

Data Exchange Standards in the AEC Industry

As a world leader in 3D design and engineering software, Autodesk works to support commonly used data exchange mechanisms within the architecture, engineering, and construction (AEC) industry.

This paper outlines the many ways Autodesk continues to promote data exchange standards for Building Information Modeling (BIM).

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Autodesk Support for AEC Data Exchange Standards

Autodesk® BIM solutions for building and infrastructure currently support a wide range of industry standards and file formats, including DXF™, DWF™, ODBC, CIS/2, DWG™, LandXML, gbXML SAT, DGN, IFC, PDF, XML, SHP, SDF, WMS, WFS, GML, and LAS, as well as imager formats such as MrSID, ECW, TIF, DEM, DTED, PNG, and JPEG2K.

Autodesk also provides support for data exchange mechanisms through open, published Application Programming Interfaces (APIs) for its software.

DXF and **DWF** are open, published file formats developed by Autodesk. The formats are supported by developer tools that provide straightforward and easy ways to interact with design information created in Autodesk products, as well as those of many other vendors.

A good example of Autodesk's support for standards delivered by open, published APIs is the **CIS/2** (CIMSteel Integration Standards/Version 2) plug-ins available for Autodesk® Revit® Structure software. CIS/2 is an open standard for the exchange of structural

engineering data, specifically concerning steel structures. Support for Autodesk Revit Structure import and export in CIS/2 format is provided through the Revit® Extensions for Autodesk® Revit® Structure software available to Revit Structure Subscription customers (see <http://subscription.autodesk.com>). Visit www.cis2.org/index-bak.htm for more information about CIMSteel and CIS/2.

DWG is the native file format of Autodesk's AutoCAD® software. For software publishers who wish to incorporate AutoCAD publishing in their application, Autodesk offers the RealDWG™ developer's toolkit. RealDWG contains the same tools used internally by Autodesk to include DWG file support in its products that are not based on the AutoCAD platform—products such as Autodesk® Inventor® software and the Autodesk® Revit® family of products. Dozens of software providers already use RealDWG within their applications to provide AutoCAD DWG publishing.

LandXML is an open, published XML file format for civil engineering design and survey measurement data, intended for the transfer of engineering design data, long-term data archiving, and electronic design submission. LandXML is supported by many registered software applications from major design software vendors, and has been adopted for use by governments around the world. LandXML.org—an industry consortium of partners, including Autodesk—created, maintains, and updates the LandXML standard.

Green Building XML (**gbXML**) is an open, published XML file format that facilitates the transfer of information between platforms for the specific purpose of building performance analysis. The gbXML schema is supported throughout Autodesk's AEC applications (both the vertical AutoCAD-based applications, such as AutoCAD® Architecture and AutoCAD® MEP software, and the Revit family of products: Autodesk® Revit® Architecture, Autodesk® Revit Structure, and Autodesk® Revit® MEP software). The gbXML format is an important conduit to transfer model data to more than a dozen building performance analysis tools, including Autodesk® Ecotect® Analysis software, Autodesk® Green Building Studio® web-based service, and other third-party software solutions. Visit www.gbxml.org for more information.

Standard ACIS Text (**SAT**) is used for transporting geometry from one 3D application to another and is supported by AutoCAD and AutoCAD-based products and the Revit family of products.

DGN is the native file format in Bentley Systems MicroStation® products. Autodesk entered into an agreement with Bentley to exchange DWG and DGN software libraries in order to make it easier for Autodesk and Bentley customers to read and write both file types with greater fidelity. AutoCAD 2012 products use the Bentley libraries for DGN compatibility.

Standards Development

Autodesk has cooperated in defining many standards for digital information exchange, including Standard for the Exchange of Product Model Data, ISO 10303 (**STEP**), Initial Graphics Exchange Specification (**IGES**), LandXML, the Open Source Geospatial Foundation™ (OSGeo™), and others. Autodesk is a founding member of LandXML.org and buildingSMART International (formerly the International Alliance for Interoperability). Additionally, Autodesk has been a "Principal" member of the Open Geospatial Consortium (OGS) since 2002.

DATA EXCHANGE STANDARDS IN THE AEC INDUSTRY

In 2006, Autodesk contributed its Feature Data Object (FDO) technology to the open source community and helped to establish OSGeo to help manage this technology. FDO helps increase productivity and save time by enabling users to work on a variety of spatial and non-spatial databases and file formats natively, without the need for translation and risk of data loss. The technology is incorporated into Autodesk geospatial and infrastructure products, and is available as a stand-alone, open source technology for developers.

