U.S. Department of Transportation

Federal Highway Administration

Building Information Modeling (BIM) for Infrastructure

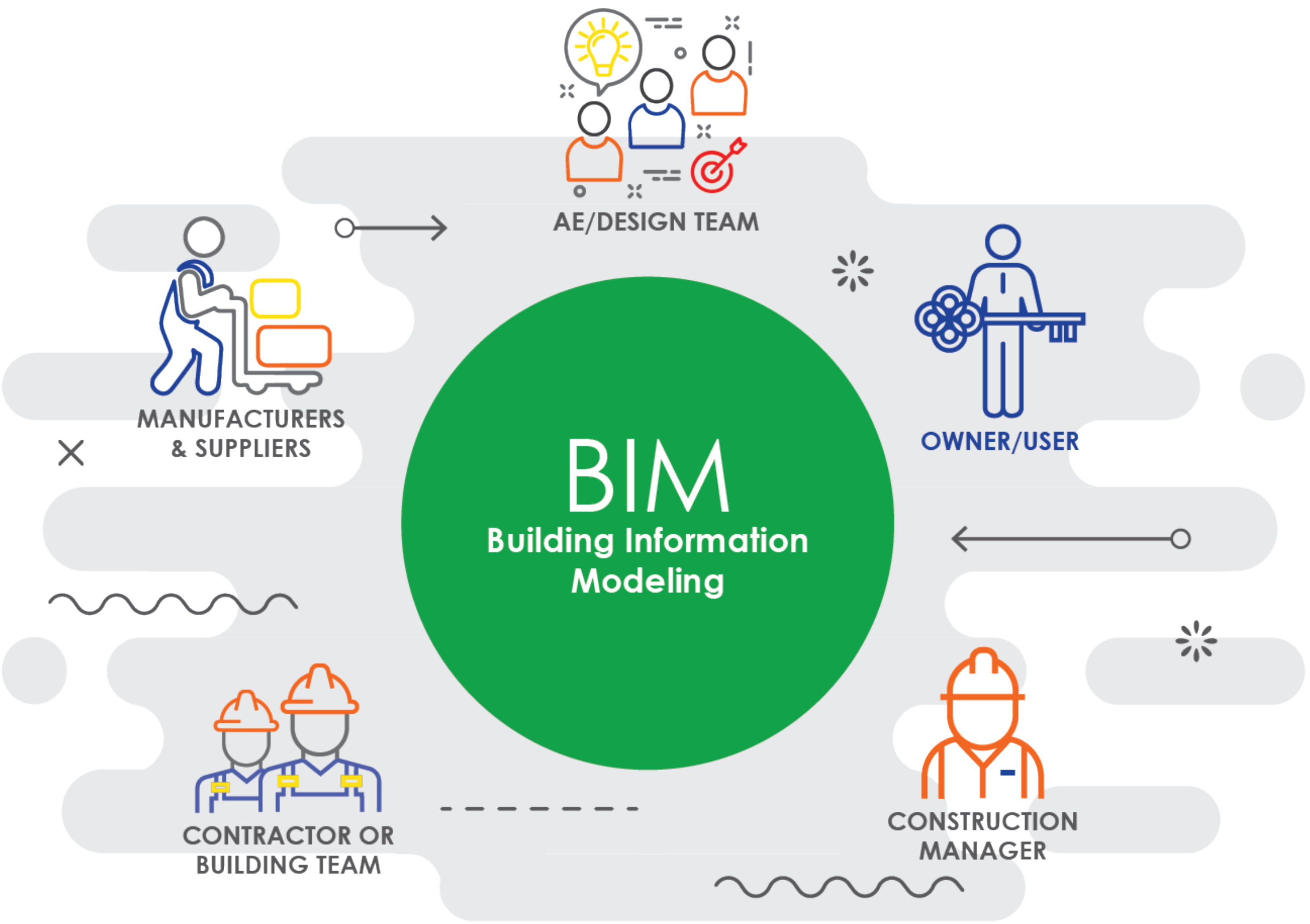
An Administrative View

Agenda

- Concepts of BIM for Infrastructure
- State DOT example projects to date
- Business value of BIM for Infrastructure
- Lessons learned

Concept of BIM for Infrastructure

- BIM means build it twice, once virtually
- Digital representation of the physical and functional characteristics of an infrastructure asset
- The process of developing a precise, data rich, virtual 3D representation of existing and proposed elements belonging to a programmed construction project
- Serves as a shared knowledge resource for information about an infrastructure asset
- Basic premise: Collaboration by different stakeholders at different phases of the life cycle of an infrastructure asset (insert, extract, update or modify information)



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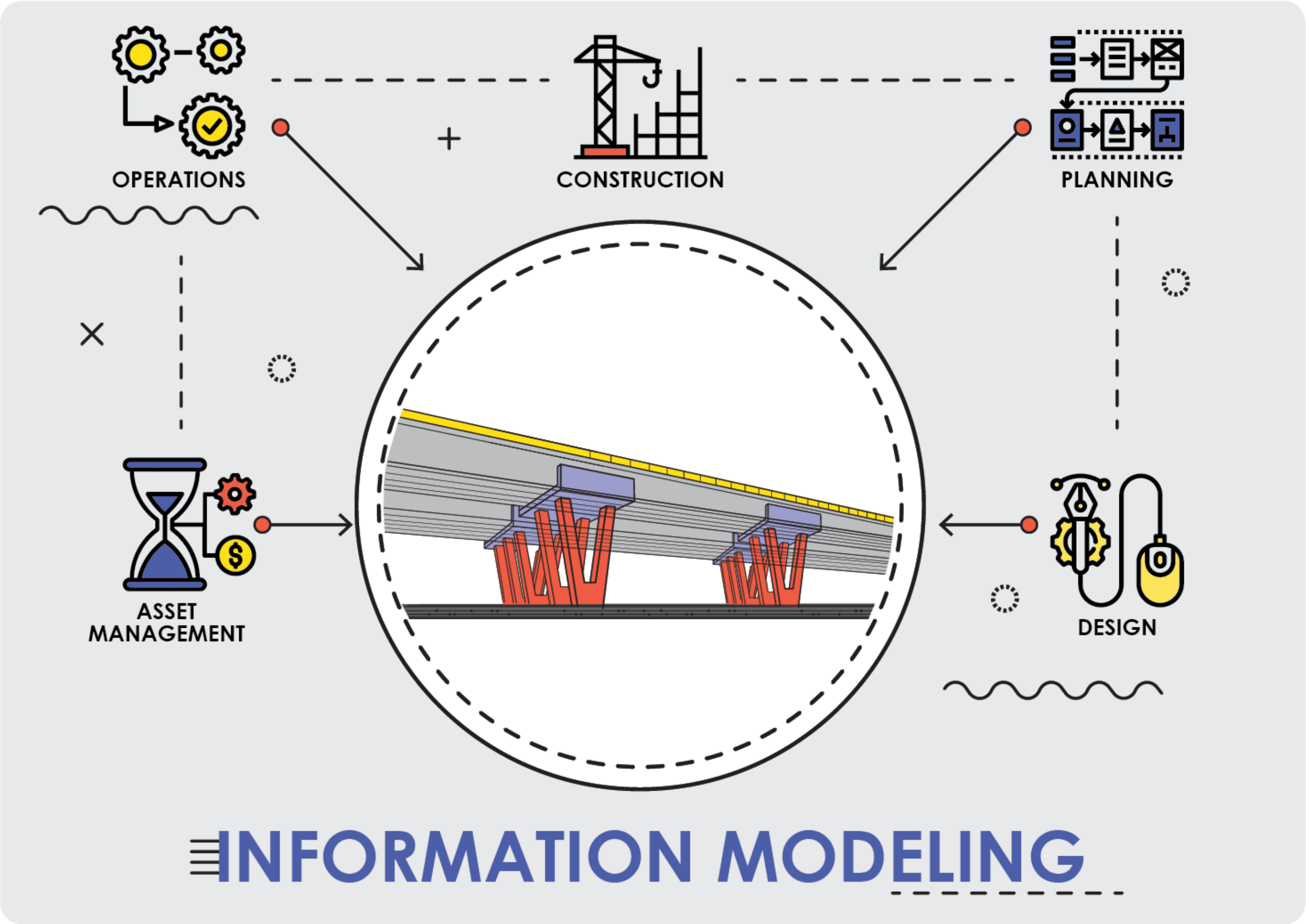
Information Modeling



