

## Chapter 2

# Constraints in Authoring BIM Components: Results of Longitudinal Interoperability Tests

**Claudio Benghi**

*Northumbria University, UK*

**David Greenwood**

*Northumbria University, UK*

### **ABSTRACT**

*The authors investigated issues of geometric interoperability for reusable BIM components across multiple platforms using industry foundation classes (IFCs) which many proprietary BIM software platforms claim to fully support. These assertions were tested, first in 2012 and then in 2017 to assess the state and evolution of interoperability in the industry. A simple test model was created representing significant types of geometry encountered in component libraries, which were then expressed in IFC files. In the 2012 study, 11 commonly used BIM tools showed a dramatic failure to process the geometries as intended, indicating that the authoring tools, whilst technically capable of supporting required component geometric representations, were constrained from doing so by their conversion interfaces with IFC geometries. In the 2017 tests, improvements were observed though there were still significant processing failures that could result in serious errors; particularly in the case of the BIM library components imported into project design models.*

DOI: 10.4018/978-1-5225-5625-1.ch002

## **INTRODUCTION**

As Building Information Modelling (BIM) becomes more prevalent in the construction industries of the world some of the practical problems of authoring and sharing models are also becoming more evident. It is generally accepted that BIM-related technologies offer considerable advantages to many, perhaps most, participants in the construction sector (Eastman et al., 2011). In the UK, for example, the Government has mandated the use on all its projects of “fully collaborative 3D BIM” (Cabinet Office, 2011) and supported the development of standards to support the industrial uptake (BIM Task Group et al., 2016).

A fundamental limiting factor in the uptake of BIM is the issue of interoperability, defined by the International Alliance for Interoperability (IAI, now ‘buildingSMART’) as ‘an environment in which computer programs can share and exchange data automatically, regardless of the type of software or where the data may be residing’ (Fischer and Kam, 2002, p. 14). Currently, there exists a whole range of commercially available BIM software platforms that have specialised to suit the functional needs of their main users (architects, structural engineers, services engineers, constructors, and so on) and consequently differ structurally and semantically. The aspirational ideal of fully collaborative BIM presumes a single model, allowing the full integration of all aspects of the design and further, for the same information to be re-used in the delivery and operation of the constructed facility (UK Treasury and Cabinet Office, 2016. p. 7). To do this effectively, secure and reliable exchange of data is essential. It is this requirement that underlies the concept of ‘interoperability’ (Yang and Zhang, 2006). As Cerovsek points out a key issue has been how to achieve ‘inter-operability between multiple models and multiple tools that are used in the whole product lifecycle’ (Cerovsek, 2011, p. 224) and BIM usage is still largely restricted to coordinated models that relate to the contribution of each of the disciplines involved. Currently, as evidenced by NBS’s National BIM Report (NBS, 2017) full collaboration is still not a reality. For some time the recognised basis of BIM interoperability has been the system of Industry Foundation Classes (IFCs) designed by the International Alliance for Interoperability and maintained by buildingSMART (Tolman, 1999; Fischer and Kam, 2002). However, the mere presence of IFC is not sufficient for overcoming the problems of interoperability, and, for some critics, data exchange remains ‘unreliable and unpredictable’ (e.g. Sacks et al., 2010, p. 420). Fischer and Kam (2002, p. 40) identify such problems, particularly when they result in ‘geometric misrepresentations across different software packages reading the same IFC source file’.

23 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: [www.igi-global.com/chapter/constraints-in-authoring-bim-components/204289](http://www.igi-global.com/chapter/constraints-in-authoring-bim-components/204289)

## Related Content

---

### E-Research Ethics and E-Planning: Emerging Considerations for Transformative Research

Elizabeth A. Buchanan (2012). *International Journal of E-Planning Research* (pp. 5-15).

[www.irma-international.org/article/research-ethics-planning/62036](http://www.irma-international.org/article/research-ethics-planning/62036)

### Challenges of Practicing and Honing Leadership Skills through Cross-Cultural Service Learning

Jeff Zimmerman (2017). *Student Experiences and Educational Outcomes in Community Engagement for the 21st Century* (pp. 225-251).

[www.irma-international.org/chapter/challenges-of-practicing-and-honing-leadership-skills-through-cross-cultural-service-learning/166391](http://www.irma-international.org/chapter/challenges-of-practicing-and-honing-leadership-skills-through-cross-cultural-service-learning/166391)

### The Role of the Creation and Sharing of Digital Media Content in Participatory E-Planning

Joanna Saad-Sulonen (2012). *International Journal of E-Planning Research* (pp. 1-22).

[www.irma-international.org/article/role-creation-sharing-digital-media/66409](http://www.irma-international.org/article/role-creation-sharing-digital-media/66409)

### Battery Efficiency in Outdoor Sports Environments for Mobile Pervasive Augmented Reality Systems

Rui Miguel Pascoal (2022). *Handbook of Research on Sustainable Development Goals, Climate Change, and Digitalization* (pp. 520-536).

[www.irma-international.org/chapter/battery-efficiency-in-outdoor-sports-environments-for-mobile-pervasive-augmented-reality-systems/290501](http://www.irma-international.org/chapter/battery-efficiency-in-outdoor-sports-environments-for-mobile-pervasive-augmented-reality-systems/290501)

### Smart City Response During Pandemic Times

(2022). *Planning and Designing Smart Cities in Developing Nations* (pp. 248-260).

[www.irma-international.org/chapter/smart-city-response-during-pandemic-times/295803](http://www.irma-international.org/chapter/smart-city-response-during-pandemic-times/295803)