BIM ENGINEERING SOFTWARE

Comprehensive Guide to Bentley OpenBuildings and AECOsim Building Designer: The Future of Multi-Disciplinary BIM

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In the modern landscape of Architecture, Engineering, and Construction (AEC), the transition from traditional 2D drafting to multi-dimensional Building Information Modeling (BIM) has become a non-negotiable standard. At the forefront of this evolution is Bentley Systems with its legacy product, **AECOsim Building Designer**, which has now transitioned into the more robust **OpenBuildings Designer**. This platform represents a sophisticated environment designed to facilitate the design, analysis, and documentation of complex infrastructure and buildings within a unified ecosystem.

The Evolution of Building Design: From AECOsim to OpenBuildings

The journey of Bentley's building design solutions is marked by a shift towards convergence. **AECOsim Building Designer** was originally developed to provide a single application for four key disciplines: architecture, structural, mechanical, and electrical engineering. Its goal was to eliminate the silos that traditionally hindered project efficiency. As the industry moved toward cloud-enabled collaboration and digital twins, Bentley rebranded and enhanced the software as **OpenBuildings Designer**.

OpenBuildings Designer incorporates the functionality of AECOsim while adding advanced capabilities for computational design and energy performance simulation. For professionals still utilizing **AECOsim Building Designer V8i (SELECTseries)**, the software remains a powerhouse for large-scale infrastructure projects due to its stability and specialized toolsets like the **Mechanical Building Designer** and **Hevacomp** integration.

The Core Pillars of Multi-Disciplinary BIM

Unlike software packages that require separate plugins or different applications for different departments, the Bentley BIM ecosystem is built on a shared platform. This ensures that a structural engineer and an architect are working on the same underlying data structure, reducing the risk of data loss or interpretation errors. The core pillars include:

- Architectural Design: Tools for creating walls, doors, windows, and complex organic geometries.
- Structural Engineering: Modeling steel, concrete, and timber structures with direct links to analytical software.
- Mechanical Design: Ductwork, piping, and HVAC system modeling integrated with load calculations.
- Electrical Systems: Power, lighting, and communications layout with circuiting logic.

Technical Framework: The DGN Engine and Interoperability

At the heart of OpenBuildings and AECOsim is the **DGN file format**. Unlike the proprietary DWG or RVT formats used by competitors, the DGN format is renowned for its ability to handle massive datasets without performance degradation. This is a critical factor for infrastructure projects like airports, hospitals, and transit hubs.

Interoperability and the Common Data Environment (CDE)

Interoperability is achieved through support for **Industry Foundation Classes (IFC)** and **COBie** (Construction Operations Building information exchange). Bentley's integration with **ProjectWise** creates a **Common Data**

Environment (CDE), allowing teams across the globe to collaborate in real-time. This reduces "information lag" and ensures that every stakeholder is viewing the most current version of the project.

Feature	AECOsim Building Designer V8i	OpenBuildings Designer (CONNECT)
Engine Architecture	32-bit/64-bit Hybrid	Pure 64-bit Performance
Computational Design	Limited / Separate Add-on	Fully Integrated GenerativeComponents
Cloud Collaboration	Manual Uploads	Native ProjectWise/iTwin Integration
Energy Simulation	External Hevacomp Link	Integrated Energy Simulator
User Interface	Classic Toolbar Based	Modern Ribbon-Based Interface

Mechanical Building Designer: A Deep Dive into Hevacomp Integration

One of the standout features mentioned in technical data sheets for Bentley software is the **Hevacomp Mechanical Designer**. This module is essential for mechanical engineers focusing on HVAC (Heating, Ventilation, and Air Conditioning).

The Procedural Workflow for Mechanical Design

The workflow within the Mechanical Building Designer typically follows a rigorous engineering sequence:

1. Spatial Definition: Importing the architectural model to define thermal zones and room boundaries.
2. Load Calculation: Utilizing the Hevacomp engine to calculate peak heating and cooling loads based on local climate data and building fabric properties.
3. Duct and Pipe Sizing: Automatically sizing distribution systems based on flow rate and pressure drop requirements.
4. Component Placement: Populating the 3D model with air handling units (AHUs), pumps, and terminal units from a standardized library.

Mathematically, the software handles complex fluid dynamics and heat transfer equations. For example, the calculation of duct friction loss (9E ’ —2 ögFVâ FW ived from the Darcy-Weisbach equation:

9E Ò b ,R „ÂôB’ ,R ƒÁv² / 2)

Where **f** is the friction factor, **L** is length, **D** is hydraulic diameter, **<s** air density, and **v**is velocity. By automating these calculations within the BIM environment, engineers can optimize system performance and reduce material waste.