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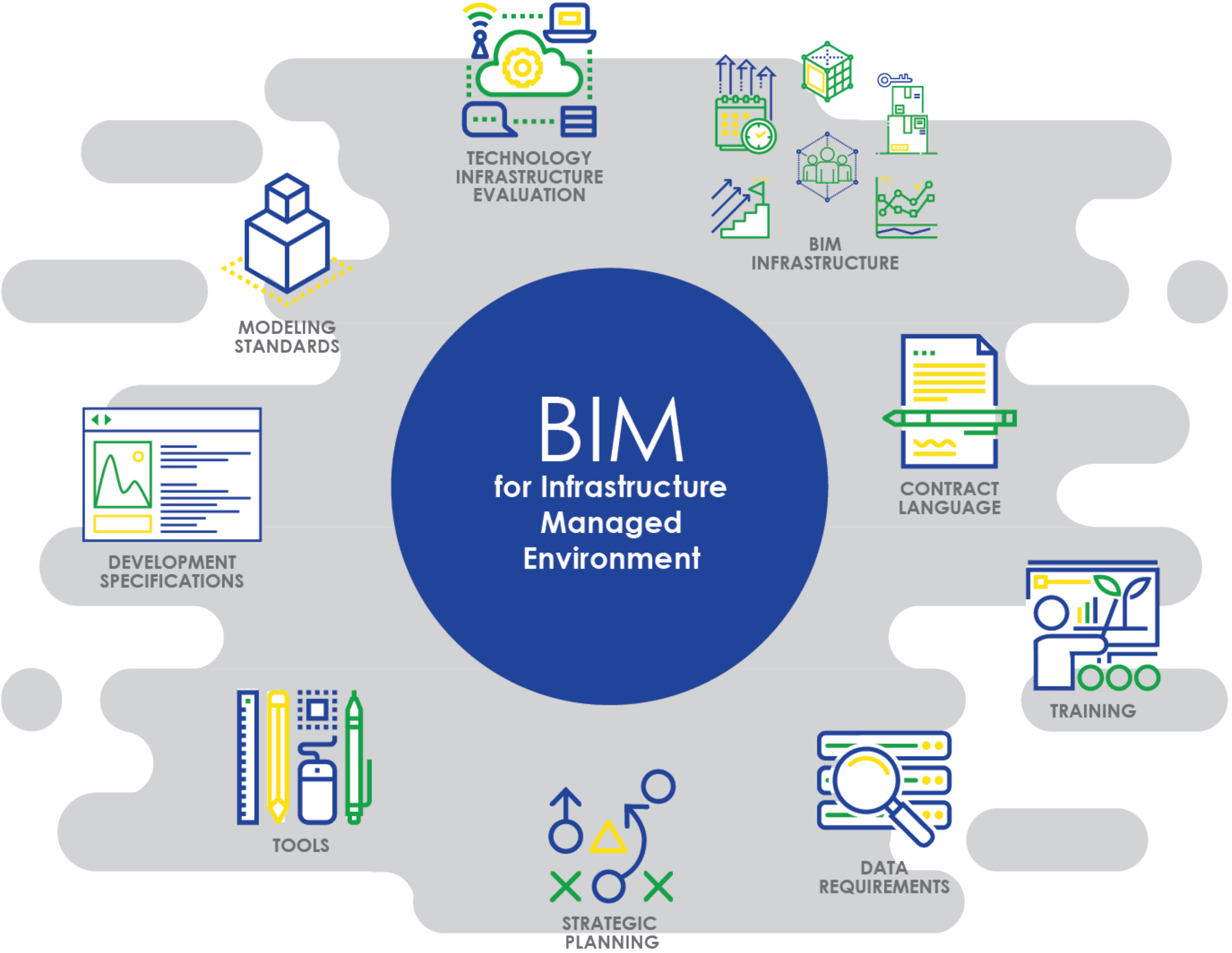
BIM for Infrastructure: The Environment

Critical factors for success:

- Clear and precise contract language
- A strategically planned and well-managed common data environment
- Owner originated data requirements
- Modeling voluntary standards that are not regulatory in nature



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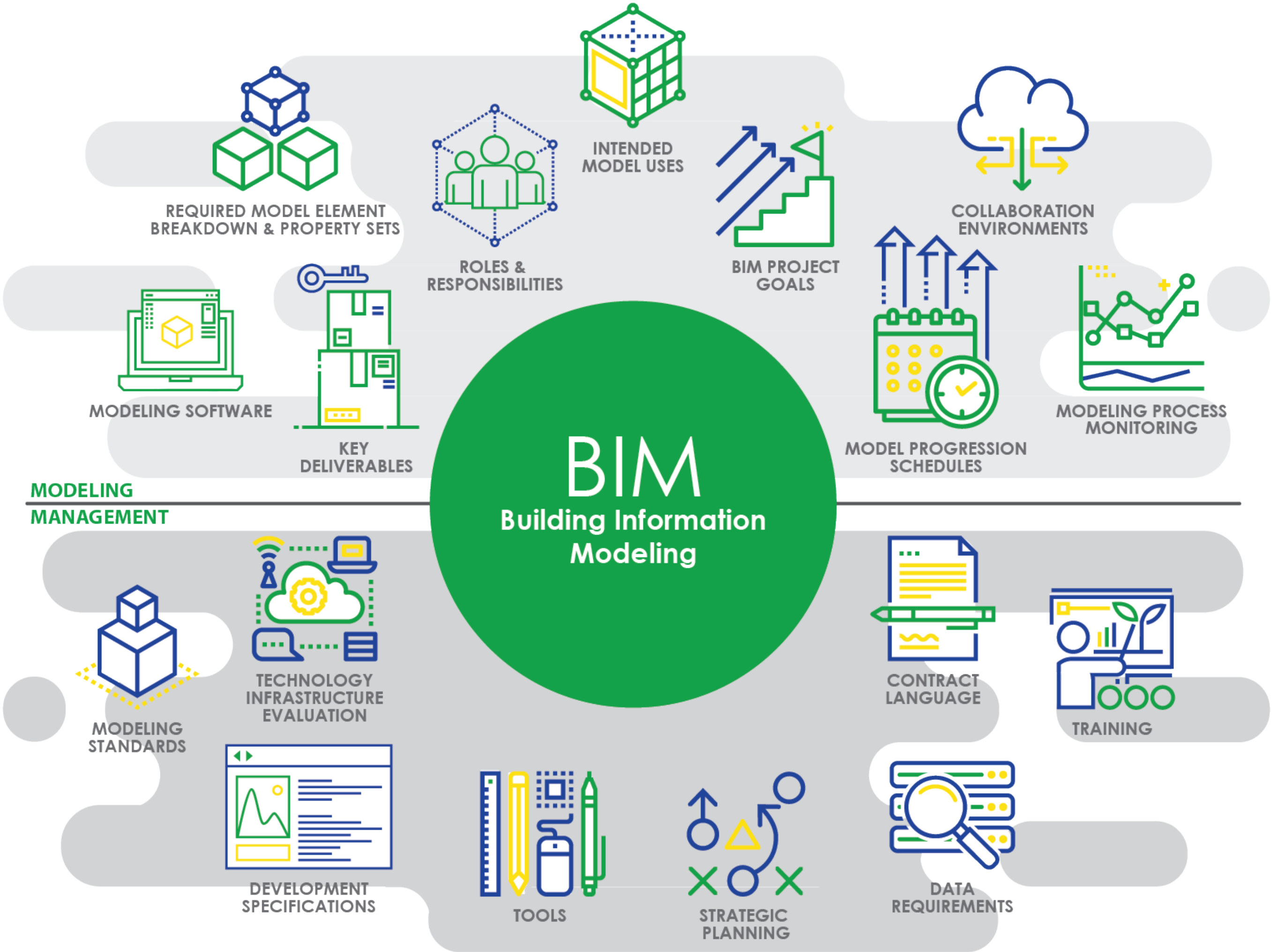
Note: The data requirements and modeling standards are voluntary and are not required or enforceable under Federal statute or FHWA regulations.

Building Information Modeling



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Note: The implementation of BIM is not required under Federal statute or FHWA regulations.

BIM Project Execution Planning Guide

- Overview of the project execution planning procedure for BIM
- Identifying BIM goals and uses for a project
- Designing the BIM project execution process
- Developing information exchanges
- Define supporting infrastructure for BIM implementation

These steps are not required under Federal statute or FHWA regulations.

