

APPENDIX A

***1. Do you consent to participate in this survey ?**

☐ Yes

☐ No

BIM for the Design and Construction of Educational Facilities

Instructions

The answers to this survey should solely be based on your experience with the design and construction of educational facilities and your company's experience using building information modeling (BIM)

Demographics

***2. Which of the choices below best represents your role in the design and construction process?**

(Select only one.)

- ☐ Owner
- ☐ Architect
- ☐ Civil engineer
- ☐ Structural engineer
- ☐ MEP engineer
- ☐ Contractor
- ☐ Subcontractor
- ☐ Manufacturer
- ☐ Property developer
- ☐ Facilities manager
- ☐ Interior designer
- ☐ Other (please specify)

***3. What types of educational projects does your company execute?**

(Select all that apply)

- ☐ Higher education (universities)
- ☐ Private schools
- ☐ Public schools
- ☐ Primary schools (elementary and middle schools)
- ☐ Secondary schools (high schools)
- ☐ None
- ☐ Other (please specify)

***4. What is the primary project delivery method your company uses for educational projects?**

- ☐ Design-bid-build
- ☐ Design-build
- ☐ Early contractor involvement/early assisted design
- ☐ Negotiated contract
- ☐ Design-build-finance-operate
- ☐ Integrated project delivery
- ☐ Construction management
- ☐ Construction management at risk
- ☐ Other (please specify)

***5. What is your company's annual revenue?**

\$

***6. How many employees does your company have?**

Employees

***7. In what city is your company primarily located?**

City

State

***8. How many years have you been in the profession?**

Years

Company's current use of BIM

*9. Does your company use BIM?

☐ Yes

☐ No

No use of BIM

***10. Which of the following best describes your company's lack of direct involvement with BIM?**

- ☐ My company does not use BIM but would like to implement BIM
- ☐ My company has used BIM in the past but no longer uses it
- ☐ My company outsources BIM
- ☐ My company has no interest in using BIM
- ☐ I have never heard of BIM

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BIM Implementation at the Management Level

*11. How long has your firm been using BIM in its practice?

Years

*12. What is the current business value of using BIM for your company?

- ☐ We have optimized the value of BIM in our current use
- ☐ We are just starting to see the potential value of using BIM
- ☐ We are getting no meaningful value from BIM

*13. What is driving the use of BIM in your company on educational facilities projects?

(Select all that apply)

- ☐ Clients
- ☐ Subcontractors
- ☐ Management
- ☐ Manufacturers/fabricators
- ☐ Government permitting agencies
- ☐ Competition from other companies using BIM
- ☐ Vendors
- ☐ Other (please specify)

*14. Rank the importance of the following roles in developing the project building information model during the design and construction processes. (4 - Most Important to 1- Least Important. Please use a ranking only once.)

Architect

Engineer

Contractor

Owner

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***15. In your opinion, who can benefit from BIM use on educational facilities projects?
(Select all that apply)**

- ☐ Owner
- ☐ Architect
- ☐ Engineer
- ☐ Contractor
- ☐ Subcontractor
- ☐ Manufacturer
- ☐ Facilities manager
- ☐ Project developer
- ☐ Public agencies
- ☐ Other (please specify)

***16. Who does your company primarily share BIM information with when working on the design and construction of educational facilities projects?**

- ☐ Owner
- ☐ Architect
- ☐ Engineer
- ☐ Contractor
- ☐ Subcontractor
- ☐ Manufacturer
- ☐ Other (please specify)

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***17. What kind of documents has your company included in the building information model of educational facilities for the owner?**

(Select all that apply)

- ☐ Maintenance manuals and warranties
- ☐ Cost data
- ☐ Operation manuals
- ☐ Shop drawings
- ☐ Specifications
- ☐ Evaluations of building performance
- ☐ Other (please specify)

***18. Which disputes has your company encountered when implementing BIM on educational facilities projects? (Select all that apply.)**

- ☐ My company has not encountered disputes with BIM implementation
- ☐ Intellectual property ownership of the model or parts thereof
- ☐ Disputes regarding liability for system designs
- ☐ Other (please specify)

***19. How many employees in your company have experience with using BIM?**

Employees

***20. How does your company encourage the use of BIM?**

- ☐ It does not encourage the use of BIM
- ☐ It provides training
- ☐ It requires it
- ☐ It compensates employees for their continuing education
- ☐ Other (please specify)

*21. What is the best way to acquire BIM expertise for the company?

- ☐ Hire new BIM skilled professionals
- ☐ Online seminar
- ☐ Internal training
- ☐ Outside training
- ☐ Other (please specify)

*22. Does your company use a BIM Implementation guide?

Yes - Which guide?

No - Would you be interested in using one?

BIM Implementation at the Project Execution Level

***23. What BIM software does your company use?**

(Select all that apply)

- ☐ Revit Architecture
- ☐ Revit Structure
- ☐ Revit MEP
- ☐ Bentley
- ☐ Bentley Facilities
- ☐ ArchiCAD
- ☐ Digital Project
- ☐ Tekla Structures
- ☐ Nemetschek Allplan Architecture
- ☐ IntelliCAD
- ☐ CADSoft Envisioneer
- ☐ Ecotect
- ☐ VICO Constructor
- ☐ Navisworks
- ☐ Gehry Technologies Digital Project
- ☐ Beck-Technology dProfiler
- ☐ Other (please specify)

***24. On what percentage of educational facilities projects completed by your company has some form of BIM software been utilized over the last 5 years?**

%

25. On what percentage of education facilities projects has your company used the following BIM applications over the last 5 years?

