Building Information Modeling (BIM) Practices in Highway Infrastructure

FHWA Global Benchmarking Program Report

RPT NO FHWA-PL-21-024

Introduction to BIM for Infrastructure

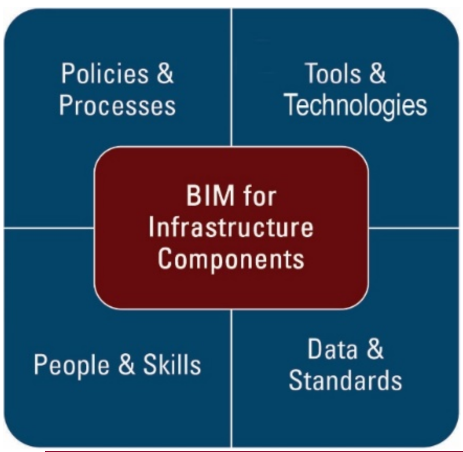
The Federal Highway Administration (FHWA) Global Benchmarking Program (GBP) supports access, evaluation, and implementation of proven, global technology innovations and best practices that can improve highway transportation in the United States. The GBP Building Information Modeling for Infrastructure[1] (referenced as BIM below) study documents how six BIM-mature nations and their public agencies use BIM to better deliver transportation projects, manage assets, and provide related services.

This factsheet summarizes key findings of the study in terms of awareness, leadership, preparation, and collaboration around BIM at each host agency. These observations could serve as a benchmark for State transportation agencies within the United States that are planning to implement BIM processes.

Learn more about the study and Global Benchmarking Program.

Building Information Modeling (BIM) is a collaborative work method for structuring, managing, and using digital data and information about transportation assets throughout their lifecycle.

Open BIM processes and open standards allow data interoperability between various software applications used to design, build, maintain, and operate infrastructure; optimize traditional asset lifecycle management workflows; prevent information loss and duplication; and replace paper outputs and deliverables.



Study

The study benchmarked the maturity of BIM-related actions, artifacts, and activities of each agency and its host country under four "pillars."

Leadership: Compelling drivers, vision, goals, value proposition, and strategy.
Framework: Policy, technical direction, processes, and people readiness.
Communication: Engagement with industry stakeholders.
Implementation: Early wins, pilot projects, and training.

INTERVIEWS WITH BIM-MATURE NATIONS AND THEIR AGENCIES		
Nation	**Agency**	**Location**
Netherlands	Rijkswaterstaat (RWS)	Utrecht, Netherlands
Norway	Norwegian Public Roads Administration (NRPA) and Norwegian Railway Infrastructure Managers (Bane NOR)	Oslo, Norway
Denmark	Danish Road Directorate (DRD)	Oslo, Norway
Finland	Finnish Transport Infrastructure Agency (FTIA)	Oslo, Norway
Sweden	Swedish Transport Administration (Trafikverket)	Oslo, Norway
United Kingdom	Centre for Digital Built Britain Department for Business, Energy and Industrial Strategy Environmental Agency Consulting industry and other private sector entities	London, United Kingdom

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KEY OBSERVATIONS

Achieving a high level of BIM for infrastructure maturity was attributed to five specific factors:

1. **Government-level recognition** of the importance of BIM for infrastructure, backed by executive and unit-level leadership support at the implementing agency.
2. **Active support by public infrastructure asset owners** for embracing open BIM practices to stimulate industry action.
3. **Implementation of a multiyear strategic plan** that outlines BIM for infrastructure targets/goals, and specifies the logical workflow needed to advance BIM maturity and sustain its momentum.
4. **Promotion of/participation in collaboration** among infrastructure owners/operators, national industry partners (software developers, contractors, consultants, suppliers), and international standards organizations to gain wider acceptance of BIM-related policies.
5. **Implementation of BIM for infrastructure integration** with broader, nationwide policies and digitalization efforts for sustainability.

LESSONS LEARNED

Study findings offer lessons on how to accelerate BIM-related efforts in the United States transportation industry.

