Project 2.82

DE-enabled asset life-cycle management

BIM/IFC Viewers Review

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Executive Summary

OpenBIM is a collaborative process that is inclusive of all participants, promoting interoperability to benefit projects and assets throughout their lifecycle. It is based on open standards and workflows that allow different stakeholders to share their data with any BIM compatible software.

In this review report, we reviewed BIM/IFC viewers that can support open-BIM environment. A total of 21 BIM/IFCE viewers are identified and critically examined.

We compared the key functions of these BIM/IFC viewers. All these BIM/IFC viewers provide standard functions such as zoom, rotate, pan, perspective control, measurement, while some exclusive functions are provided in specific software. Some of BIM/IFC viewers have APIs for users' development. We further compared the capabilities of APIs provided by each BIM/IFC viewer. This report can server as a reference for selecting an appropriate BIM/IFC viewer for construction projects.

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1   Introduction

OpenBIM is a collaborative process that is inclusive of all participants, promoting interoperability to benefit projects and assets throughout their lifecycle. It is based on open standards and workflows that allow different stakeholders to share their data with any BIM compatible software. Under openBIM, the language for exchanging model information is Industry Foundation Classes (IFC). IFC is a standardised, digital schema for describing architectural, engineering and construction data. It is also the international standard ISO 16739-1:2018. It defines how to store BIM data in a database file, providing the foundation to openBIM data exchanges. Specifically, IFC is meant to save and exchange modeldata like real walls, floors, doors, windows, etc. with all their real-live properties.

In a typical openBIM workflow as illustrated in Figure 1, a BIM model is created by BIM authoring software such as Revit or ArchiCAD. Native file formats can only be read and edited by their own authoring software. For example, rvt is the native file format of Revit, and the data of a BIM model stored in the rvt file can only be changed by Revit, not ArchiCAD. If we want to share the model with the project team, the BIM model should be exported from its native file into an IFC file that is a vendor-neutral format. An IFC file is a frozen copy of the original model. Changes should not be made in an IFC file in the openBIM workflow, although some BIM software can edit IFC files. If changes are needed, the change request should be made to the owner of the model who will then modify the model in the original native file using the original BIM authoring software. The IFC file can be used as a reference for coordination and analysis, such as measurement, clash detection, cost estimation and energy simulation. This process protects the model from unauthorised changes during data exchange and ensures that each stakeholder can open the IFC file and view the model without the original BIM authoring software.
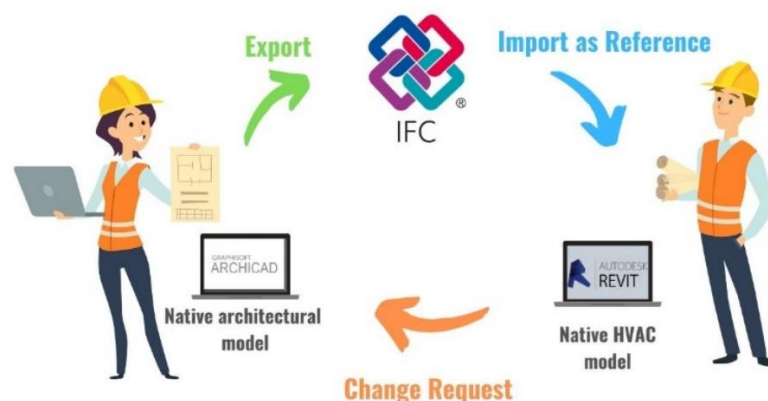

Figure 1 Workflow with IFC model between different disciplines (Source: Majcher (2019)[1])

To view the BIM model in a IFC file, a IFC viewer is needed. There is several IFC viewers available in the market. All these software is feature rich and able to view IFC files using numerous viewing tools and viewing mode. You can view 3D models with no or partial transparency, selectively hide or view components, view wireframe of models, view component details, and do much more with these IFC file viewer software. With so many choices, it is important to understand the features of each IFC viewer and choose the most appropriate one for your organisation and project. To this end, this report provides a review of 21 popular BIM/IFC viewers in the industry. The rest of this paper is structured as follows. Section 2 presents an overview of BIM/IFC viewers in terms of their cost, deployment and development capabilities. Section 3 compares the functions of these BIM/IFC viewers. Section 4 compares the development capabilities of these BIM/IFC viewers.

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[1] Majcher, J. 2019. Everything worth knowing about the IFC format. BIM Corner.
https://bimcorner.com/everything-worth-knowing-about-the-ifc-format/

2   Overview of BIM/IFC Viewers

Table 1 lists 21 BIM/IFC viewers commonly used in the industry. Most of them are freeware or free versions with basic functions. Only Autodesk Forge and Visoplan IFC Viewer are fully paid software. Except Visoplan IFC Viewer, the pricing model of all the paid software is based on subscription, allowing customers to purchase to the services for a specific period of time for a set price. Visoplan IFC Viewer has two types of payment structures: project-based and user-based. The project-based model is based on the respective project volume and is independent of the number of users. The user-based model is based on the number of users and projects and is independent of the project volume. The project-based model is suitable for large-scale projects, while the user-based model is suitable for small organisations with fewer projects on hand.