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Image: Penn State University, used with permission

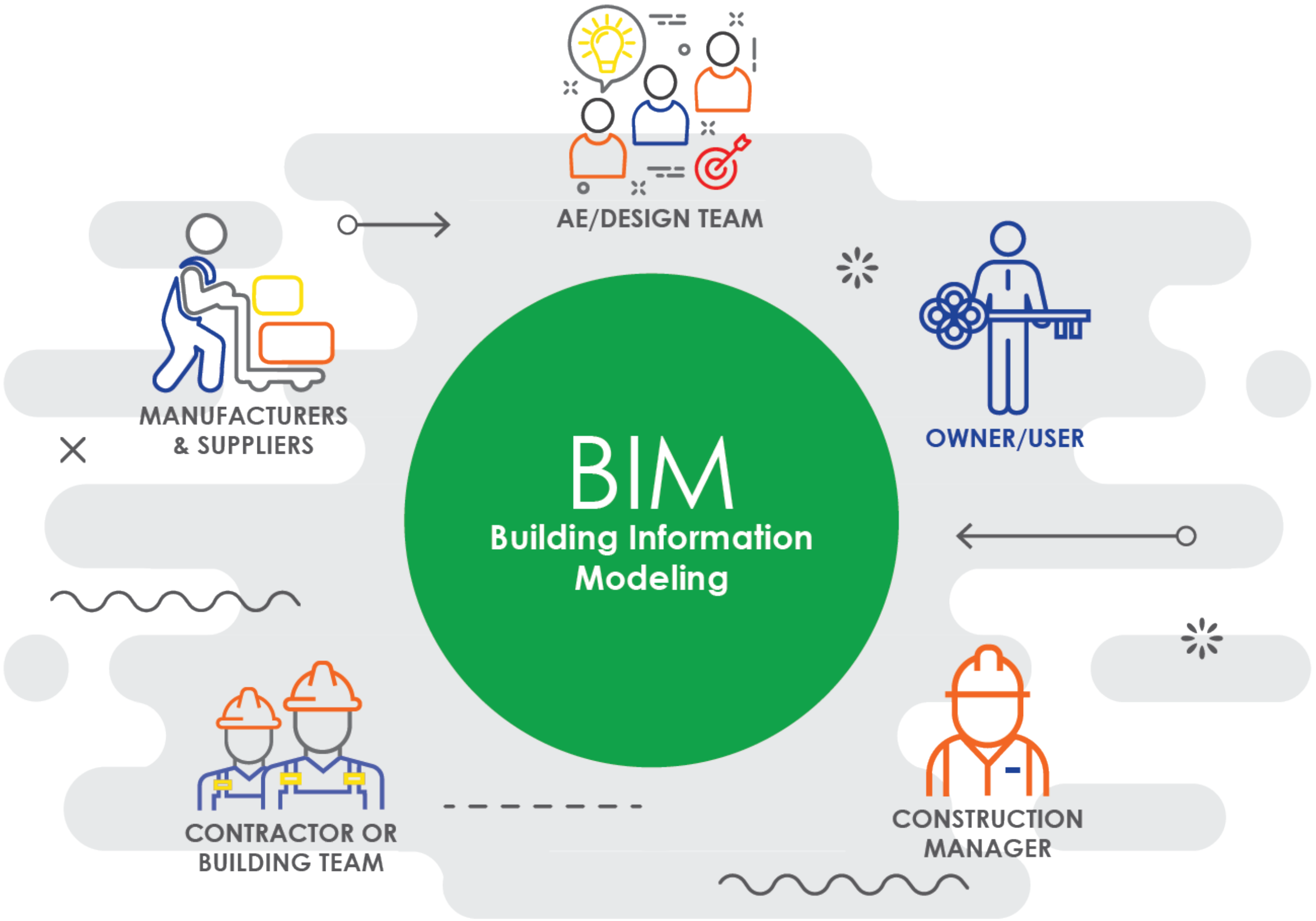
http://bim.psu.edu/bim_project_execution_planning_guide/bim-project-execution-planning-guide.html, *BIM Project Execution Planning Guide*, Version 2.1, CIC-Penn State University, 2011

Challenges

- Initial acceptance
- Change management
- Training program development
- Technology investment

Why Use BIM for Infrastructure?

- Application of innovative technologies, practices, and solutions on the rise for highway project delivery
- A wide range of technologies to improve predictability, performance, transparency (Planning to Operations and Maintenance)
- It's time to analyze and understand the technology adoption at the agency-level, in its entirety!



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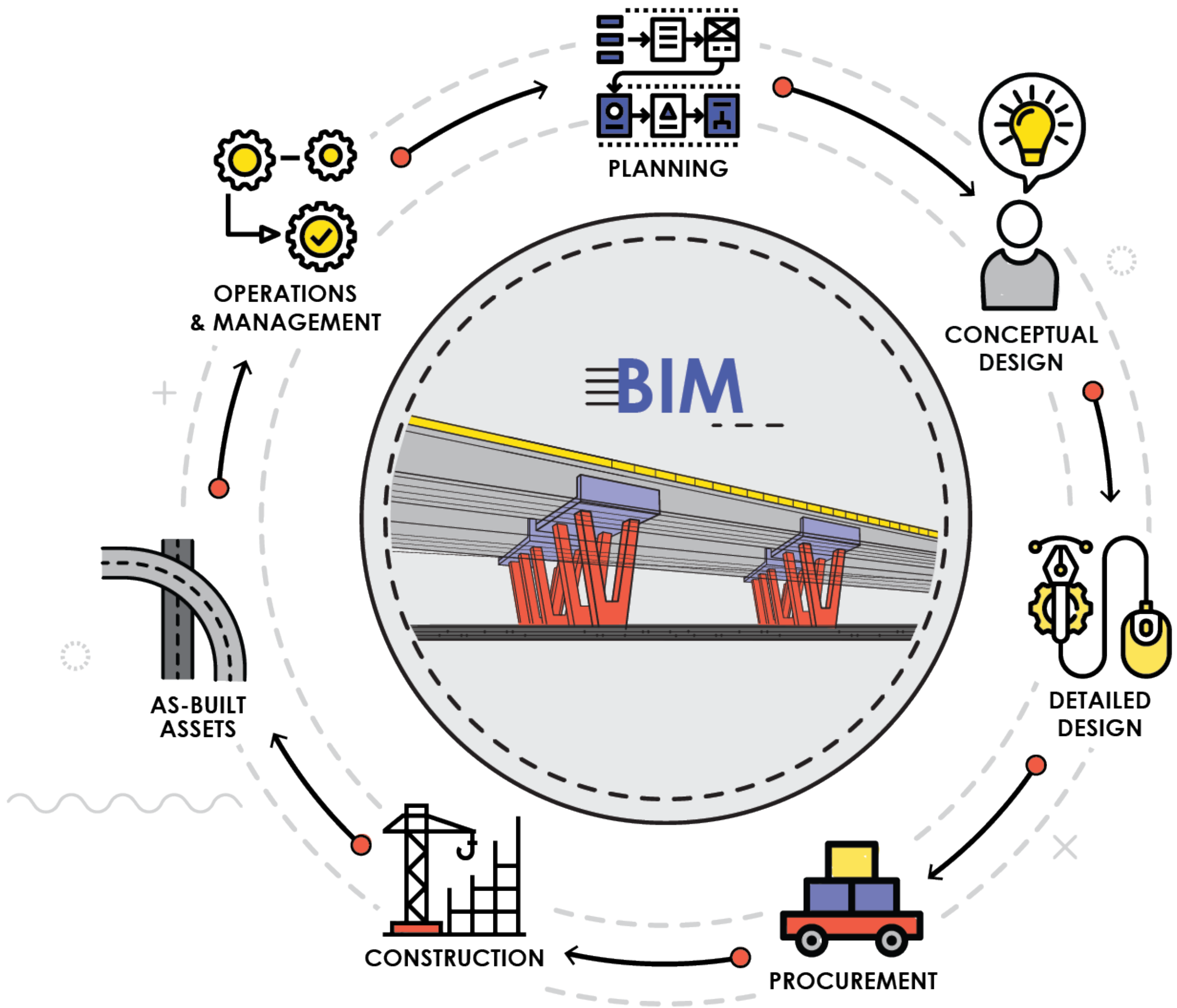
BIM for Infrastructure Life Cycle



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Example Projects

Iowa DOT

Michigan DOT

New York State DOT

Oregon DOT (Selwood Bridge)

Oregon DOT (Selwood Bridge Detour)

Texas DOT

Connecticut DOT

Wisconsin DOT

Iowa DOT

Location:

- Statewide 3D-engineered model development program

Primary Goal/Focus for Program:

- Use of 3D models for visualization and constructability reviews

Technology Used:

- Discipline-specific 3D models
- Digital delivery

BIM Uses Applied:

- 4D schedule integration
- Visualization
- 3D coordination (clash detection)

Lessons Learned:

- 3D visualizations provided by the contractor for constructability during this five-year project resulted in positive feedback from DOT staff