Structural and Architectural Synergy

Structural engineers utilize AECOsim to model intricate steel connections and reinforced concrete. The software supports **ISM (Integrated Structural Modeling)**, which allows for a bidirectional workflow between the physical BIM model and analytical engines like **STAAD.Pro** or **RAM Structural System**.

The Role of GenerativeComponents

A major differentiator for Bentley is **GenerativeComponents**. This is a computational design platform that allows designers to use algorithms to drive geometry. Instead of manually drawing 500 unique glass panels for a curved facade, a designer can write a script that defines the logic of the panels based on the curvature of the building

surface. This algorithmic approach is vital for modern, non-linear architecture.

Practical Implementation: Quick Start Guide

For new users or firms transitioning to AECOsim/OpenBuildings, the following implementation steps are recommended:

1. Environment Setup

Ensure that the **WorkSpace** and **WorkSet**are correctly configured. In Bentley terminology, a WorkSpace represents a client or standards body (e.g., ISO, UK Standards), while a WorkSet is the specific project. This hierarchical structure ensures consistency across all files within a project.

2. Modeling Best Practices

Always utilize **AccuDraw** and **AccuSnap**. These are Bentley's precision drafting tools. AccuDraw uses a compass-based system that allows for rapid coordinate entry, which is significantly faster than traditional Cartesian input when working in 3D space.

3. Data Management

Every element in the model should have **DataGroup**information attached. A wall is not just a 3D solid; it contains data regarding its fire rating, manufacturer, U-value, and cost. This metadata is what transforms a 3D model into a true BIM model.

Comparative Evaluation: Bentley vs. The Competition

When evaluating BIM software, firms often compare Bentley’s offerings with Autodesk Revit or Graphisoft ArchiCAD. While Revit dominates the commercial building sector, OpenBuildings/AECOsim is often preferred for infrastructure.

Metric	Bentley OpenBuildings	Autodesk Revit	Graphisoft ArchiCAD
Primary Focus	Large-Scale Infrastructure	General Building Design	Architectural Design
File Size Handling	Excellent (DGN)	Moderate (RVT)	Good (PLN)
Multi-Disciplinary	Native Unified Environment	Requires Multiple Suites	Strong Architectural, Improving MEP
Customization	High (C++, MDL, Python)	High (C#, Dynamo)	Moderate (GDL)

Troubleshooting and Operational Challenges

Implementing a high-end BIM solution is not without challenges. Common issues include:

- License Management: Older versions like V8i use SELECTserver, while newer versions use SES (Subscription Entitlement Service). Incorrect configuration can lead to "Trial Mode" interruptions.
- Hardware Bottlenecks: While DGN is efficient, the rendering and energy simulation modules require robust GPUs and high RAM (32GB+ recommended).
- Data Mapping in IFC: When exporting to IFC for stakeholders using other software, ensuring that DataGroup properties map correctly to IFC entities requires careful setup of the export mapping file.

Solution for Interoperability Gaps

To solve the common problem of "data dropping" during IFC exports, users should utilize the **IFC Optimization tool** within OpenBuildings. This tool validates the model geometry and metadata against the IFC 2x3 or IFC 4 schema before export, identifying missing GUIDs or unassigned spatial locations.

The Broader Implications for the AEC Industry

The utilization of platforms like OpenBuildings Designer signifies a shift toward the **Digital Twin**. A BIM model is no longer just a set of construction drawings; it is a living digital representation of the physical asset. By integrating IoT sensors with the model, building owners can monitor energy consumption, structural health, and occupancy patterns in real-time.

For the technical professional, mastering this software involves more than just learning where the buttons are; it requires an understanding of how data flows through the lifecycle of a building. From the initial **Hevacomp** energy analysis to the final **COBie**handover for facility management, the value of the model lies in its accuracy and its ability to be queried. As urban environments become more complex and sustainability requirements become more stringent, the role of high-fidelity BIM software will only continue to grow, providing the tools necessary to build a more resilient and efficient world.

Baca Juga (Artikel Terkait)

- **The Comprehensive Technical Guide to Autodesk Revit 2015: Architecture, Structure, and MEP Engineering**

  URL: http://123caramba.com/comprehensive-technical-guide-autodesk-revit-2015.pdf

Tags: #AECOsim #OpenBuildings Designer #Bentley Systems #BIM Workflow #Mechanical Engineering #Structural Design