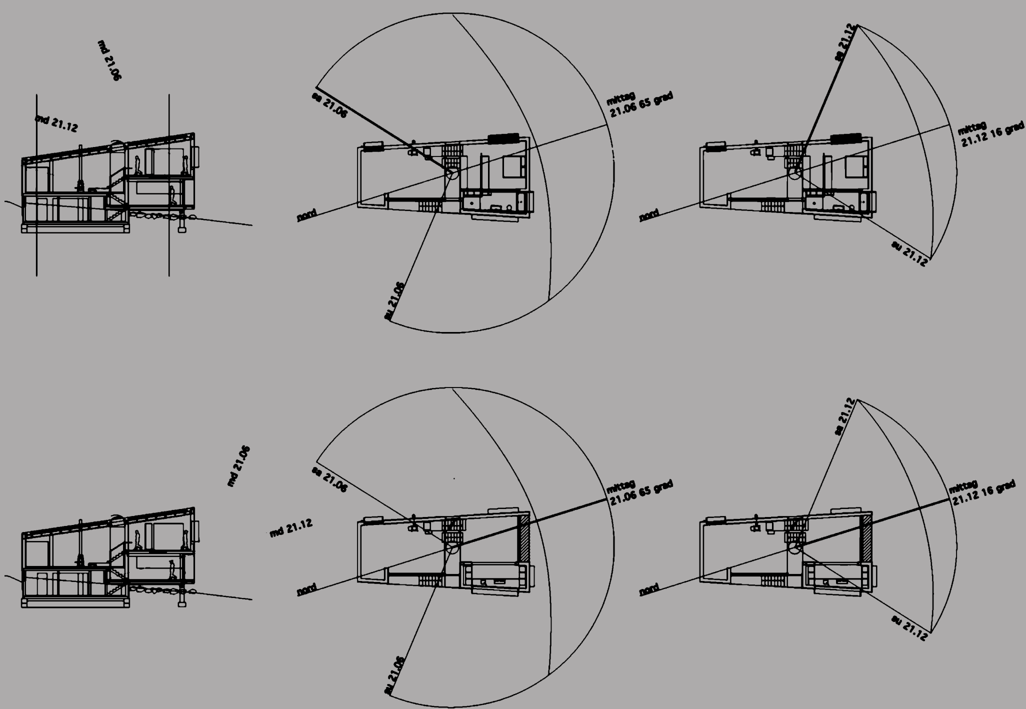
Blind Spot House



by Storp Weber Architects

Project Details

Practice:	Storp Weber Architects
Designers:	Patrick Weber and Sabine Storp Weber and Storp contributed equally to this project through their joint practice Storp Weber Architects.
Title:	Blind Spot House
Output type:	Building
Function:	Family dwelling (detached house)
Location:	Achern Fautenbach, Germany
Client:	Private
Practical completion:	2010 (with new extension currently in planning)
Budget:	Undisclosed
Area:	House 110m^2
Structural engineer & environmental consultant:	Sterk Ingenieure im Bauwesen, Baden Baden
Main building contractor:	Bauunternehmen Edgar Sutterer GmbH, Renchen

Statement about the Research Content and Process

Description

The Blind Spot House is an experimental house built on the slopes of the Black Forest in southern Germany, using passive solar energy principles for an open-plan contemporary mode of living. The family dwelling is designed around specific views and creates controlled blind spots to 'hide' the neighbouring buildings. An iterative research process is used to analyse the sight lines and in-depth research is undertaken to achieve low-energy building operation. The building fulfils the strict requirements of the German low-energy house standard *KfW Effizienzhaus 60,* so its energy consumption is considerably lower than that of an average UK home.