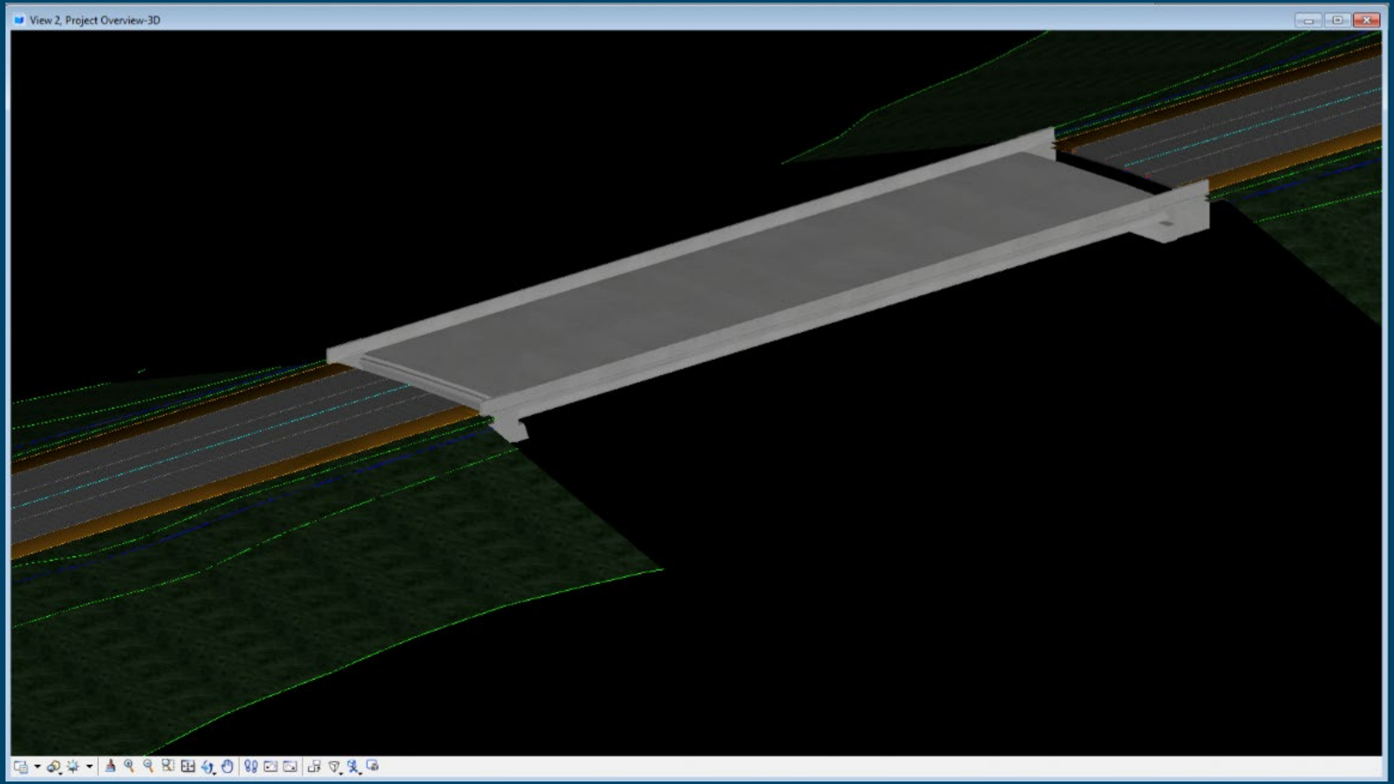


Image: Iowa DOT, used with permission

Michigan DOT

Location:

- Statewide 3D engineered model development program

Primary Goal/Focus for Program:

- Use of 3D models for visualization and constructability reviews
- Surface modeling for automated machine guidance

Technology Used:

- Discipline specific 3D models
- Existing conditions modeling

BIM Uses Applied:

- 4D schedule integration
- 3D coordination (clash detection)

Lessons Learned:

- Clash detection and 3D visualizations provided efficiencies in determining constructability of the project

New York State DOT

Location:

- NY17/I-81 Interchange and the Kosciuszko Bridge

Primary Goal/Focus for Program:

- Use of 3D models for visualization

Technology Used:

- Discipline-specific 3D models

BIM Uses Applied:

- 3D model authoring
- Visualization

Lessons Learned:

- Visualization and 3D coordination performed during design phase provided cost saving/avoidance during construction activities

Oregon DOT Selwood Bridge

Location:

- Statewide 3D engineered model development program

Primary Goal/Focus for Program:

- Use of 3D models for visualization and constructability reviews
- Surface modeling for automated machine guidance

Technology Used:

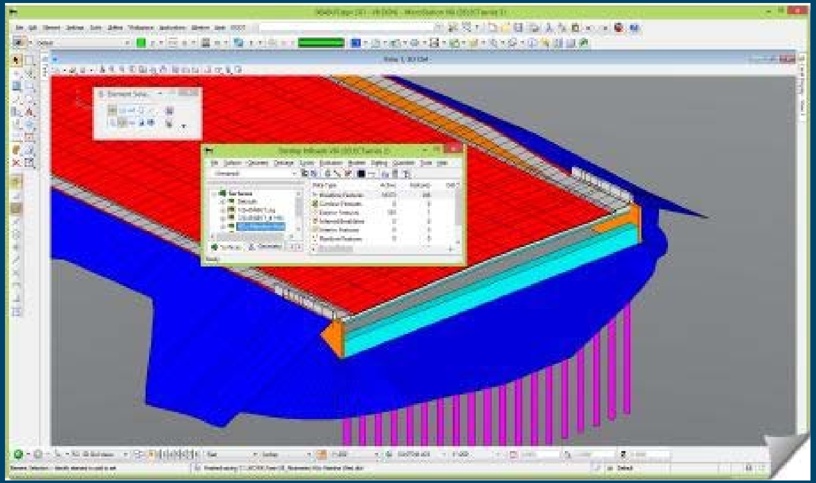
- Discipline specific 3D models
- Existing conditions modeling
- Digital delivery

BIM Uses Applied:

- 4D schedule integration
- 3D coordination (clash detection)

Lessons Learned:

- Clash detection and 3D visualizations provided efficiencies in determining constructability of the project



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Images: Oregon DOT, used with permission
https://www.oregon.gov/ODOT/ETA/Pages/3D-Design.aspx

Oregon DOT (Selwood Bridge Detour)

Location:

- Sellwood Bridge, Portland, OR

Primary Goal/Focus for Program:

- Use of 3D models for visualization and constructability reviews

Technology Used:

- Discipline-specific 3D models
- Visualization, video

BIM Uses Applied:

- Visualization
- 3D coordination

Lessons Learned:

- 3D visualizations provided the platform to propose a less expensive, faster, more efficient and safer approach to construct the project.

Images: Slayden Sundt, A Joint Venture, used with permission
https://www.autodesk.com/solutions/bim/hub/bim-reduces-cost-sellwood-bridge-project

Texas DOT

Location:
- Horseshoe Project I-35/I-30 Interchange, Dallas, TX

Primary Goal/Focus for Program:
- Use of 3D models for visualization

Technology Used:
- Discipline-specific 3D models

BIM Uses Applied:
- 3D model authoring
- Visualization

Lessons Learned:
- 3D visualizations provided by the contractor for constructability during this five-year project resulted in positive feedback from DOT staff

Connecticut DOT

Location:
- I-95 New Haven Harbor Crossing

Primary Goal/Focus for Program:
- Use of 3D models for visualization

Technology Used:
- Discipline-specific 3D models

BIM Uses Applied:
- 3D model authoring
- 4D schedule integration
- Visualization

Lessons Learned:
- 3D visualization and 4D schedule integration provided clarity to the owner and public

Wisconsin DOT

Location:

- Zoo interchange I-94 / I-41 / I-894 corridors

Construction Schedule/Project Cost:

- 2013-2018 (completed) / $1.7B

Primary Goals/Focus for Project/Program:

- Electronic project delivery
- 3D models used for AMG/grading/paving/structures/utilities
- Conflict/issue resolution in design to reduce costs in field

Technology Used:

