

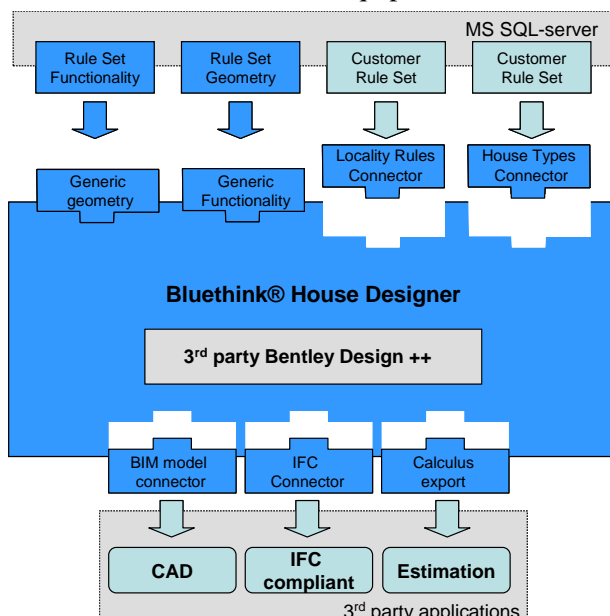
Bluethink® House Designer Technical White Paper



House Designer is a rule based design tool that guides the engineers and architects, but let them explore their creativity, in product and house design. The user sketch functional intent and layout, and the system apply the rules and automatically work out the various elements and decisions that constitute a complete building design. The system warns the user immediately when conflicts appear and rules are violated. Several rule sets may be defined in the system; geometry rules, functional rules, building systems, etc. The design is stored in a Building Information Model (BIM) that can be exported to a BIM system, or to cost estimation tools and structural analysis tools for further processing. As the system immediately verifies design against all defined rules, a high quality BIM is created a early as possible, the number of iterations between the different specialists will be reduced and engineering time will be saved.

The user of **House Designer** is referred to as 'the designer'. It might be an architect or a building engineer. The user interface provides the designer with the tools to define the basic characteristics of an apartment or building: its shape, its space plan, its furniture and other equipment. These characteristics become the input definition of the building and apartments, and are the basis upon which the rules are applied. The design space is restricted to the set of features that the company sees as essential and part of its consciously selected principles for design and construction. These are the rules that are defined in the knowledge system.

The rules are implemented in **House Designer** in one of three different forms; as input parameters, as data tables and as statements written in a computer language. Various external elements function as raw materials to the more fundamental rules -- like dimensions of doors and windows, the properties of walls, the cost of different equipment -- are added to data base tables. That way the objects can



easily be modified and new ones added. A large number of design aspects can be modified by changing the values of parameters, for example, whether exterior walls should be positioned so that they are on the inside of the building lines, or on the outside. Most of these parameters are easily available in the user interface, so that the designer can experiment with various values and thus different rules. The core rules of the **House Designer** are written as statements in a computer language. Due to the modular nature the knowledge-based engine, learning how to read and modify these core rules are within the capabilities of an interested and motivated engineer or architect.

The power of **House Designer** is amplified by connecting it to third-party computer systems and having House Designer drive these and

feed them with data. In this way, existing systems and their data are leveraged and become part of a larger rule based system. Even more powerful effects can be had by establishing a feedback loop from the third-party system back into House Designer. By having **House Designer** automatically analyzing the results of certain third-party system outputs and altering its decisions on the basis of these results, even better designs can be worked out by the system.

Functionality:

Generic functionality

House Designer generic functionality consists of several main features

Sketching a house or an apartment layout

- Easy to draw sketching tool for apartments, designing spaces and assign functionality to each space
- Placement of furniture, equipment, fittings and building parts to indicate functionality and use

Sketching a building layout

- Easy to draw sketching tool for building layout including adding and deleting floors, adding and editing garage etc.
- Assigning apartments and common functionality like stairs, entrance, elevator to spaces

Sketching and using a furniture and fittings

- Easy to draw furniture, equipment and fixtures
- Easy to insert and reuse furniture groups and fittings
- Indicate where furniture or fittings can expand or reduce size to enable the same group adapting to area or segment with different size or length.