Questions

1. **How can the occupant's pre-existing and enduring relationship with the specific site be enhanced by the design and experience of a new building?**
2. **How can a house act like a visual device to control specific outward views?**
3. **How can the architect achieve a balance between the requirements of the German low-energy house standard *KfW Effizienzhaus 60* and an innovative contemporary open-plan design?**

1 *(previous page)*
Completed building seen from south-west

Methods

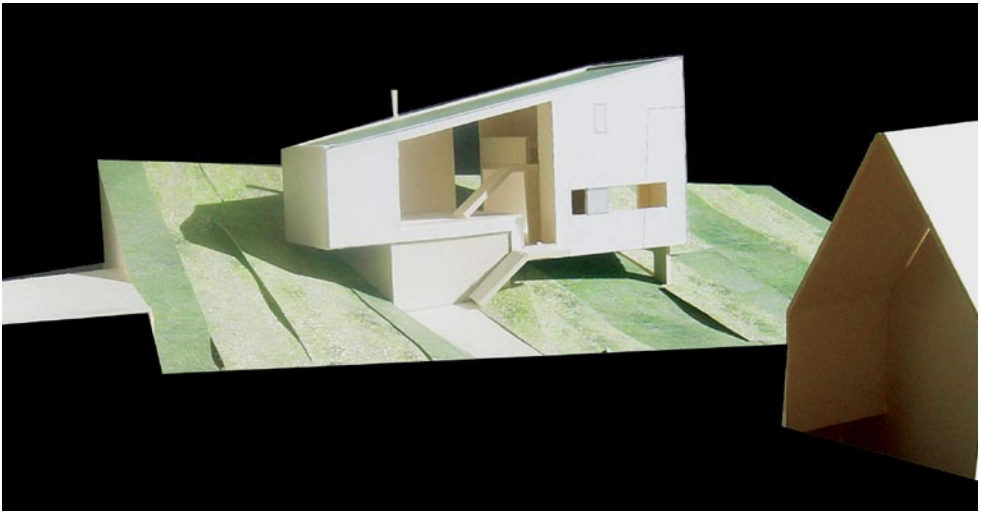
1. **Site analysis and fieldwork to establish the site conditions.**
2. **Addressing the notion of a lost horizon through theoretical investigations into phenomenology.**
3. **Drawing and model-making to test the design and establish the exact positioning and geometry of the building form and windows.**
4. **Efficiency modelling of various types of house forms to determine the best solution that strikes a balance between energy efficiency and the desired spatial conditions.**

Dissemination

Presented as a conference paper in Istanbul; reviewed on design websites including *Designboom, Baunetz Wissen, Architecture News Plus, Architourist, Architectural, Magazine Domo.*

Statement about Significance

The house met the strict requirements of the German low-energy house standard *KfW Effizienzhaus 60* due to its passive solar energy efficiency and was granted additional funding by the German government-owned bank KfW.



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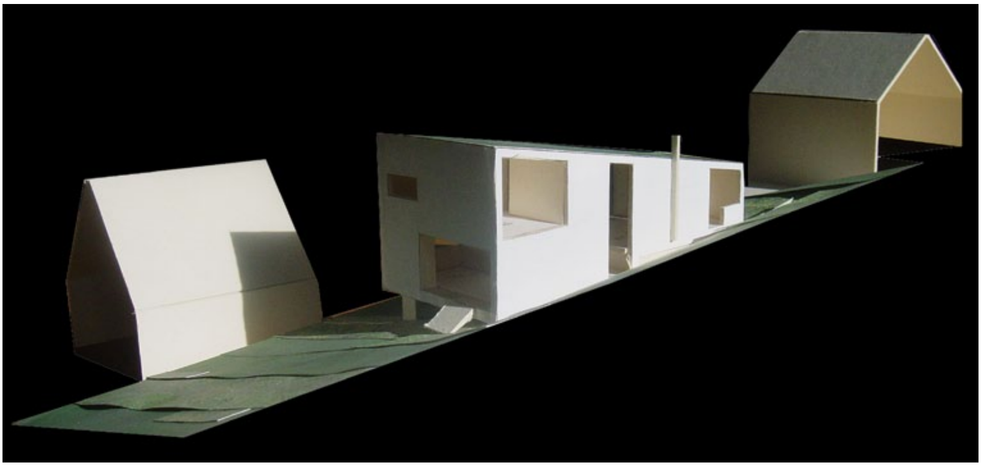

