Survey of Building Information Modeling for Infrastructure (BIM4I)

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Introduction

The rapid development of information technologies is transforming how data and information are produced, shared, exchanged, and managed. This transformation is accelerating in state departments of transportation (DOTs) across the country due to the need for efficient means of delivering transportation projects and collaboration. A key driver for this transformation is the implementation of Building Information Modeling (BIM) throughout the stages of Infrastructure projects lifecycle, otherwise called BIM for infrastructures (BIM4) or digital delivery. BIM4I implementation is leading to a digital transformation that affects technology, processes, and people within organizations. Transportation agencies in the U.S. and abroad are in the transition of implementing BIM4I at different maturity levels. Thus, this research provides recommendations for the implementation based on best practices from agencies that have implemented BIM in one or several stages of infrastructure project delivery.

Study Methods

The research followed a four-step approach including:

1. Literature review – The literature and state-of-the-art review set the foundations for designing a survey and identifying target agencies.
2. Data collection via survey and follow-up interviews – The survey targeted 134 transportation agencies in the U.S. and abroad and considered 39 questions. Eighteen follow-up interviewees were selected from survey respondents based on their BIM4I maturity level, and follow-up interviews improved understanding of their implementation practices.
3. Data analysis using descriptive statistical analysis and content analysis – The survey data was analyzed using descriptive statistical analysis and content analysis, which identified common themes.

4. Recommendations – Based on the analysis of survey responses and follow-up interviews, 102 recommendations for BIM4I implementation were provided on general implementation approach, BIM implementation plans, technology, processes, and people and change management.

Findings

Key findings are categorized as national and international based on the respondents and interviewees considered:

International

Based on responses from Australia, Spain, Canada, Sweden, Ireland, and the UK:

- Maturity: Forty (40%) of respondents indicated that they deliver the 3D model contractually with conventional plans. Nobody indicated that they deliver 3D models contractually without conventional plans.
- Standards use: Seventy-nine (79%) respondents used ISO 19650 as the data standard in their implementation processes.
- Training: Forty-one percent (41%) of respondents indicated that they have implemented a training program and/or staff development plan for BIM implementation.
- Workflows: Forty-five percent (45%) of respondents indicated that their organization has developed new project delivery workflows incorporating BIM.
- 3D model in maintenance: Twenty-five percent (25%) of respondents indicated that they use 3D models in asset management/maintenance.

National

Based on responses from state DOTs in Ohio, Montana, Illinois, New York, Texas, Michigan, Iowa, Idaho, Washington State, Indiana, Oklahoma, Oregon, North Dakota, Tennessee, Kentucky, North

Carolina, Pennsylvania, Nevada, Utah, FHWA, South Carolina, Caltrans, Florida, Connecticut, Alabama, New Mexico, the District of Columbia, and South Dakota:

- Maturity: Four percent (4%) of respondents indicated that they deliver the 3D model contractually with conventional plans. Twenty-one (21%) indicated that they deliver 3D models contractually without conventional plans.
- Standards use: Twenty-one percent (21%) of respondents used ISO 19650 as the data standard in their implementation processes.
- Training: Twenty percent (20%) of respondents indicated that they have implemented a training program and/or staff development plan for BIM implementation
- Workflows: Twenty-five percent (25%) of respondents indicated that their organization has developed new project delivery workflows incorporating BIM.
- 3D model in maintenance: Four percent (4%) of respondents indicated that they use 3D models in asset management/maintenance

Policy Recommendations

Recommendations based on results include:

- Strategic Planning: Establish a clear definition of Building Information Modeling (BIM), create an implementation plan including a roadmap with defined objectives, and assess organizational readiness for BIM adoption.
- Standardization and Training: Develop clear standards and guidelines for BIM usage, prioritize data quality, and invest in training.
- Technology Integration: Ensure that BIM tools and software are compatible with existing systems and establish a user-friendly Common Data Environment (CDE) for effective data sharing.
- Collaboration and Communication: Foster interdepartmental and cross-stages collaboration and engage stakeholders early in the design process to enhance understanding of project impacts.

The pie chart represents the answer to this question: does your organization have a BIM implementation plan?" in the U.S.
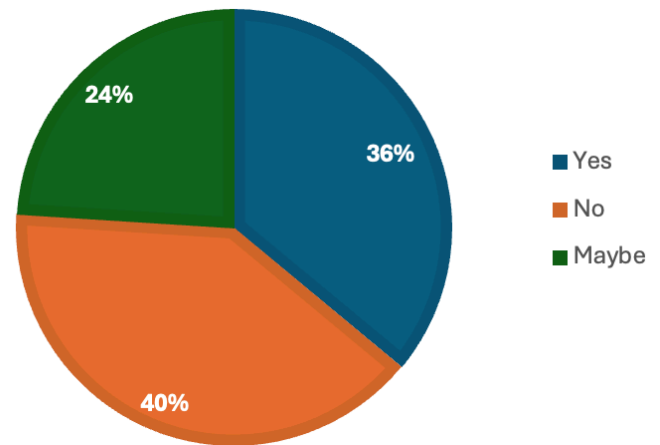
Only 36% of respondents have a BIM implementation plan, which suggests that most DOTs are in the early stages of BIM implementation.

About the Principal Investigator

Dr. Maria Calahorra-Jimenez is an assistant professor at California State University, Fresno, and her research focuses on alternative and digital project delivery. She brings 20 years of experience blending industry and academia.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2453