Table 1 Overview of BIM/IFC viewers

	Name	Cost	Web-based or desktop-based	Development
1	BIMvision	Free version: Viewer only, basic functions, one-time fees for plugins for advanced functions Paid version: Subscription-based, include all plugins	Desktop-based	SDK for plugin development
2	Xbim Xplorer	Free	Desktop-based	open-source
3	BlenderBIM	Free	Desktop-based	open-source, Blender add-on
4	OpenIfcViewer	Free	Desktop-based	N/A
5	usBIM.viewer+	Free	Desktop-based	N/A
6	BIMData viewer	Free	Web-based	SDK for plugin development
7	BIMcollab ZOOM	Free version: Full functions of model viewing, limitation on model validation and data extraction Paid version: Subscription-based, full functions of model validation and data extraction	Desktop-based	SDK
8	Solibri Anywhere	Free	Desktop-based	N/A
9	Autodesk Viewer	Free	Web-based	N/A
10	Autodesk Forge	Subscription-based	Web-based	API
11	Trimble Connect (formerly Tekla BIMsight)	Free	Desktop-based	N/A
12	DDScad Viewer	Free	Desktop-based	N/A
13	Bentley View	Free	Desktop-based	N/A
14	IfcQuery (Viewer application based on IFC++)	Free	Desktop-based	open-source
15	Areddo	Free	Desktop-based	N/A
16	Dalux BIM Viewer+	Free	Web- and desktop-based	N/A
17	FZKViewer	Free	Desktop-based	N/A

18	BIM BEAVER	Free	Desktop-based	N/A
19	xeokit-bim-viewer	Free	Web-based	open-source
20	BIM Track	Free version: No API access Paid version: Subscription-based, API access provided	Web-based	API (Paid version only)
21	Visoplan IFC Viewer	Project-based or user-based	Desktop-based	N/A

15 out of the 21 BIM/IFC viewers are desktop-based, five are web-based and only one is both desk- and web-based. Desktop-based viewers are installed directly on your computer, while web-based viewers are used through the internet via a web browser on your computer or mobile device. We cannot simply conclude that desktop or web-based software is better. The suitability should be analysed according to the requirements of your organisation and project. The general advantages and disadvantages of web-based and desktop-based BIM/IFC viewers are listed in **Error! Not a valid bookmark self-reference.** When selecting a desktop- or web-based BIM/IFC viewer, your requirements and constraints should be considered, such as the internet access on the construction site, the performance of your computer, the privacy policy of your organisation, etc..

Table 2 Comparison of desktop- and web-based BIM/IFC viewers

	Advantages	**Disadvantages**
Desktop-based	• No internet access required • Matters of privacy • Better performance	• Not portable • Hard drive space • Mandatory installation • Deployment for each computer
Web-based	• No need for installation • Automatic updates • Cross-platform availability • Mobile access • Light on computer resources	• Security threats • Dependence on Internet access • Potentially slower than desktop equivalents

3 Comparison of BIM/IFC Viewers

Standard functions are common among these BIM/IFCviewers, while some functions are exclusively available. Standard functions include zoom, rotate, pan, perspective control, measurement etc. When choosing an BIM/IFC viewer, we should focus on the exclusive functions that make a viewer stand out from others. Table 3 compares the exclusive functions among these BIM/IFC viewers. In addition, the following points should be noted:

- The free version of BIMvision only provides the same basic functions as most other IFC viewers, while its paid version can access a series of plugins that enrich the functionality of BIMvision. Users can also create their own plugins through API and publish them in the plugin store of BIMvision.
- BlenderBIM is essentially an add-on for Blender that is computer graphics software used for creating 3D models, animated films, virtual reality and computer games. Blender is very popular in the field of computer graphic and thus has large number of plugins. BlenderBIM is compatible with Blender plugins, which enriches its functionality.
- Although Autodesk Forge only has one function in Table 3, this does not mean that its functions are limited. In fact, its functionality is realised through its extensive APIs. Autodesk Forge is a platform of web service APIs that allow to integrate Autodesk SaaS products into users' own web or mobile applications. Forge Viewer, as a part of Forge, is a JavaScript-based viewer for 2D drawings and 3D models served by Autodesk's Model Derivative API.