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2
Model of the building with site context

3
Model showing the proximity to the adjacent buildings

Introduction

Sustainability and an increased need for energy saving tend to result in approaches where design is often secondary to the strict conventions dictated by the framework of regulations governing the certification process for energy efficiency. In Germany designers are often substituted by engineers and surveyors due to the complexity of the certification regulations. This project resists this tendency and uses design research to study and achieve the standards of low energy building without compromising its aesthetic and spatial qualities. [fig. 1–3]

Drawing from 'framing' explorations in modern architecture and art, and Merleau-Ponty's thought on the body's relation to space, we explored ways in which architecture can enhance one's experience of the horizon. The house is located on a steep hill overlooking the Rhine valley, blessed with extreme views to the far horizon towards France on one side, along the valley on the other side and towards the Black Forest mountains behind. The site is also in close proximity to three existing houses at adjoining sites. This complex visual field was central to the research and design development. [fig. 4 & 5]

Aims and Objectives

The Blind Spot House aims to incorporate an intelligent architectural approach to the creation of a fluid interior space with key horizon views while having optimal passive energy use performance:

1. An internal promenade where the occupants can inhabit the house along a path connecting a series of views and blind spots. Each view provides distinct orientation, aperture and depth of visual field. Spanning over three main levels of living accommodation, the space is conceived as one large unbroken volume.
2. To undertake detailed design research into the environmental parameters of the project to achieve optimal passive solar gain, heating, natural ventilation and cooling. [fig. 6 & 7]

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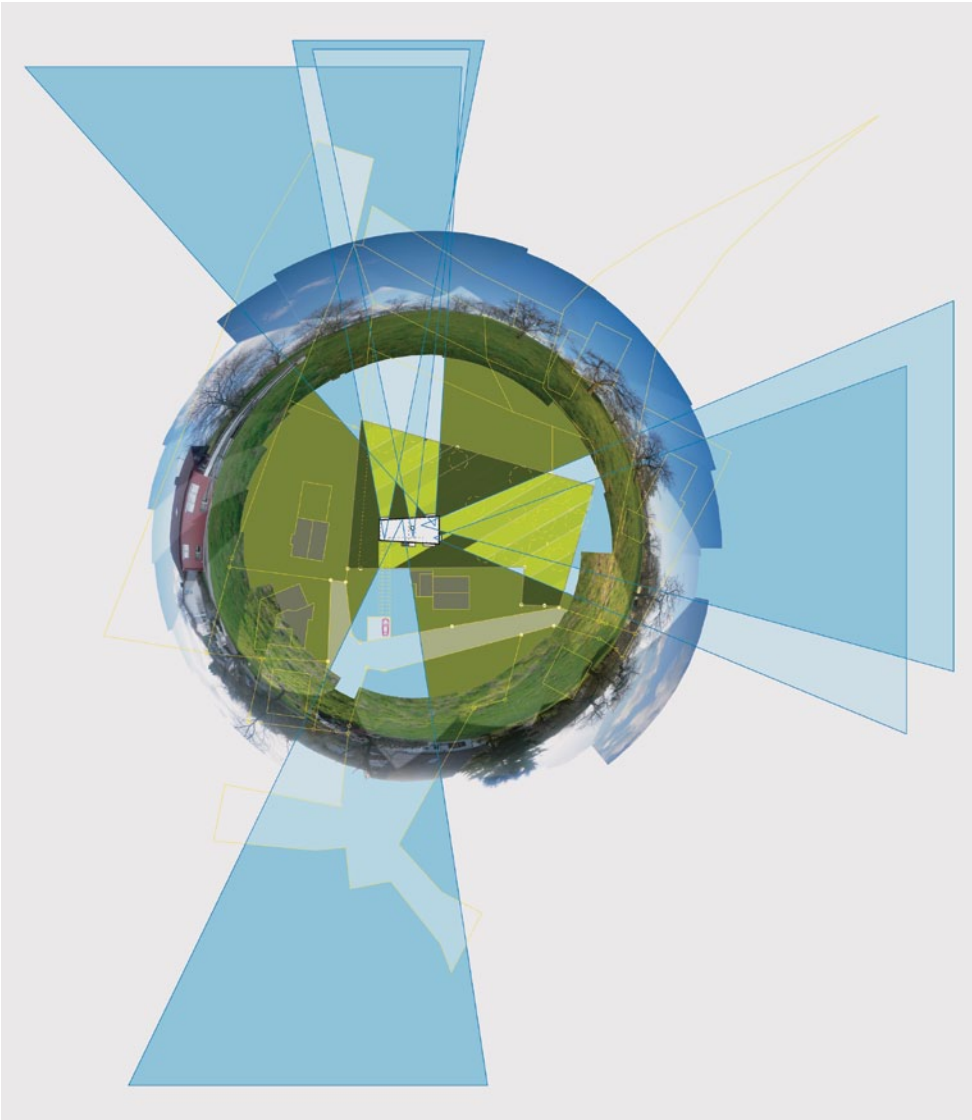
4
Site drawing with 360-degree panoramic montage, setting out the blind spots