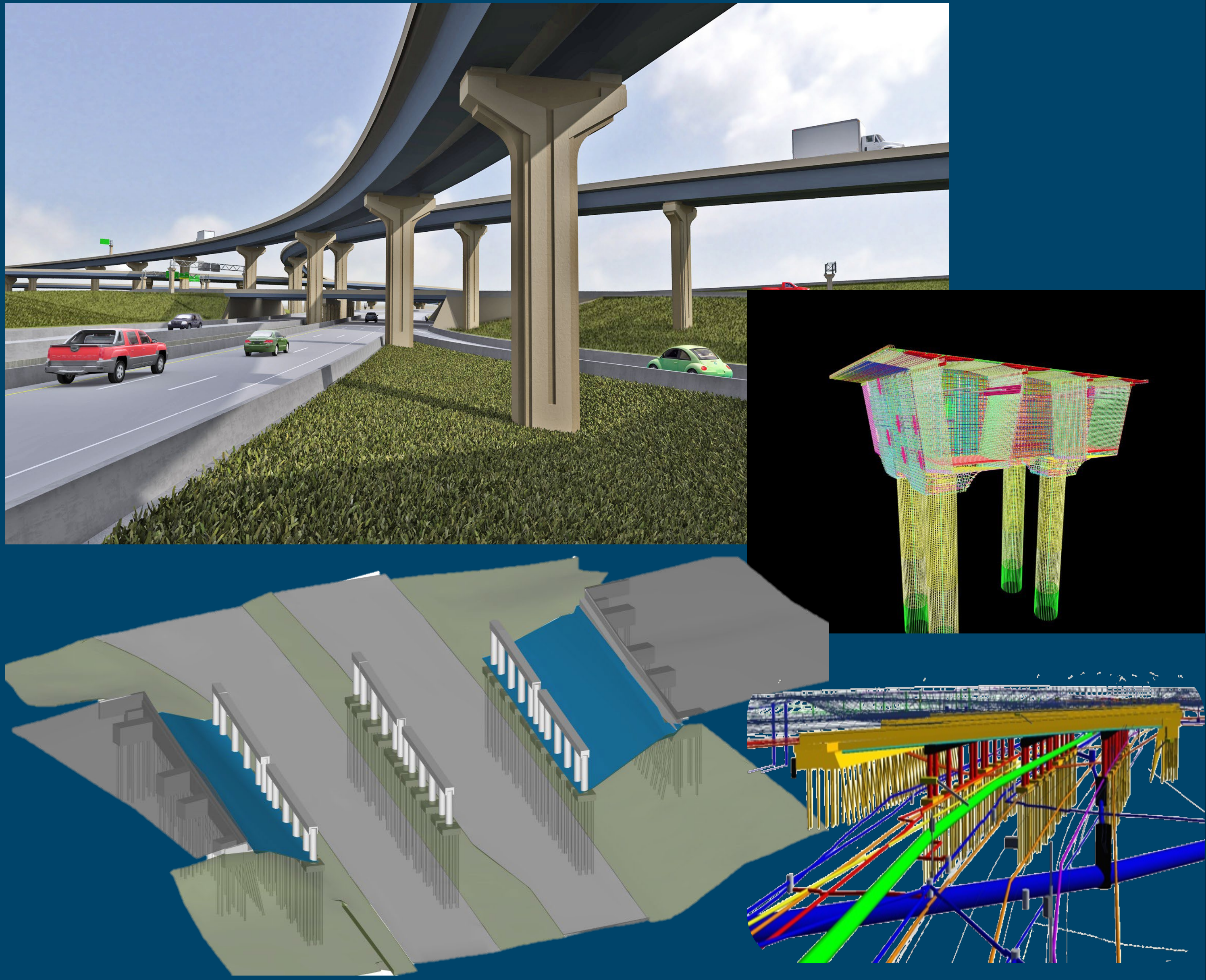
- Full Discipline 3D Design Models
- Mobile-static LiDAR high-accuracy survey existing models
- Integrated CAD-BIM-GIS

BIM Uses Applied:

- 3D/4D design models including staged models
- 3D coordination for discipline clash detection/resolution
- Visualization and cloud-based design-construction reviews

Lessons Learned/ROI:

- 3D coordination and visualization reduced issues in field
- Cost savings/avoidance reduced change order/bid costs
- Plans quality improved and reduced schedule delays



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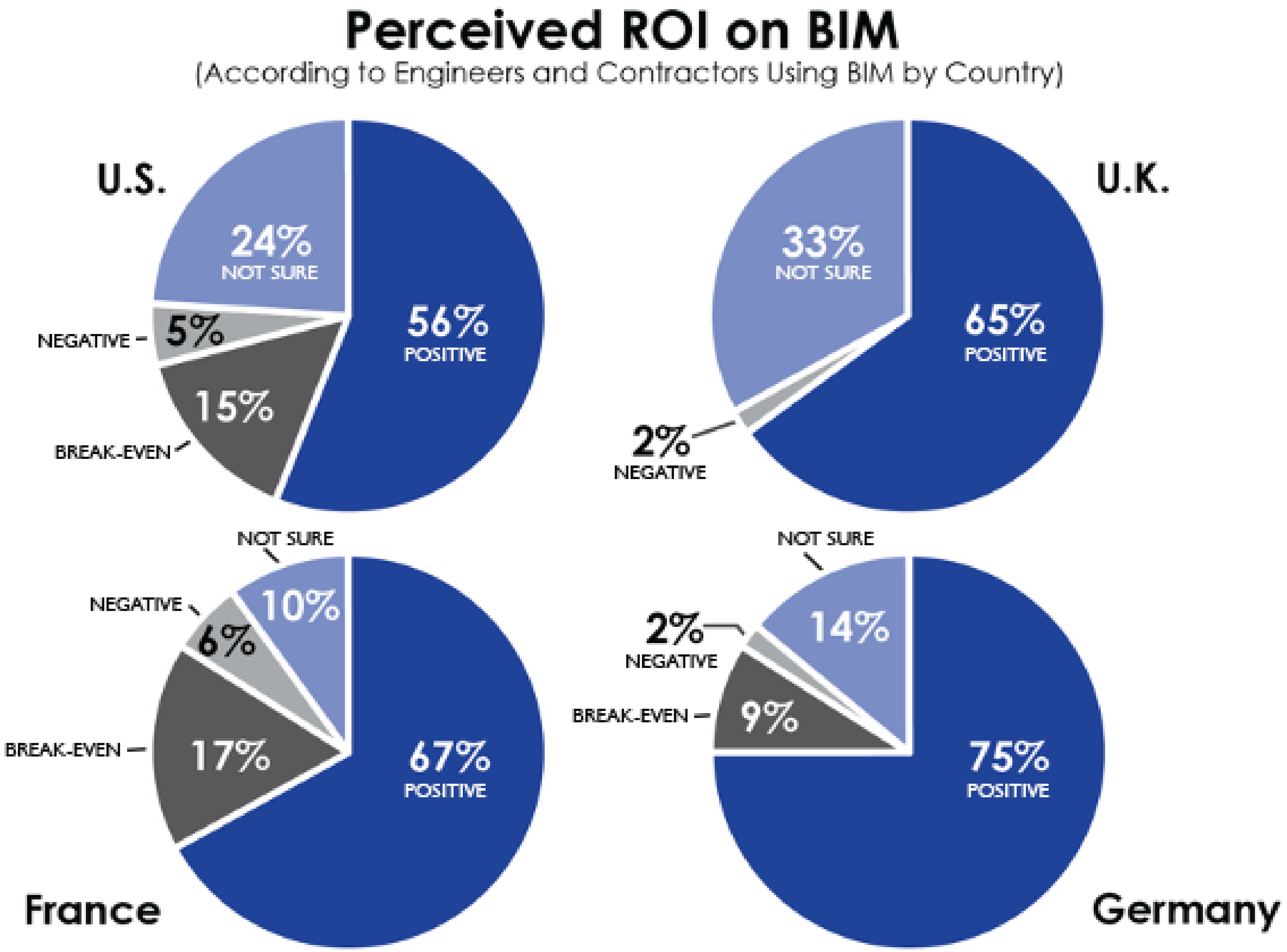
Business Value of BIM for Transportation Infrastructure



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After Laquidara-Carr, D. (managing editor). 2017. *SmartMarket Report: The Business Value of BIM for Infrastructure 2017*. Dodge Data & Analytics, Research & Analytics, Bedford, MA. https://www2.deloitte.com/ content/dam/Deloitte/us/Documents/finance/us-fas-bim-infrastructure.pdf.

