

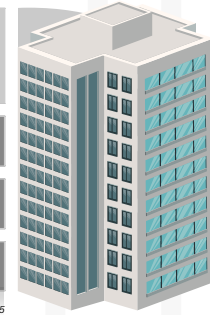
EVOLUTION OF
CONSTRUCTION CAD (BIM) DATA STORAGE FORMATS

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Geometric properties
of project entities

Attribute properties
of project entities

In construction projects, data manipulation begins with the collection of attribute and geometry requirements for project entities. Using parametrized CAD systems, the project is populated with data on the geometric parameters of the entities, which allows to confirm volumes and prepare data to be transferred to systems for handling the attribute parameters of the project entities.



COMPARATIVE
ANALYSIS OF FILE
FORMATS FOR
CONSTRUCTION
PROJECTS

	Excel®	AutoCAD®	MicroStation®	AutoCAD® DXF	Tekla	ArchICAD®	IFC	FBX	Navisworks®	SketchUp®	Revit®	BlenderBIM	BIM 360® & ACC	Online CDE	BEXEL	SYNCHRO®	GBXML	ITWO® / MTWO®	PRIMAVERA®	ACONEX®	PROCORE®	GLTF	Unreal Engine®	Pixar® & NVIDIA®	DataDrivenConstruction
Year published	XLM 1985, XLSX 2007	1982	1982	1982	1987	1987	1991	1996	1997	2000	2000	2019	2020	2020s	2010	2005	1999	2004	1983	2000	2002	2015	1998	2016	1987 & 2004
Developer	Microsoft®	Mike Riddle / Autodesk®	MicroStation®/Intergraph®	Autodesk®	Tekla Corporation®	Graphisoft®	TU Munich	Kaydara® / Autodesk®	Lightwork D / Autodesk®	Last Software / SketchUp®	Charles River Software®	OpenBIM®	Autodesk®	Different	BEXEL Consulting®	Synchro Software	Green Building Studio, Inc.	RIB Software®	Koppelman & Faris	Aconex Ltd®, Oracle®	Craig "Toony" Courtenay	Khronos Group® (Google, Apple, Intel, NVIDIA...)	Epic Games®	Pixar®	Microsoft® & Khronos Group®
Purpose of creation	Calculations, analyze and visualize data	Used in CAD applications	Used in CAD (BIM) applications	Interoperability between CAD software	Used in CAD (BIM) applications	Used in CAD (BIM) applications	Interoperability between CAD (BIM) software	Exchange of data between 3D application	Data management and 4D-8D use cases	3D model storage	Used in CAD (BIM) applications	Work with IFC format	Data management and 4D-8D use cases	Data management and 4D-8D use cases	Data management and 4D-8D use cases	Data management and 4D-8D use cases	Environmental analysis data	Data management and 4D-8D use cases	Project management and collaboration tools	Data management and 4D-8D use cases	Data management and 4D-8D use cases	Simulations, visualization and project assets	Simulations, visualization and project assets	Simulations, visualization and project assets	4D-8D use cases
Importing data from formats	RVT, IFC, DWG, DXF, ...	DXF, DGN, STP, ...	DWG, DXF, IFC, ...	DWG, DGN, RVT, IFC, ...	IFC, DWG, DXF, ...	DWG, DXF, IFC, SKP, ...	RVT, IFC, DGN, SKP, ...	RVT, IFC, OBJ, DAE, ...	RVT, DWG, DXF, DGN, SKP, ...	DWG, DXF, 3DS, DAE, STL, ...	DWG, DXF, DGN, IFC, SKP, ...	OBJ, FBX, 3DS, DAE, STL, ...	RVT, DWG, IFC, DXF, DGN, ...	RVT, DWG, IFC, DXF, DGN, ...	RVT, IFC, DWG, NWC, ...	RVT, IFC, DWG, DGN, NWC, ...	RVT, IFC, DXF, ...	RVT, IFC, DWG, DGN, ...	XLS	RVT, IFC, DWG, NWC, ...	RVT, IFC, DWG, DGN, NWC	RVT, IFC, DXF, NWC, ...	RVT, IFC, FBX, OBJ, ...	RVT, IFC, DWG, DGN, NWC	RVT, IFC, DWG, DGN, NWC
Storage	Tabular	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Tabular	Cloud-based	Cloud-based	Hierarchical	Hierarchical	Tabular & Hierarchical	Tabular & Hierarchical
Data structure	Structured Data	Closed Data	Closed Data	ASCII	Closed Data	Closed Data	Semi-Structured Data	ASCII	Closed Data	Closed Data	Closed Data	Semi-Structured Data	Closed Data	Closed Data	Semi-Structured Data	Closed Data	Semi-Structured Data	Semi-Structured Data	Structured Data	Closed Data	Closed Data	Semi-Structured Data	Closed Data	Semi-Structured Data	Structured Data
Open format	Yes	No	No	Yes	No	No	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes
Don't need the internet to work	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parametric geometry creation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Creating & modifying entity geometry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Checking geometric collisions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Creating & modifying entity attribute	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quality of data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Visualisation of entity geometry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Completeness of geometry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Creation of drawings	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integration with other tools	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Community	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grouping & filtering	1 line of code (Python/Pandas)	Only UI	Only UI	Only UI	30+ lines of code	30+ lines of code (DGN)	30+ lines of code (IFC)	5+ lines of code (FBX/SK)	30+ lines of code (Python/Sheet)	Only UI	30+ lines of code (Dynamo)	30+ lines of code (Revit/Sheet)	30+ lines of code (Forge)	30+ lines of code (Forge)	30+ lines of code (API Console)	10+ lines of code (Python)	10+ lines of code (Python)	10+ lines of code (Python)	10+ lines of code (Python)	10+ lines of code (Python)	10+ lines of code (Python)	10+ lines of code (Python)	10+ lines of code (Python)	10+ lines of code (Python)	1 line of code (Python/Pandas)