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5
Site drawing of the building proposal with 360-degree panoramic montage, setting out the selected viewing corridors

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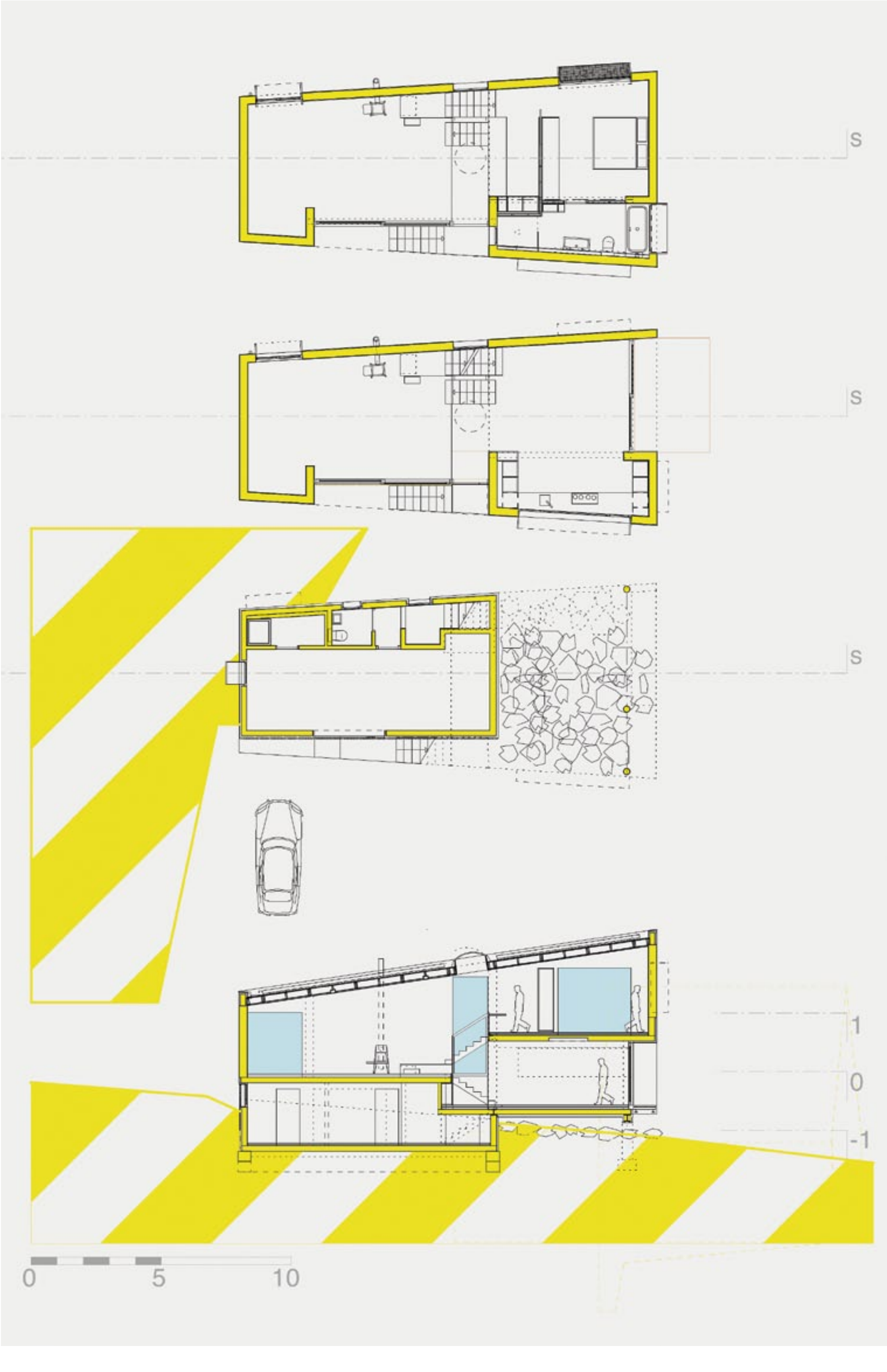
6
Site drawing