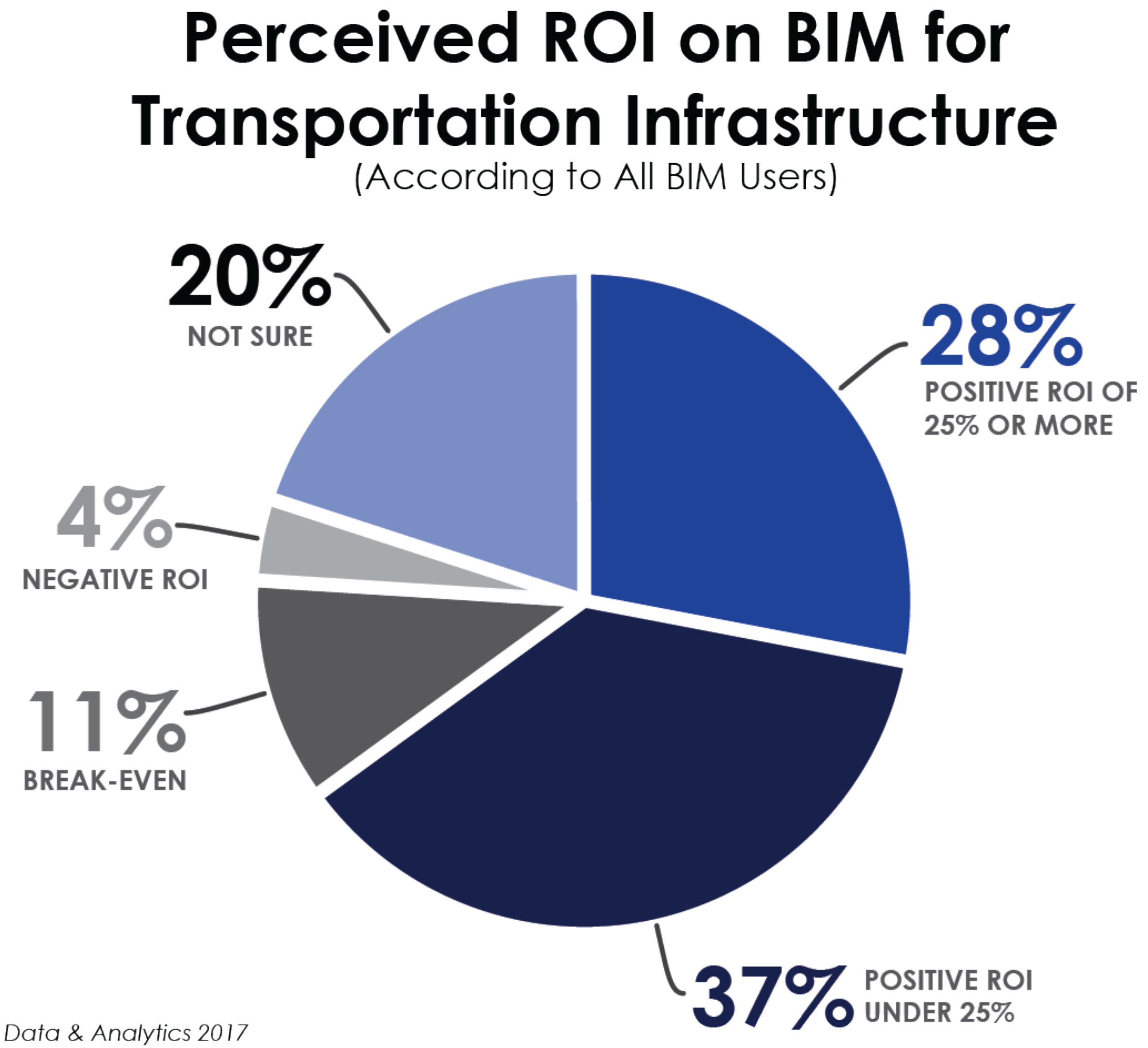
Business Value of BIM for Transportation Infrastructure

Nearly two thirds (65%) perceive that they get a positive ROI from their investment in BIM.

Includes all BIM users surveyed in the U.S., U.K., France, and Germany

U.S. Numbers:

- Positive, 56%
- Break-Even, 15%
- Negative, 5%
- Not Sure, 24%



Dodge Data & Analytics 2017

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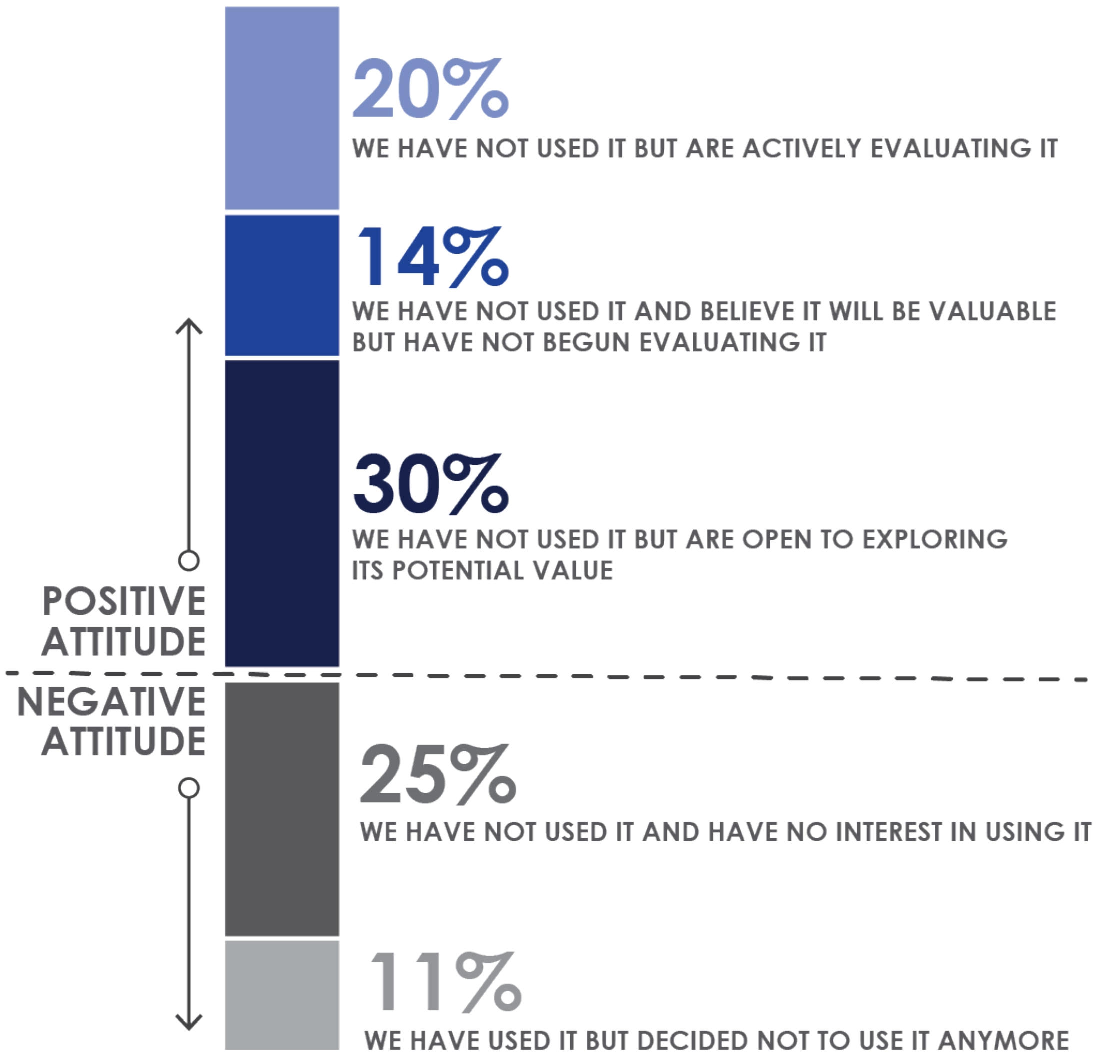
Business Value of BIM for Transportation Infrastructure

What is keeping companies away from BIM?

- Owners are not asking for it, 43%
- Cost required, 31%
- Less Efficient for small projects, 30%
- Training time required, 22%
- Lack of understanding, 21%
- Current software inadequate, 20%