Table 3 Comparisons of BIM/IFC Viewers (i.e. key functions)

	Name	Comment & Markup	Export BCF	Querying syntax	Federate IFC models	Clash Detection	View IFC Structure	Edit IFC	Other exclusive functions
1	BIMvision	X	with plugin		with plugin	with plugin	X		• Plugin store allowing extensibility • Compare IFC models
2	Xbim Xplorer		with plugin	X			X		• IFC Schema Validation
3	BlenderBIM	X		X			X	X	• Compatible with Blender plugins
4	OpenIfcViewer					X	X		• Publish any IFC model to 3D PDF
5	usBIM.viewer+			X	X	X		X	• Convert other 3D models (DWG viewer, SKP, 3DS, etc.) into IFC files
6	BIMData viewer	X	X		X			X	
7	BIMcollab ZOOM	X		X		X			• Check point clouds against IFC models • Export BIM data to Excel or PowerBI
8	Solibri Anywhere	X		X	X	X			• Cloud collaboration
9	Autodesk Viewer	X							• Supports most 2D and 3D files, including DWG, STEP, DWF, RVT and Solidworks.
10	Autodesk Forge	X							• Provide with APIs ready-made apps
11	Trimble Connect (formerly Tekla BIMsight)	X	X		X	X			• Cloud collaboration
12	DDScad Viewer	X	X		X	X		X	• Support IFC, BCF, gbXML and DWG files
13	Bentley View	X							• Support DWG, IFC, DGN files
14	IfcQuery (Viewer application based on IFC++)						X		

	Name	Comment & Markup	Export BCF	Querying syntax	Federate IFC models	Clash Detection	View IFC Structure	Edit IFC	Other exclusive functions
15	Areddo	X		X	X	X			• Support IFC, DWG, PTS and GML files
16	Dalux BIM Viewer+	X	X		X				• Support IFC, Revit, PDF and DWG files • iOS & Android Apps
17	FZKViewer	X		X	X		X		• Support IFC, CityGML and gbXML files
18	BIM BEAVER	X		X				X	• Quantity take-off • Export to STL, OBJ, FBX, CSV and image files
19	xeokit-bim-viewer	X	X		X				• Check point clouds against IFC models
20	BIM Track	X	X		X				• Cloud collaboration
21	Visoplan IFC Viewer	X	X		X				• Cloud collaboration

4   Development of BIM/IFC Viewers

There are five BIM/IFC viewers provide APIs for development. Table 4 provides an overview of their API capabilities. All of them provide the control of viewpoints, while the controls of snapshot, BCF and GUI are not fully open for users.

Table 4 Overview of API Capabilities

	Name	Language	Capabilities of API
1	BIMvision	C#.NET	• Access to the model structure, element types and properties • Change the colour, transparency, visibility of elements • Select elements • Change the view • Respond to events in the program (file opening, selection changing, element clicking etc…) • Access to measurements of objects • Draw text labels on elements • Add GUI elements and cooperate with custom plugin windows

2	BIMData viewer	JSON	**IFC API:**
			• Upload Models
			• Retrieve and update Model's data in real-time
			• Implementations:
			    ○ IFC Spacial Structure
			    ○ IFC Zones
			    ○ IFC Classifications
			    ○ IFC Systems
			    ○ IFC Layers
			    ○ IFC Properties and PropertySets
			• 3D models throught glTF format
			
			BCF API
			• Create BCF
			• Share BCFs with other services
			• Build a complete automated error management flow
			• BuildingSMART BCF 2.1 API
			
			Collaboration API
			• Create clouds and projects
			• Invite users
			• Manage their rights
			• Share models, data and documents
			
			Checker API
			• Validate Models
			
			Single Sign-On (SSO) API
			• Log in on desktop, tablet, mobile
			• Log in all your BIM Services through BIMData Connect
			• Log in through your own SSO

3	BIMcollab ZOOM	C#	• Create and set camera position • Set and retrieve colour and visibility of components • Grab a snapshot of the model

4	Autodesk Forge	JavaScript	Autodesk Forge provides a wide range of APIs to control the viewer on the web, including the following categories: • Implement basic viewer functionality • Add and edit UI elements • Create and edit extensions • Attach pointer events to vertices and edges
5	BIM Track	JSON	• Create, edit and delete issues • Create, edit and delete viewpoints and comments • Manage project attributes, such as project status, project types, project zones and project phases

5 Conclusion

This report provides a review of 21 BIM/IFC reviewers commonly used in the industry, including both free/paid software and desktop-based/web-based software. We compared the key functions of these BIM/IFC viewers. All these BIM/IFC viewers provide standard functions such as zoom, rotate, pan, perspective control, measurement, while some exclusive functions are provided in specific software. Some of BIM/IFC viewers have APIs for users' development. We further compared the capabilities of APIs provided by each BIM/IFC viewer. This report can server as a reference for selecting an appropriate BIM/IFC viewer for construction projects.