7
Set of three plans (top floor, entrance level, basement) and cross section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8
Interior view of the finished building (second level)

Questions

How can the occupant's pre-existing and enduring relationship with the specific site be enhanced by the design and experience of a new building?

The client grew up in the building next to the site and was very familiar with the hills of the Black Forest, and a view across the Rhine valley towards France. Since then trees have grown and the view has been lost. We explored how to reconnect the inhabitant's everyday pattern of living with the remaining fragmented views of this 'lost' horizon.

How can a house act like a visual device to control specific outward views?

The site restrictions for the building, although positioned on a 1,250m^2 plot of land, were severe. Local building regulations defined a very small location for it, positioned far too close to neighbouring buildings. An iterative drawing process determined a series of strategically positioned blind spots, intended to hide the neighbouring buildings, and a sequence of views of the background (horizon), foreground or middle ground.

How can the architect achieve a balance between the strict requirements of the German low energy house standard *KfW Effizienzhaus 60* and an innovative contemporary open-plan design?

Incentives to meet German sustainable design regulations, including *KfW Effizienzhaus 60,* have been achieved by offering clients lower mortgage rates (up to €50,000 per housing unit) towards the building costs. As a result in Germany, the design quality of a building is often neglected in favour of solutions that simply comply with the regulations. The Blind Spot House owner's desire was to find a balance between the design ideas and the regulatory framework. [fig. 8 & 9]

9

9
Finished building seen from the east

10

10
Drilling equipment for installation of the ground source heat pump

Context

This project is situated within the context of sustainable building, particularly contemporary ‘passive houses’, which critically and imaginatively interpret the principles of energy saving in Europe. It also belongs within an interdisciplinary context of contemporary architecture and art projects that deal with visual promenades and concepts of revealing and masking views.

Passive house

Houses designed under the term ‘passive house’ require a combination of measures to ensure reduced use of primary energy for heating the building and to provide a comfortable living environment. Five main areas have to be considered to meet the standards:

Passive solar design: The house must be orientated towards the sun, conserving energy by reducing the windows facing away from the sun. A compact design ensures heat loss is minimal. Main windows are orientated towards the sun, maximising the solar gain during the winter months.

