

Nov 04, 2025

Version 2

Protocol for the article: "Applications of Virtual Reality Integrated with BIM in Modeling, Management, and Training in Civil Construction: A Systematic Review of the Literature" V.2

DOI

<https://dx.doi.org/10.17504/protocols.io.eq2ly499elx9/v2>

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Protocol Citation: Gláuber slan Ferreira Vieira, Bianca Maria Vasconcelos, Emília ahnemay Kohlman Rabbani 2025. Protocol for the article: "Applications of Virtual Reality Integrated with BIM in Modeling, Management, and Training in Civil Construction: A Systematic Review of the Literature". protocols.io <https://dx.doi.org/10.17504/protocols.io.eq2ly499elx9/v2> Version created by GLÁUBER IF VIEIRA

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Protocol status: Working

We use this protocol and it's working

Created: November 04, 2025

Last Modified: November 04, 2025

Protocol Integer ID: 231447

Keywords: Interoperability, Collaboration, Immersive simulation, Technological innovation., Virtual reality, VR, BIM, Building Information Modelin, modeling, training, management., building information modeling, virtual reality, training in civil construction, conjunction with building information modeling, immersive technology, applications of virtual reality, application of immersive technology, civil construction, bim in modeling, professionals in the modeling, modeling, systematic literature review, systematic review of the literature, management stage, bim, construction

Funders Acknowledgements:

CAPES

Grant ID: 001

Abstract

This protocol presents the structure of a systematic literature review aimed at critically analyzing and synthesizing the current body of knowledge on the application of immersive technologies, especially virtual reality, in conjunction with building information modeling (BIM), to assist in processes for the AECO sectors. The review seeks to identify how these integrations can assist professionals in the modeling, training, and management stages.

Although there are previous literature reviews on this subject, we point out the need for an updated systematic review that provides a structured and comprehensive synthesis of the studies. This approach allowed the extraction and organization of the reported data, presenting the technologies used, the processes adopted, the limitations encountered, and the favorable path for implementation in the sectors.

Defining the terms of interest and guiding questions for the review

1 **Table - PICO criteria (Population, Intervention, Comparison, Outcome)**

A	B	C
Criteria	Description	Synonyms
Population	Architecture, Engineering, Construction, and Operations Sector	AECO
Intervention	Integration of BIM with Virtual Reality	Building Information Modelin, VR
Comparison	Comparison with tradicional methods	
Outcome	Application in modeling, project management, and worker training	Modeling, Training and management

2 **Preparing the generic string with the relevant terms of interest**

("Building Information Modeling" OR BIM) AND ("virtual reality") AND ("construction" OR AECO) AND (management OR modeling OR training)

3 **Defining the guiding questions for the review**

- What implementation methodology was used?
- What are the engineering applications and limitations?
- What information model was used for information exchange?
- What programming language was used? What about data hosting?
- What tools were used for BIM and VR integration?

Defining the databases for the search and the adapted strings

4 **Database selection**

4.1 Databases with the largest collection of publications

- Science Direct - <http://www.sciencedirect.com>
- Web of Science - <https://www.webofscience.com/wos/woscc/basic-search>
- Scopus - <https://www.scopus.com/home.uri>

4.2 Database applied to engineering and construction

- Engineering Village - <https://www.engineeringvillage.com/home.url?redir=t>

5 Search string adapted to all databases

A	B
Database	String Adapted
Science Direct	("Building Information Modeling" OR BIM) AND ("virtual reality") AND ("construction" OR AECO) AND (management OR modeling OR training)
Scopus	("Building Information Modeling" OR BIM) AND ("virtual reality") AND ("construction" OR AECO) AND (management OR modeling OR training)
Engineering Village	("Building Information Modeling" OR BIM) AND ("virtual reality") AND ("construction" OR AECO) AND (management OR modeling OR training)
Web of Science	("Building Information Modeling" OR BIM) AND ("virtual reality") AND ("construction" OR AECO) AND (management OR modeling OR training)

Defining the selection criteria for research papers

6 Criteria for including files for evaluation:

Inclusion criteria:

IC1: Publications in indexed journals

IC2: Timeframe of 10–15 years

Exclusion criteria:

EC1: Duplicates

EC2: Literature reviews / secondary articles

EC3: Titles and keywords not aligned with the topic

EC4: Abstract does not cover the integration of BIM and VR

EC5: Language other than English

EC6: Portrayed by the newspaper for reasons of reliability

Quality criteria:

QC1: Methodological analysis of integration approaches

A	B
Description	Score
Implementation method/framework used	1,0
Interoperability criteria and subcriteria	1,0
Hierarchical structure of the model	1,0
Application of the study	1,0
Research limitations	1,0
Weights, scores, or hierarchy of each criterion	0,5
Justification and detailed definition of the criteria	0,5

To qualify the methodology and results of the studies analyzed, a scoring evaluation was applied, in which each criterion received specific values according to its relevance: 1 point for the five mandatory criteria and 0.5 points for the two complementary criteria. Only articles with a score higher than 3.5 will be included.

**This review included articles that addressed virtual reality when dealing with mixed or extended reality, but excluded articles that addressed only augmented reality.*

Protocol references

Page M J, McKenzie J E, Bossuyt P M, Boutron I, Hoffmann T C, Mulrow C D et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews BMJ 2021; 372 :n71 doi:10.1136/bmj.n71

Acknowledgements

I would like to thank the State of Pernambuco and the University of Pernambuco (UPE) for their institutional support and for the conditions they provided for the development of this research. I would also like to express my gratitude to the Coordination for the Improvement of Higher Education Personnel (CAPES) for the funding and scholarship, which have been fundamental for the completion and continuity of this academic work.