Non-User Attitudes Toward BIM for Transportation Infrastructure Projects



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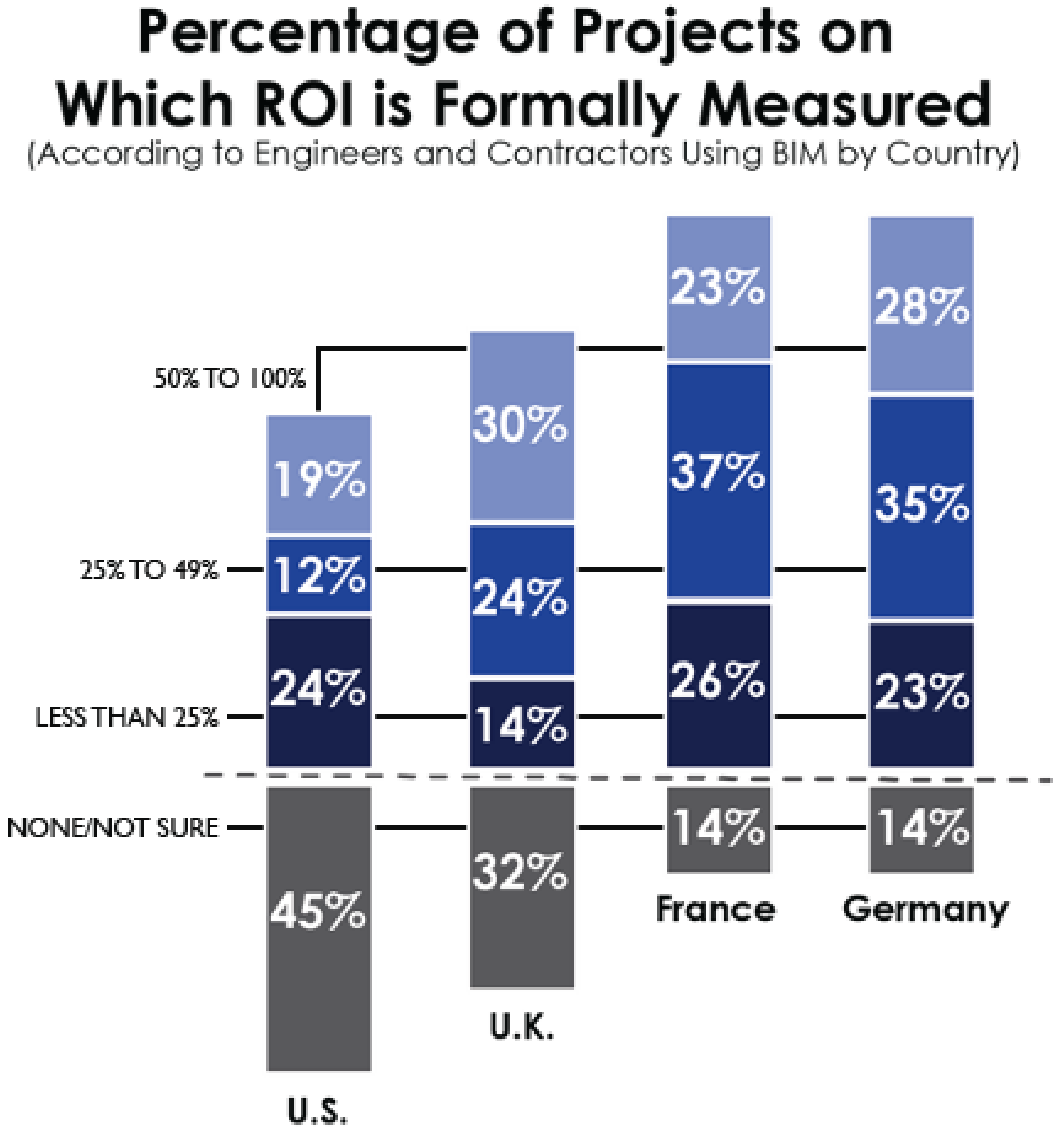
Business Value of BIM for Transportation Infrastructure

“Overall, 74% report that they do formally measure BIM ROI, and measurement occurs on average on about one third (34%) of their projects”

(Dodge Data & Analytics)



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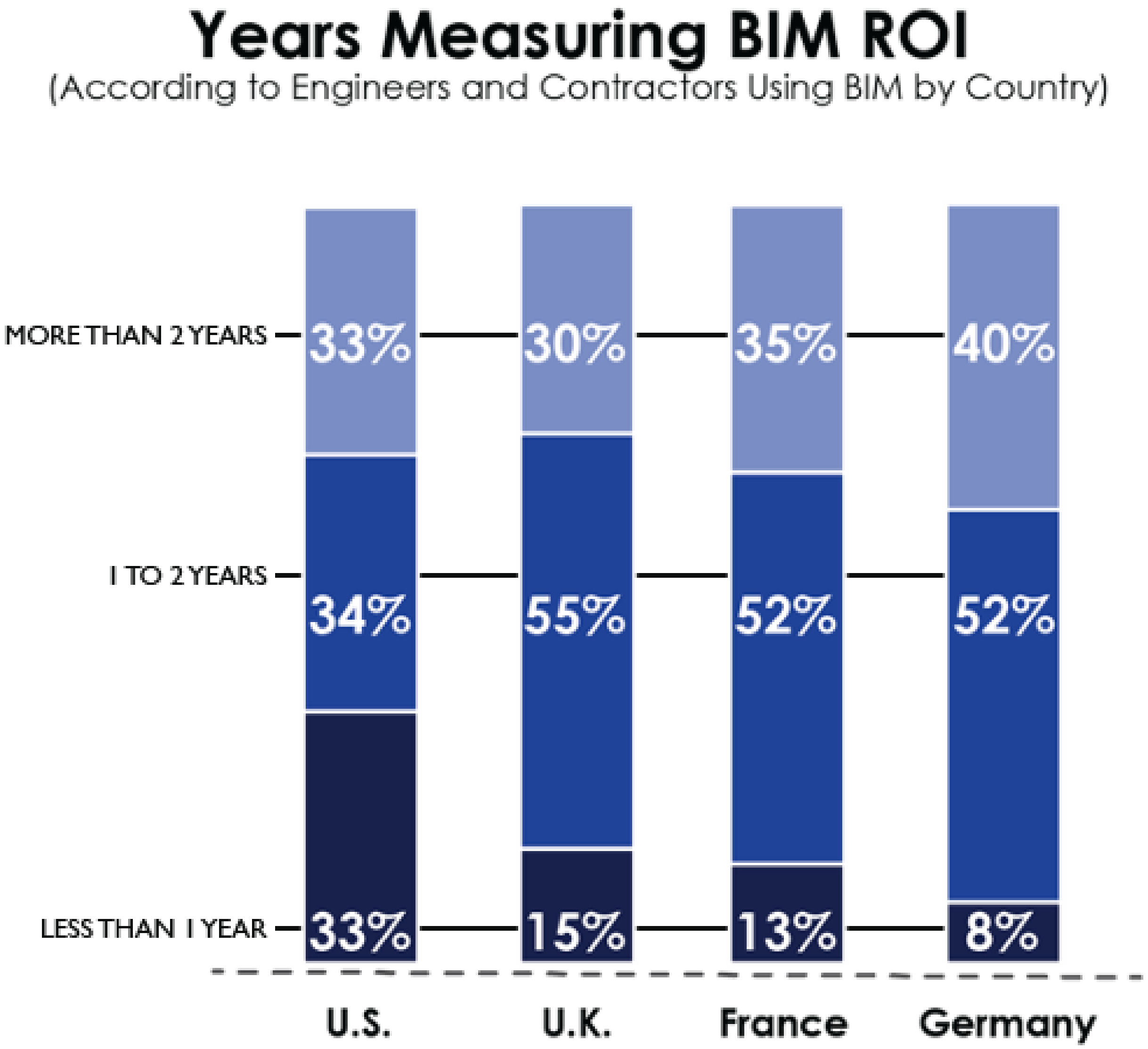

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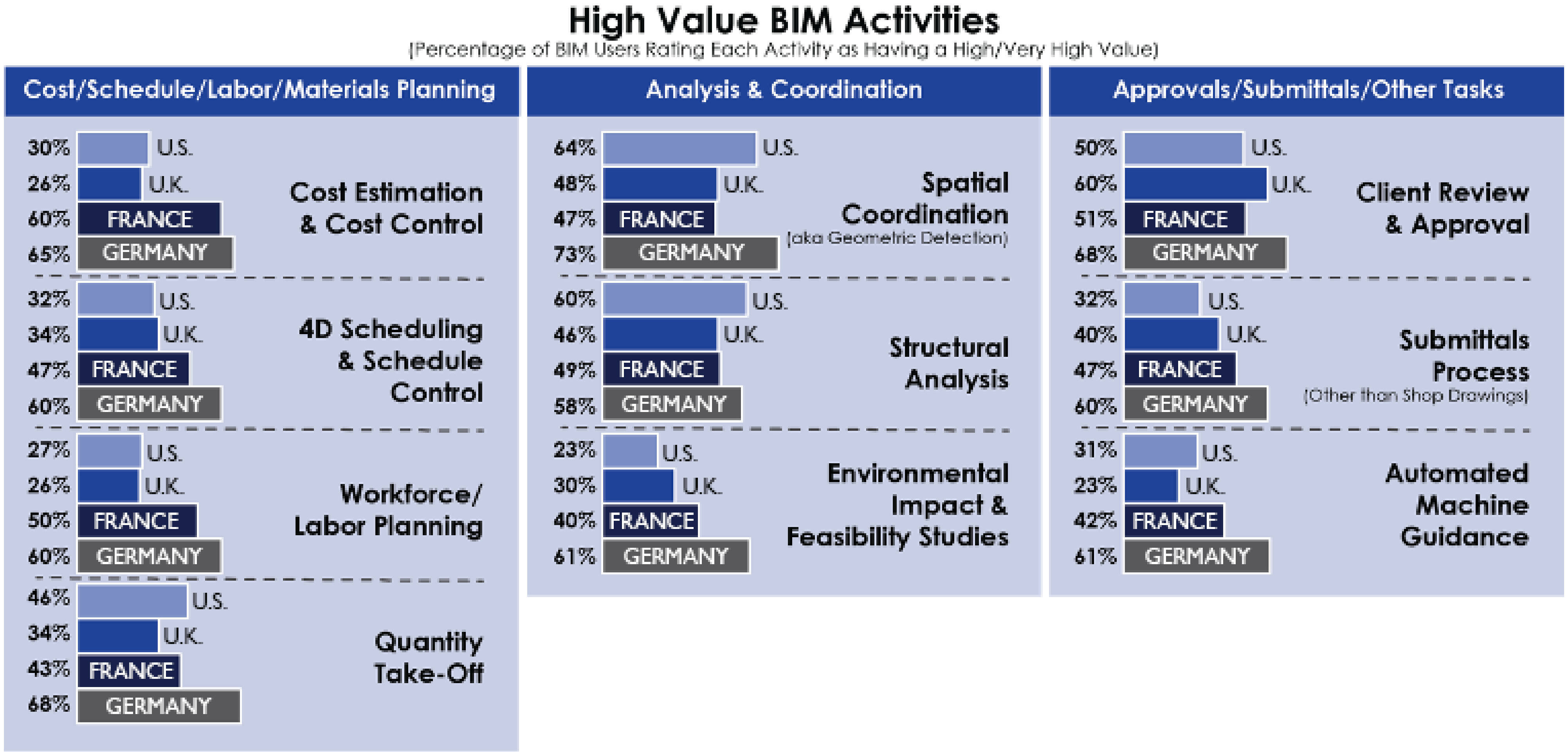
Lessons Learned