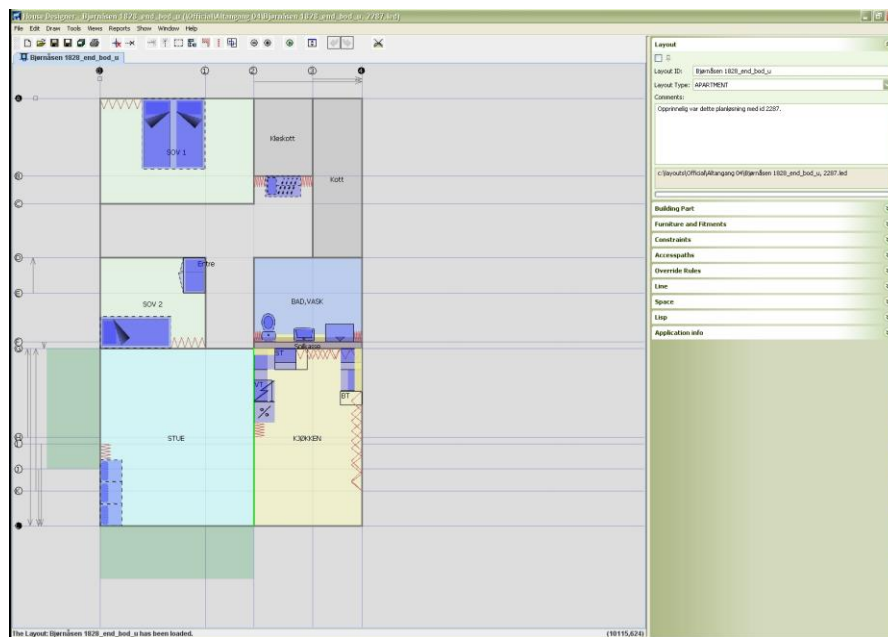


Figure 1: Effective sketching tool for functional intent and layout

Generating a complete BIM – automated design

- Based on selected layouts and selected rule sets, House Designer auto generates a complete BIM
- The BIM can be viewed in various ways to support fast decision making
- The level of details and functionality can be turned on and of for areas like HVAC and Electric components.

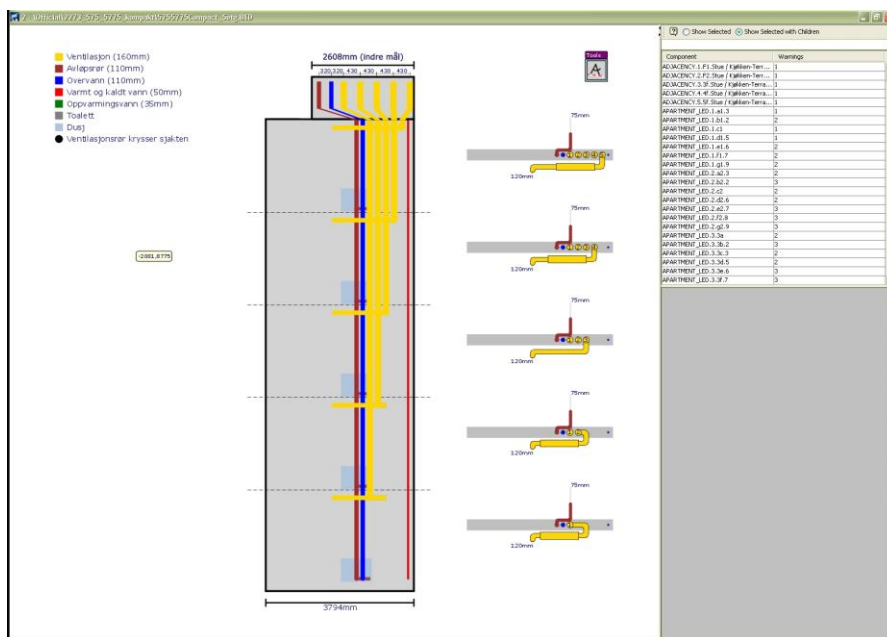


Figure 2: Automatic layout and verification of HVAC in vertical shafts.

Automated knowledge

- The KBE (Knowledge Based Engineering) engine turns all the implemented rule sets into automated design decisions when generating the BIM.

Validating the result – automated redlining

- When the BIM is generated, **House Designer** checks the result against the current rule sets and reports all shortcomings.