Geographic Information Systems (GIS) and site specific analysis	<input type="text"/>
Space planning and validation	<input type="text"/>
3D visualizations	<input type="text"/>
Structural analysis	<input type="text"/>
MEP analysis	<input type="text"/>
Sustainability analysis (LEED)	<input type="text"/>
Automation of documentation	<input type="text"/>
Automated checking of code compliance	<input type="text"/>
Clash detection and collision assessment	<input type="text"/>
4D scheduling and simulation of construction activities	<input type="text"/>
5D quantity take-off and cost estimate	<input type="text"/>
6D facilities management and maintenance	<input type="text"/>
Building performance analysis (Energy consumption calculations)	<input type="text"/>
Lifecycle analysis	<input type="text"/>

General opinions on BIM

***26. In your opinion what is the importance of using BIM on educational facilities projects today?**

- ☐ Very important
- ☐ Important
- ☐ Slightly Important
- ☐ Not important

***27. In your opinion what will be the importance of using BIM on educational facilities projects by 2020?**

- ☐ Very important
- ☐ Important
- ☐ Slightly Important
- ☐ Not important

***28. Which project delivery method provides the best environment for using BIM on educational facilities projects?**

- ☐ Design-bid-build
- ☐ Design-build
- ☐ Early contractor involvement/early assisted design
- ☐ Negotiated contract
- ☐ Design-build-finance-operate
- ☐ Integrated project delivery
- ☐ Construction management
- ☐ Construction management at risk
- ☐ Other (please specify)

***29. In what phase of design and construction is BIM use valuable?**

(Select all that apply.)

- ☐ Pre-design
- ☐ Schematic design
- ☐ Design development
- ☐ Construction documents
- ☐ Bidding process
- ☐ Pre-construction
- ☐ Construction administration phase
- ☐ Fabrication
- ☐ Closeout/commissioning
- ☐ Operations and maintenance
- ☐ Other (please specify)

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BIM Applications

***30. Rate the importance of using the following features of BIM software in order to enhance the quality of educational facilities projects.**

	Not Important	Slightly Important	Neither Important nor Not Important	Important	Very Important
Geographic Information Systems (GIS) and site specific analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Space planning and validation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3D visualizations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Structural analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MEP analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sustainability analysis (LEED)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Automation of documentation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Automated checking of code compliance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clash detection and collision assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4D scheduling and simulation of construction activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5D quantity take-off and cost estimate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6D facilities management and maintenance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building performance analysis (Energy consumption calculations)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lifecycle analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

BIM for the Design and Construction of Educational Facilities

BIM Benefits

***31. Rate your level of agreement with the following benefits of BIM for the design and construction of educational facilities.**

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Serves as a new marketing tool for firms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increases client engagement and provides clearer understanding of 3D visualizations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Allows for long term data assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowers risk and better predicts outcomes due to discovery of errors, omissions and conflicts prior to construction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduces RFI's, change orders, claims, disputes and conflicts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improves collaboration and communication between disciplines due to more reliable and direct data exchange from a single resource of information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Encourages the use of other technologies (GIS, Unity, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Encourages consideration for sustainable building systems that conserve energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Evaluates the impact of different design solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facilitates modular construction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increases prefabrication	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduces on-site waste and materials use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduces project delivery time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enables faster reviews for approval and permits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduces construction and production costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enables automation of documentation (better accuracy and accounts for adjustments and changes automatically)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Allows more time to be spent on design than on contract documentation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improves construction safety	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increases project profitability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increases productivity and efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provides more accurate as-built deliverables	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

BIM Obstacles

32. How likely is it that the following obstacles would prevent BIM use for the design and construction of educational facilities?

	Not Likely At All	Somewhat Likely	Moderately Likely	Very Likely	Extremely Likely
Cost of software and new hardware to keep up with software	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost of hiring experienced staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of expertise and need for training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unclear responsibilities, assigned roles and BIM deliverables	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disruption in workflow to implement new BIM process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vulnerability or security of file sharing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Legal liabilities of the BIM process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of precedence, established laws and regulations about BIM use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not enough owner demand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fast-paced and small sized projects do not justify the time needed for and cost of implementing BIM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of substantial quantifiable benefits and evaluation methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of BIM use standards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of software interoperability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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BIM Procedures

***33. In your opinion, how important is it to include each of the following procedures in a BIM guide for the design and construction of educational facilities?**

	Not Important	Slightly Important	Neither Important nor Not Important	Important	Very Important
Developing a BIM adoption plan (assigning responsibilities, organization and workflow of all participants)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Establishing short-term and long-term goals for BIM adoption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transitioning from CAD-based to BIM-based delivery approach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Selecting contract specifications using BIM and determining BIM based project deliverables (handover model, specifications and as built)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Selecting BIM software and appropriate BIM applications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setting standards for using BIM, model production and creation, standards for sharing and documentation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using BIM for design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using BIM for constructability reviews	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Measuring building performance using BIM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Measuring and evaluating benefits of BIM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>