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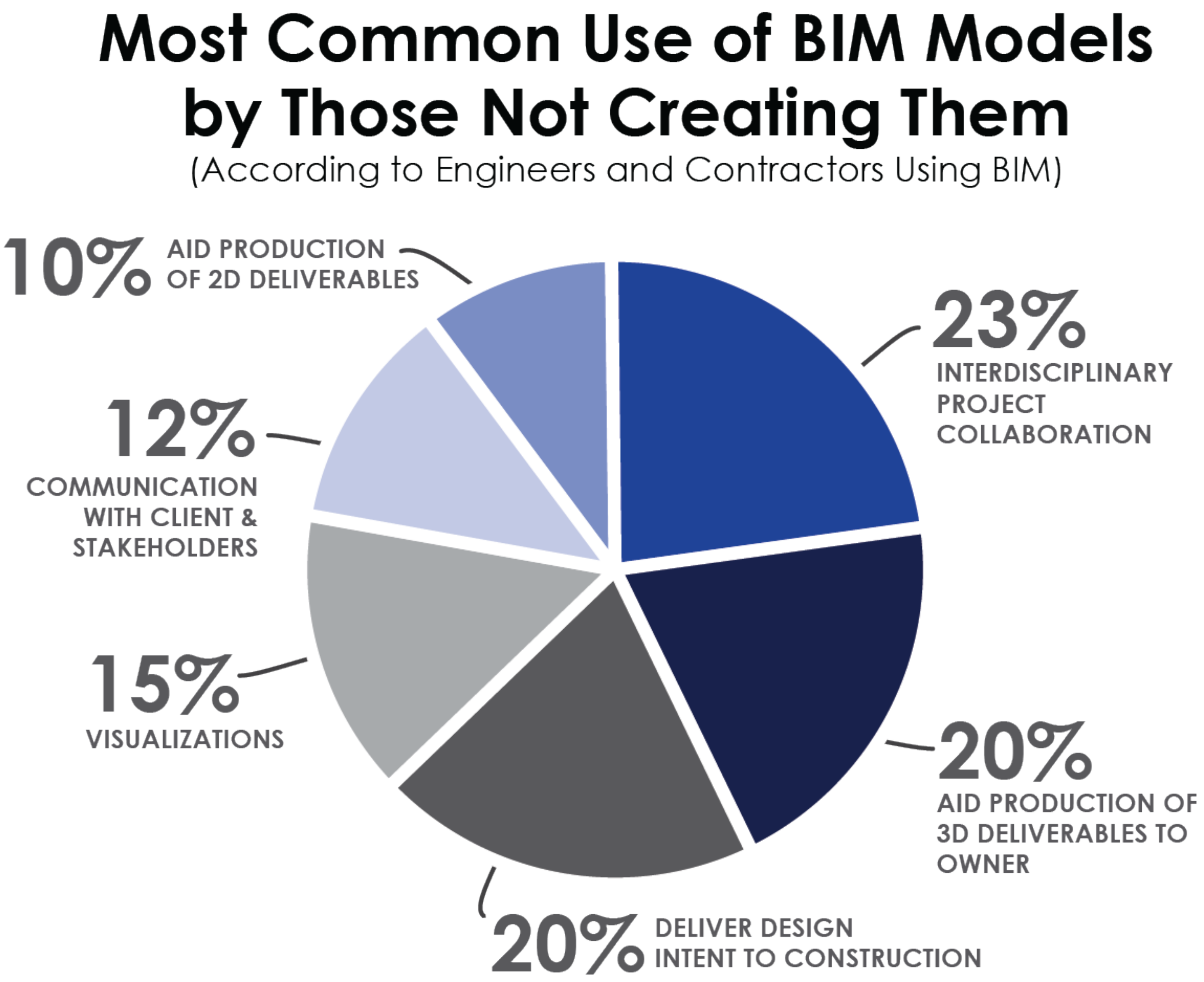

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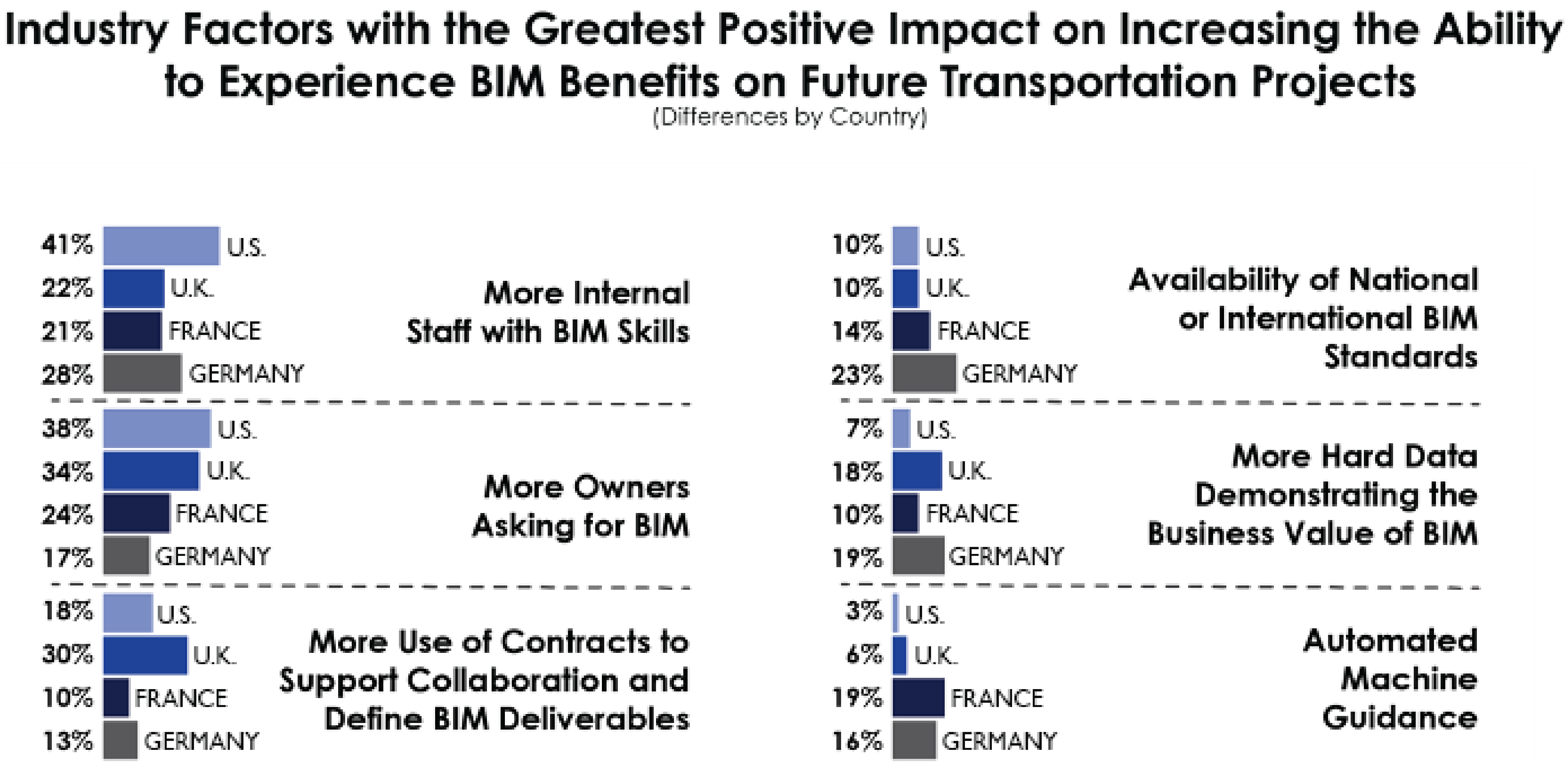

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