Calculations 4D, 5D, 6D, 7D	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No API Restrictions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Batch Processing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Don't need CAD (BIM) tools to work	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Difficulty in handling data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Versioning and change management	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Support for data analytics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Creating dashboards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Easy to create data processing tools	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Compatible with ERP Systems	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
The ability to create Big Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ML and AI support without ETL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Usage in ChatGPT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Primary application ecosystems	Almost any sector requiring data analysis	CAD Software	CAD Software	CAD Software	CAD (BIM) software	CAD (BIM) software	CAD (BIM) Interoperability Format	Interoperability, 3D modeling, animation, and game development	Project Review Software	CAD (3D Modeling) Software	CAD (BIM) software	3D modeling and animation software	Cloud-based Viewing and Data Management Platform	Cloud-based Viewing and Data Management Platform	4D-5D use cases, Construction Project Information Management	4D-5D use cases, Construction Project Information Management	6D-7D use cases, Energy analysis in building design	ERP, 4D-5D use cases, Construction Project Information Management	4D Project scheduling, Tracking, and Management	Managing documents, processes, and communications in large-scale projects	Project management, resource coordination, and communication in construction projects	3D rendering and virtual reality platforms	Real-time Rendering Engines	High-end rendering and animation platforms	ERP, 4D-5D use cases, Construction Project Information Management
Main users of the format	Project Managers, BIM Coordinators & Manager's	Planners, Architects, Designers	Planners, Architects, Designers	Planners, Architects, Designers	Planners, Architects, Designers	Planners, Architects, Designers	BIM Coordinators, BIM Managers	AI/VR, Game Developers, 3D Designers	Project Managers, BIM Coordinators & Manager's	Architects, Interior Designers	Planners, Architects, Designers	Planners, Architects, Designers	Project Managers, BIM Coordinators & Manager's	Project Managers, BIM Coordinators & Manager's	Project Managers, BIM Coordinators & Manager's	Project Managers, BIM Coordinators & Manager's	Projects - Estimators - Logistics Managers, Construction Project Managers	Projects Managers, Logistics Managers, Construction Project Managers	Projects Managers, Logistics Managers, Construction Project Managers	Projects Managers, Logistics Managers, Construction Project Managers	Projects Managers, Logistics Managers, Construction Project Managers	Simulation creators, AI/VR, Game Developers, 3D Designers	Simulation creators, AI/VR, Game Developers, 3D Designers	Simulation creators, AI/VR, Game Developers, 3D Designers	Project, Estimating, Logistics Managers, Construction Project Managers
Usage	Widely used across all platforms	Autodesk® AutoCAD®	Bentley® Systems MicroStation®	Autodesk® AutoCAD®	Tekla Structures	Graphisoft® ArchICAD®	OpenBIM® ArchICAD®, Tekla®, Revit®, Vectorworks®, BlenderBIM	Autodesk® 3ds Max, Maya®, and Unity®	Autodesk® Navisworks®	SketchUp®, Trimble Connect®	Autodesk® Revit®, Autodesk® BIM 360®	Blender	Autodesk® Forge®, Autodesk® BIM 360®, Autodesk® Construction Cloud®	BIM 360®, Forge based, Bentley® ProjectWise®, Trimble® Connect®, Procore® and others	Bentley® Manager	Bentley® ecosystem, Synchro® software	Autodesk® Green Building Studio	RIB® ITWO, MTWO Construction Cloud	Oracle® Primavera P6	Oracle® Construction and Engineering suite	Mobile applications, enabling use on various devices in the field or office	Microsoft® Mixed Reality Toolkit, Facebook® 3D Posts, Sketchfab, Three.js	Unreal Engine®	NVIDIA® Omniverse®, Apple® ARKit, Pico® VR tools	Excel® Python/Pandas, Unreal Engine®, PowerBI, ChatGPT, Unreal Engine
Popular usage platforms																									

data-driven
construction.io

FREE GUIDEBOOK
key data-related topics

50+
PRACTICAL
PROBLEMS
SOLVED

300+
UNIQUE
ILLUSTRATIONS

WARS OVER DATA
IN CONSTRUCTION

BOM BIM STEP IFC AIA
openBIM buildingSMART

FREE
STANDALONE
CONVERTERS

FREE IFC CONVERTER
FREE STEP CONVERTER
FREE IFC TO STEP CONVERTER
FREE STEP TO IFC CONVERTER

LLM AND CHATGPT
WITH REVIT, IFC
AND DWG