Autodesk also supports cross-vender data exchange, as evidenced by its agreement with Bentley to expand interoperability between their AEC software portfolios. In addition, Autodesk is a member of FIATECH and supports the work of the ISO 15926 committee by participating in ISO 15926 meetings and conferences. ISO 15926 is an international standard for the representation of process plant lifecycle information. FIATECH is an industry consortium working to accelerate the development of the ISO 15926 standard to provide complete lifecycle interoperability throughout a capital project. AutoCAD® P&ID and AutoCAD® Plant 3D software are ISO 15926–ready and share a common data architecture and XML-based application programming interface (API) that supports the basic tenets of ISO 15926 and allows for straightforward integration with ISO 15926–based systems.

Autodesk is actively involved in the National BIM Standard (NBIMS) and the related efforts of Construction and Operations Building Information Exchange (COBie) and National CAD Standard (NCS). All of these efforts are aimed at improving the performance of facilities over their lifecycle by defining standards for the building information needed by owners for operations. NBIMS is in the early phases of development, and as such it is not yet an actionable standard. However, Autodesk is an active participant in the creation of a National BIM Standard.

Autodesk AEC Solutions and IFC

Industry Foundation Classes (IFC) is an open standard for building data exchange developed by buildingSMART (formerly the IAI). Autodesk is a founding member of buildingSMART, is an active member of the North American chapter, and participates in buildingSMART International. IFC export from Autodesk AEC solutions expands the ability of architects and designers to share building data with other team members in the building design process, and supports compliance with U.S. General Services Administration (GSA) IFC delivery requirements.

Autodesk demonstrated its support for open standards and data interoperability by releasing the Revit® IFC export code to the open source community. This was made possible by basing Revit IFC export on the Revit API. This change enables the IFC community to enhance Revit IFC export according to individual or collective needs while demonstrating Revit API access to model data.

Autodesk is involved in the current initiatives with buildingSMART and the IFC community to achieve a high-quality IFC Coordination View 2.0 recertification process that involves Revit Architecture, Revit MEP, and Revit Structure software. Autodesk is also working to meet specific requirements for GSA CD BIM 2010.

Revit Architecture 2012 software provides IFC export and import based on the buildingSMART IFC 2x3 data exchange standard. Revit Structure and Revit MEP software contain the same IFC capabilities as Revit Architecture.

Revit Architecture software (formerly called Revit® Building) received full buildingSMART certification for its export of IFC data in November 2005. Revit Architecture continues to support the IFC2x2 Code Checking View that expands the IFC Coordination View for architectural code checking. Revit Architecture (formerly Revit® Building 9.1) received stage-1 IFC 2x3 Coordination View Certification in June 2006, and full stage-2 certification for Coordination View in May 2007. These certifications constitute the full set of certifications currently available from buildingSMART for architectural design software.

AutoCAD® Architecture software has a long history of support for IFC. Autodesk® Architectural Desktop (now AutoCAD Architecture) supported IFC in 2006 through a plug-in provided by G.E.M. Team Solutions GbR. Starting from AutoCAD Architecture 2008, IFC export and import based on the buildingSMART IFC 2x3 data exchange standard are implemented directly into the product. AutoCAD Architecture 2008 received stage-1 certification by the IAI in November 2006 and full stage-2 certification for the IFC 2X3 Coordination View for both import and export in May 2007. These certifications constitute the full set of certifications currently available from buildingSMART for architectural design software. . Visit www.buildingSMART.org for more information about buildingSMART and IFC.

IFC export from Revit Architecture also complies with the Corenet e-Plan Check System requirements from Singapore's Building and Construction Authority

Summary

Building Information Modeling is an intelligent model-based process that provides insight for creating and managing building and infrastructure projects faster, more economically, and with less environmental impact.

BIM is not a file format or data schema. The standards discussed here such as IFCs or CIS/2, are mechanisms for moving data from one software application to another but are not themselves BIM project models. The intelligent information delivered by BIM, however, is the foundation for the value these standards deliver.

Organizations across the architecture, engineering, plant and construction industries use Autodesk BIM solutions to design, visualize, and simulate their ideas. As such, Autodesk continues to develop the broadest portfolio of state-of-the-art software for these customers *and* to provide advanced mechanisms for the exchange of intelligent models and information.

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