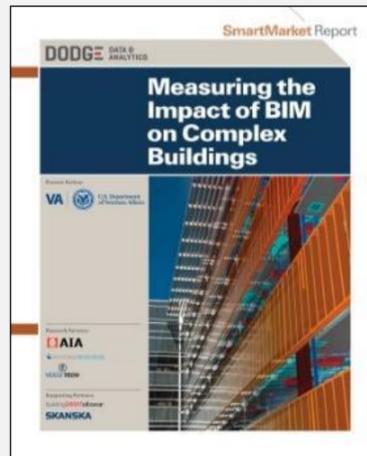
Information Mobility



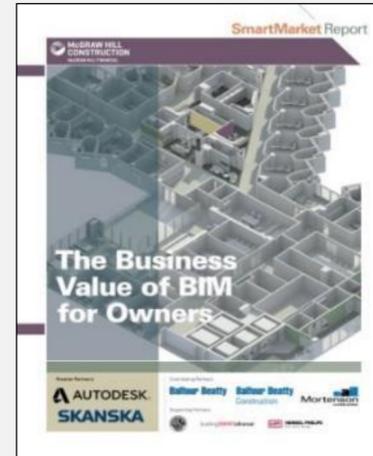
BIM for Contractors



Measuring BIM

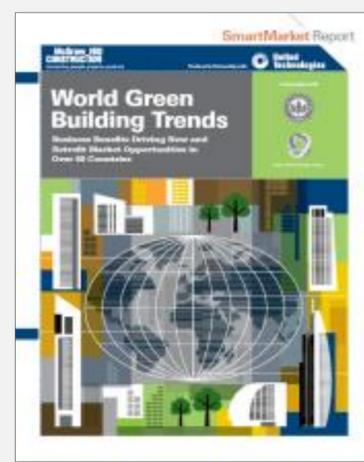


BIM for Owners

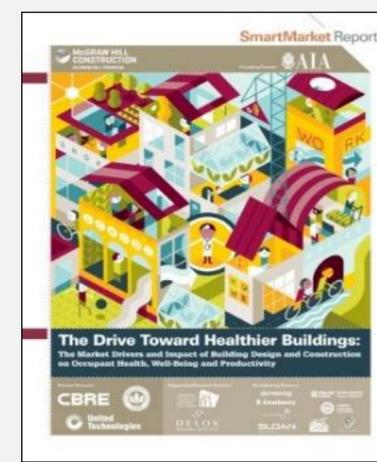


## SUSTAINABILITY

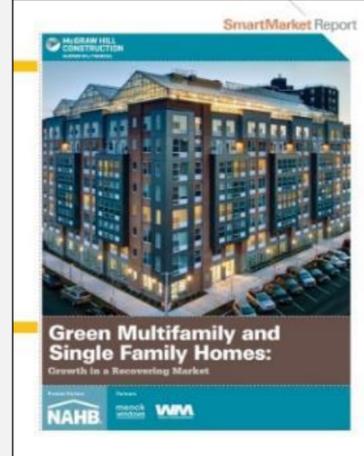
World Green Trends



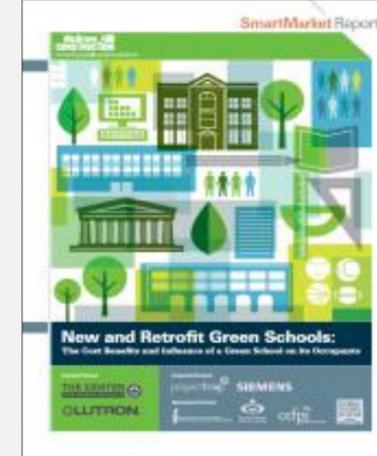
Design for Health



Green Homes

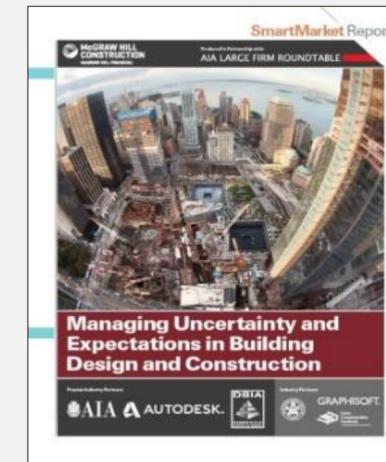


Green Schools

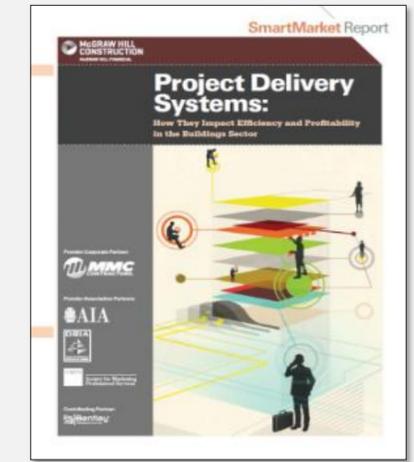


## PRACTICES/PROCESSES

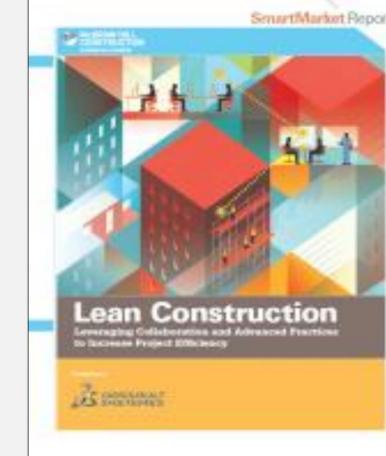
Managing Uncertainty



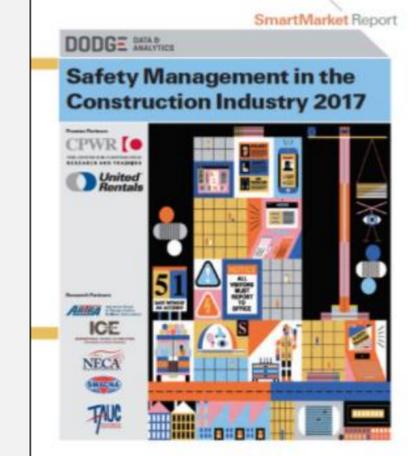
Project Delivery Systems



Lean



Safety (3x)



Thank you!

# Town Hall Discussion

# Town Hall Discussion

Stephen Hagan FAIA

- President | CEO, Hagan Technologies
- Principal, Construction Data Ventures

Kimon Onuma FAIA

- President, Onuma, Inc.

Jonathan Widney

- Principal, Construction Data Ventures

Steve Jones

- Senior Director, Dodge Data & Analytics



# Contact Information



**Role: Session Organizer; Moderator**

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President | CEO

Hagan Technologies, LLC

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**Role: Panelist**

Jonathan Widney

Principal

Construction Data Ventures

Email: [jonathan.widney@gmail.com](mailto:jonathan.widney@gmail.com)

Office Telephone: [\(480\) 250-4626](tel:(480)250-4626)

Cell Phone: [\(480\) 250-4626](tel:(480)250-4626)



**Role: Panelist**

Kimon Onuma, FAIA

President

Onuma, Inc.

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Cell Phone: [\(626\) 644-9920](tel:(626)644-9920)



**Role: Panelist**

Steve Jones

Senior Director

Dodge Data & Analytics

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Cell Phone: [\(610\) 505-0359](tel:(610)505-0359)

# Architecture



as a Platform  
for the Urban Agenda  
6/21/2018 9:45 AM - 11:15 AM

Thank you!



# Harness the Technology Innovation Revolution

Course Number TH204

Thursday, June 21, 2018, 7:30 AM – 9:00 AM

Learning Units 1.5 LU RIBA