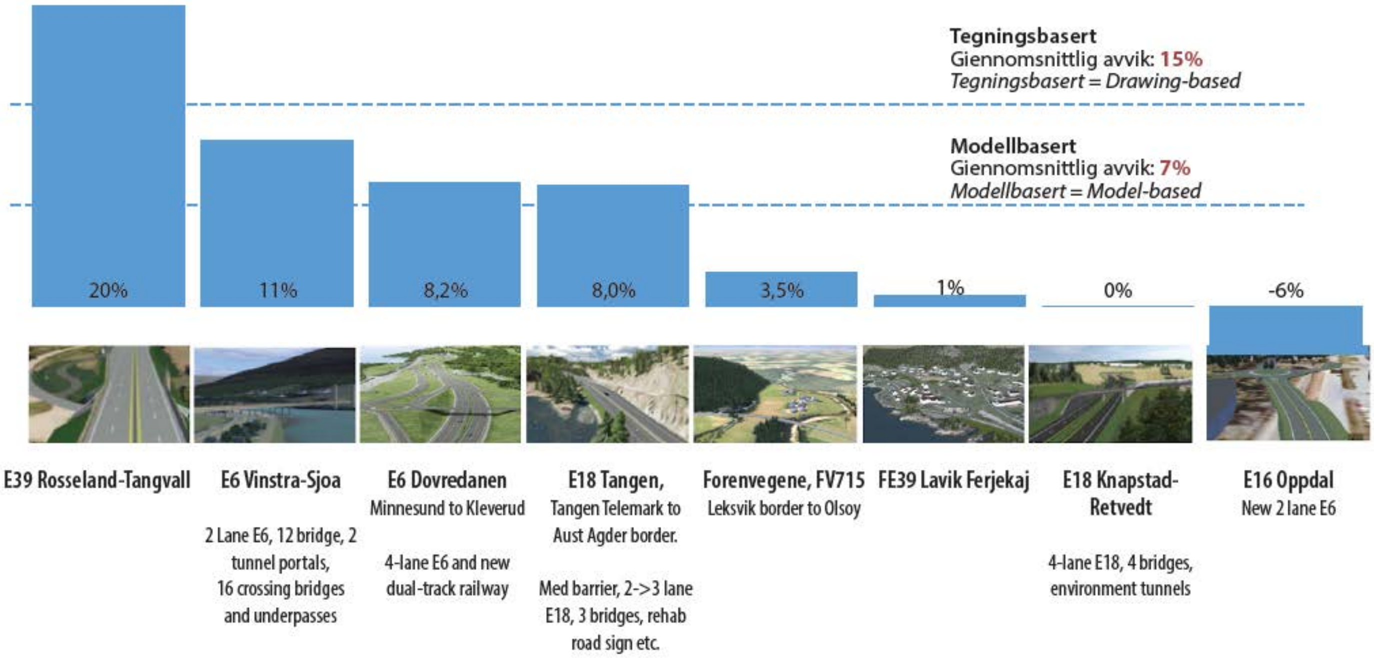
- **BIM awareness, leadership, preparation, and collaboration** are needed to generate a shared national vision or regulation that fosters a cultural shift and change management - in addition to technology and tool adoption - on which client organization (e.g., State DOTs) can act.
- **BIM for infrastructure building blocks that are** inclusive of organizational structure, data modeling, data exchange, and management platforms, clearly define organizational roles, responsibilities, and cooperative relationships, and set parameters for cooperating with asset owners to facilitate adoption of foundational open standards and definitions of object properties.

BENEFITS

Host agencies experienced qualitative and quantitative benefits from BIM implementation. Quantified benefits were measured in the project delivery phase from design to construction only.

- Transaction cost savings and cost avoidance in the design, construction, and operations phases due to efficient data handling and improved data quality.
  - Netherlands/RWS reported a reduction in 2 percent for BIM contracts vs. 12 percent for traditional contracts.
  - Finland/FTIA recorded 15 to 20 percent savings on cost of construction, including time savings and safety, after using BIM processes.
- Improved asset information and findable, accessible, interoperable, and reusable data.
- Improved strategic planning and decisionmaking.
  - UK/Environmental Agency reported that before BIM processes, the agency's data were only 20 percent accessible throughout the agency due to siloed systems.
- Efficient and effective internal processes.

[1] Mallela, J. A. Blackburn, R. Grant, M. Kennerly, K. Petros, C. Yew. 2020. *Building Information Modeling (BIM) Practices in Highway Infrastructure: FHWA Global Benchmarking Program Report.* Report No. FHWA-PL-21-024. Washington, DC: Federal Highway Administration.



Reduction in construction costs – Drawing-based models *(Tegningsbasert)* vs. BIM based models (*Modellbasert)* of several Norwegian road projects. Gjennonmsnittlig avik is average deviation.

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