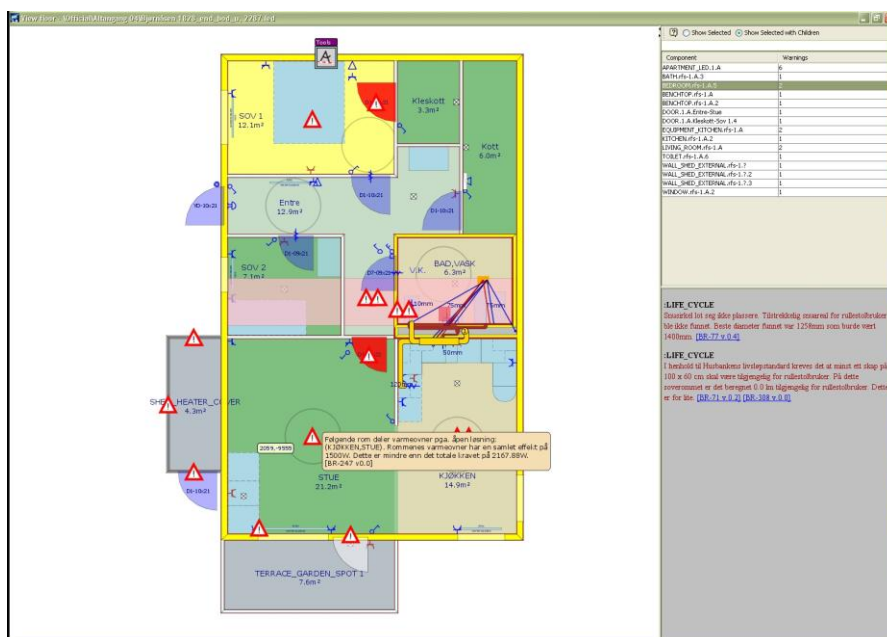


Figure 2: Automatic checking against defined rule sets and reporting of all deviations.



Analyzing and reporting

- In addition to knowledge based BIM generation and validation, House Designer also supports analysis and reports like quantity takeouts and heat loss report.

Rule sets

A knowledge based system like **House Designer** needs rules to be able to reason over, generate from and validate against. The rules are gathered in rule sets and each rule set can be turned on and off. The rule sets are divided into several categories listed below. The standard generic rules are defaults and must be a part of House Designer. The other sets are optional.

Standard generic building geometry rules

House Designer handles a large number of rules governing how to assemble standard building objects like walls, roofs, floor slabs, etc ensuring for instance vertical alignment. Other rules assure that elements do not collide, or create warnings describing conflicts.

Standard generic housing functional rules

House Designer handles rules that maintain generic functional aspects of building design, for instance checking that all spaces have access, doors are placed efficient, all furniture can be passed and used etc.

Generic locality rules

Enables use of generic locality rules. The rule set must be developed or bought separate. Typical locality rules are governmental codes and regulation rules for a region or country.

Building systems

Enables use of building system rules. The rule set must be developed or bought separate. Typical building system rule sets are rules regarding building methods like pre-fabricated elements, light steel frames versus timber frame etc.

House types

Enables use of building system rules. The rule set must be developed or bought separate. Typical house types are: low rise with an access balcony or common entrance, high rise, singular homes etc.

Export and integration

House Designer Support various validation, analysis and views of the generated BIM, but to enable more detailed documentation and analysis like drawing as well as a starting point for further design and detailing, the BIM and other related information can be exported.

BIM model export Connector

House Designer features export of the BIM model to three BIM systems;

- native support of Bentley Architecture,
- native support of DDS-CAD House Partner,
- IFC based support of AutoCAD Architecture 2008



For all BIM model export Connectors, **House Designer** exports building elements like, wall, floor, space etc. together with validations and other **House Designer** specific information.

IFC Structural Connector

House Designer exports the structural aspects of its model including loads, by means of IFC 2x3. This IFC-representation can be imported into a third-party structural analysis package for further analysis and calculations.

IFC Architectural Connector

House Designer exports the architectural aspects of its model by means of IFC 2x2. This IFC-representation can be imported into any IFC-compliant third-party visualization, modeling or analysis tool.

Calculus data export API

House Designer supports exporting the model on a form suitable for import into a third-party calculation and bill of materials system. The data is written in the XML file format and can easily be adapted to local needs.

Energy data and export

House Designer features a energy report of the modeled building. Additionally, by means of the IFC export, any third-party energy analysis tool should be able to create detailed energy reports of the **House Designer** building model.

Key benefits:

- Time to market improvement
- Fast, accurate and effective design process
- Design comply with embedded rules
- Design generates BIM that can be exported to CAD system and BIM based analysis tools
- Reduced time for calculations and analysis
- Reduced number of changes
- Productivity increase
- Reduced engineering time
- Reduced construction time
- Cost reduction
- Reduced material cost
- Reduced warranty cost
- Reduced operation cost
- Quality improvement
- Error reduction
- Corporate knowledge reuse

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Related products:

- Bluethink® Supervisor
- Bluethink® Experience

Related services:

- **Support:**
Technical Support gives our customers key personnel access to support engineers for assistance when technical issues occur, as well as software patches and product enhancements.
- **Training:**
Training of our customer's super-users and end-users are provided, both as standard classroom training at Selvaag Bluethink, as well as customized on-site.
- **Consulting:**
Installation and implementation services are important elements in Selvaag Bluethink's offering. The implementation services are based on the methodologies developed in parallel with the software products, ensuring the customer a best possible starting point for use of our products.

System requirements:

- Microsoft Windows 2000 or higher.
- 2GB RAM

Required 3rd party products:

- Design++ from Bentley Systems. Must be licensed separately.
- Microsoft SQL Server. Must be licensed separately.



Active knowledge

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