Chapter 5
OpenBIM-Based Processes in Collaborative VR Environments:
Methodology and Issues on Specific Use-Cases

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ABSTRACT

This chapter explores how openBIM standards can be integrated into immersive and collaborative virtual reality (VR) environments to support specific use cases in the construction industry, in line with ISO 19650. It highlights the benefits of VR for intuitive 3D model interaction, understanding complex geometries, integrating diverse media, and enhancing stakeholder engagement. The use of open standards such as IFC, BCF, and openCDE ensures interoperability, data traceability, and structured information flows across platforms. VR is positioned not just as a visualization tool,

DOI: 10.4018/979-8-3373-3256-7.ch005

but as an active environment for information production and coordination. Three case studies illustrate how openBIM and VR can effectively converge to improve communication, validation, and decision-making in design and operational processes.

INTRODUCTION

The use of Virtual Reality (VR) is certainly common in the construction industry, where the transition from the design—virtual, as it is not yet built—to realization, the physical copy of the imagined prototype, is of interest to all stakeholders. It is useful to clarify that VR belongs to a Reality–Virtuality Continuum, also defined as the Mixed Reality (MR) spectrum. Unlike augmented reality, virtual reality environments fall within this spectrum as those experiences in which the participant is fully immersed in a synthetic world, where the laws of physics may or may not correspond to those of the real world (Milgram et al., 1995). However, especially in reference to the built environment, it is appropriate to think of virtual reality as a continuum in most of the process. The opportunity to use virtual reality environments has always been welcomed in the construction industry to virtually anticipate what exists in reality: the evolution from virtual to real is exemplified by the shift from the design to its realization, both in its formal aspects and in its technological and constructional ones. In this sense, VR is expected to take the role descriptive geometry and sketched representations and scaled models played in the past to link what is designed to what will be built.

Any evaluation regarding its use must begin with its definition in a general context. VR is a concept that has undergone significant evolution, shifting from a definition strictly tied to hardware to one more focused on the user experience. It is therefore appropriate to analyze both the early definitions and the more recent ones over a span of thirty years, in order to highlight the initial assumptions and the subsequent consolidation of the topic, which can be ultimately discussed in this chapter in operational AEC procedures.

One of its earliest definitions, proposed by Steuer, is based on the concept of "telepresence," understood as "the experience of presence in an environment by means of a communication medium" (Steuer, 1992). This definition, which avoids reference to any specific hardware, shifts the focus from the technological apparatus to the user's individual perception. In the early stages of VR application development, it was seen as a perfect tool with respect to the "potential power of VR to create human testing and training environments that allow for precise control of complex stimulus presentations as well as provide accurate records of targeted responses in a cognitive psychologist's dream!" (Rizzo et al., 1997). The concept expressed here encompasses many uses that have also been developed within the