

# Building Information Modeling (BIM) Practices in Highway Infrastructure

## FHWA Global Benchmarking Program Report

Program Fact Sheet of RPT NO FHWA-PL-21-024

### Awareness, Leadership, Preparation, and Collaboration Around BIM

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*<sup>1</sup> (simply referred to herein as BIM) study documents how six BIM-mature nations and their public agencies use BIM to better deliver transportation projects, manage assets, and provide related services.

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

The study centered on understanding the organizational maturity of each host agency and using critical success factors for benchmarking BIM maturity. 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 guidance 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** 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.

<sup>1</sup> 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.

# Building Information Modeling (BIM) Practices in Highway Infrastructure

## FHWA Global Benchmarking Program Report

Program Fact Sheet of RPT NO FHWA-PL-21-024

### Introduction

The GBP study team reviewed four notable issues that pertained to BIM motivation, BIM business process transformation and sustaining BIM changes. More specifically, four critical success factors, drawn from a standard capability maturity mapping framework, were reviewed in depth and benchmarked for each BIM mature host agency.

Critical Success Factor	Components
<b>A. BIM Awareness and Leadership Support</b>	Top down support; leading edge practices; status of R&D; and problems addressed
<b>B. Performance Awareness and Application</b>	Alignment with performance goals; performance measures; assessment of anticipated benefits and costs; challenges and risks
<b>C. Supportive Systems and Staff to Enable BIM</b>	Pilot testing; institutional knowledge management; staff capacity; and access to funding
<b>D. External Collaboration</b>	Interaction with transportation sector and academia; communication beyond transportation; private sector outsourcing and partnering

The following nominal rating levels were used to assess the maturity of each host organization against the critical success factors:

- Level 1: The agency is in a relatively weak position to advance BIM for infrastructure with significant gaps in capability.
- Level 2: The agency is in a tenable position to advance BIM but should address gaps in capability that could pose risks to successful implementation.
- Level 3: The agency is well positioned to advance BIM.

### Summary of Capability Assessment

#### BIM Awareness and Leadership Support

- **Finland/FTIA** – the Finnish government has been promoting BIM practices since 2007. However, in 2015 the “Common National Requirements for BIM (coBIM)” became a mandate for all highways, railroads, and waterways. CoBIM specified a standard way to carry out projects using BIM methods. To demonstrate its commitment, FTIA created an InfraBIM unit to establish common requirements, asset classification systems, and open data exchange standards.
- **United Kingdom/Various Agencies** – A coalition between public and private sector stakeholders helped create the United Kingdom BIM Initiative. The government provided

# Building Information Modeling (BIM) Practices in Highway Infrastructure

## FHWA Global Benchmarking Program Report

Program Fact Sheet of RPT NO FHWA-PL-21-024

seed funding to advance and support BIM practices (i.e. information process standards, training, and communications). In 2011, the Initiative became a national mandate. A key requirement was that all construction suppliers had to be working at BIM Level 2. The requirement expedited the adoption of BIM.

### Performance Awareness and Application

- **Netherlands/RWS** – RWS tracked quantitative, qualitative, and third-party benefits through a formal process. They experienced the greatest benefits in the following areas 1) standardization of prefabrication and making the design process more efficient; 2) lower transactions costs because designs are produced faster using only broad outlines; and 3) early identification of construction errors and reduction in failure costs.
- **Norway/NRPA** – NRPA documented evidence of BIM benefits based on field studies. They witnessed a reduction in change orders and construction costs when comparing traditional model-based projects to BIM-based projects. On average, BIM-based projects produced a net savings of 11.5 percent of total construction costs for the agency.

### Supportive Systems and Staff to Enable BIM

- **Netherlands/RWS** – RWS is a leader in developing and setting data and process standards. They have a skilled workforce of BIM experts such as senior data modelers and database administrators who can advance open BIM processes expeditiously. In 2012, RWS created the Area Information Rijkswaterstaat Building Information Modeling (AIRBIM) program to align data and information asset management systems with those in design and construction. RWS has strong institutional knowledge and is committed to educating and training staff in BIM processes. Lastly, RWS is piloting BIM standards and workflows on more than two dozen capital highway infrastructure projects and a handful of maintenance projects.
- **Sweden/Trafikverket** – Trafikverket has been using BIM in all public procurements since 2015. They are committed to bringing along the entire construction industry to adopt its BIM strategy. The agency is piloting BIM on the Stockholm Bypass and is committed to developing skills and knowledge, collecting feedback to improve processes and evolving procurement requirements. In the long-term Trafikverket is working toward efficient data flows between GIS, BIM projects, and asset management systems.

### External Collaboration

# Building Information Modeling (BIM) Practices in Highway Infrastructure

## FHWA Global Benchmarking Program Report

Program Fact Sheet of RPT NO FHWA-PL-21-024

- **Denmark/DRD** – DRD and Banedanmark (Rail Authority) entered a five-year partnership to specifically work on open BIM standards to advance digitalization of the infrastructure sector. However, the partnership also works collaboratively with industry through a common platform called BIM Anglægsforum. DRD places heavy emphasis on international cooperation and international standardization to avoid “reinventing the wheel”. As such, DRD is part of the Nordic Rail and Road Collaboration Forum and buildingSMART International chapter.
- **Finland/FTIA** – FTIA works with industry partners including contractors, consultants, and software vendors. In 2018, FTIA launched the Velho Alliance project—an online project and design asset information register and portal for roads, rail, and seaways. This allows contractors and consultants to download and upload standardized designs and construction data. FTIA is also active with non-profit standards organizations such as buildingSMART International’s Nordic chapter and buildingSMART Finland chapter to advance BIM and to address implementation challenges.

All host organizations visited were highly advanced BIM practitioners and ranked exceptionally well on the following critical success factors:

- BIM Awareness and Leadership Support.
- External Collaboration.

Some organizations were further along than others with Performance Awareness and Application and Supportive Systems and Staff. For example, RWS, FTIA and NPRA had dedicated BIM programs which were involved in several enterprise-wide development and training efforts related to BIM. Whereas, Trafikverket and DRD were starting to pilot BIM programs on major projects with unit-specific budgets.

The need for broader performance awareness, BIM systems, supportive staff, and budgets were noted as consistent challenges across all the organizations.

Overall, RWS, FTIA, and NPRA had highly structured approaches and were further along in their BIM development, piloting, and mainstreaming efforts than the others. However, the others were not far behind.