Insulation: Significant insulation ensuring no heat loss through the main building structure, achieved, for example, by wrapping the building in a layer of insulation materials and/or by using super-insulating primary building materials such as Porotherm, and roof insulation at 350–450mm.

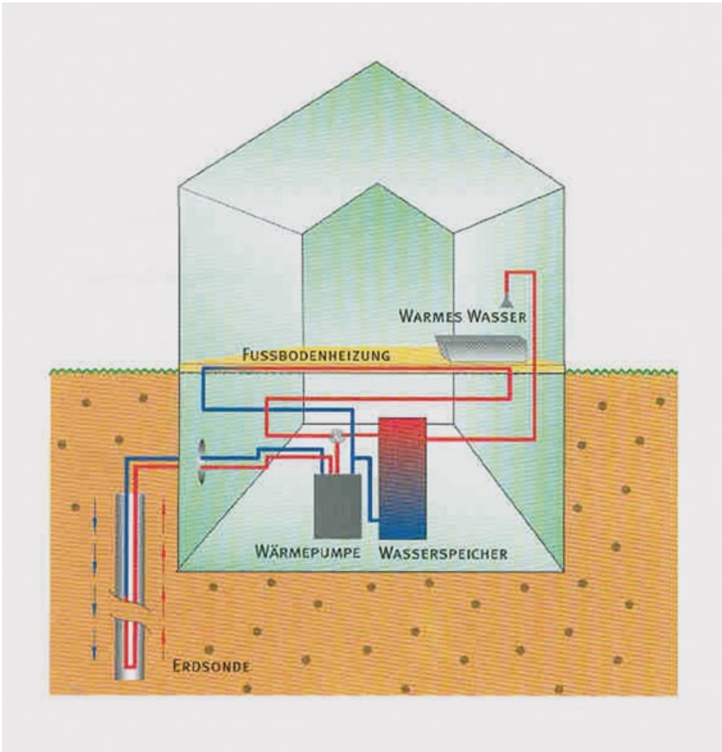
Windows: All windows manufactured to a higher standard of insulation, including the frames and the fixings, and a low-emissivity coating on the glass maximising solar heat gain and preventing heat loss.

Ventilation: Passive houses require ventilation strategies to be reconsidered for the whole house. A simple stack effect with a skylight can be used instead of a forced mechanical ventilation system.

Heating: Maximum-efficiency central heating systems. The use of solar panels and heat pumps is desired to make sure energy consumption is reduced. German passive house regulation categories include *Effizienzhaus Plus* (no external primary energy used for heating); standard (maximum of 15Wm^2/year); and variable *KfW Effizienzhaus 40–70* standards (40–70Wm^2/year of primary energy) (KfW 2013). [fig. 10 & 11]

Interdisciplinary study of visual promenades

1. Saul Steinberg’s drawing *The Line* (1954), a single narrative line connecting different events, spaces and outlooks. *The Line* was originally conceived as a 10m-long wall painting The line starts with the hand drawing, continuing over 29 folded panels, changing from horizon to washing line, to a pool, to the edge of a table. [fig. 12]



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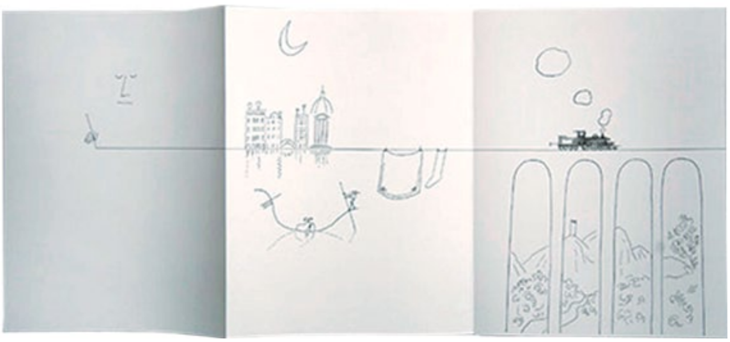

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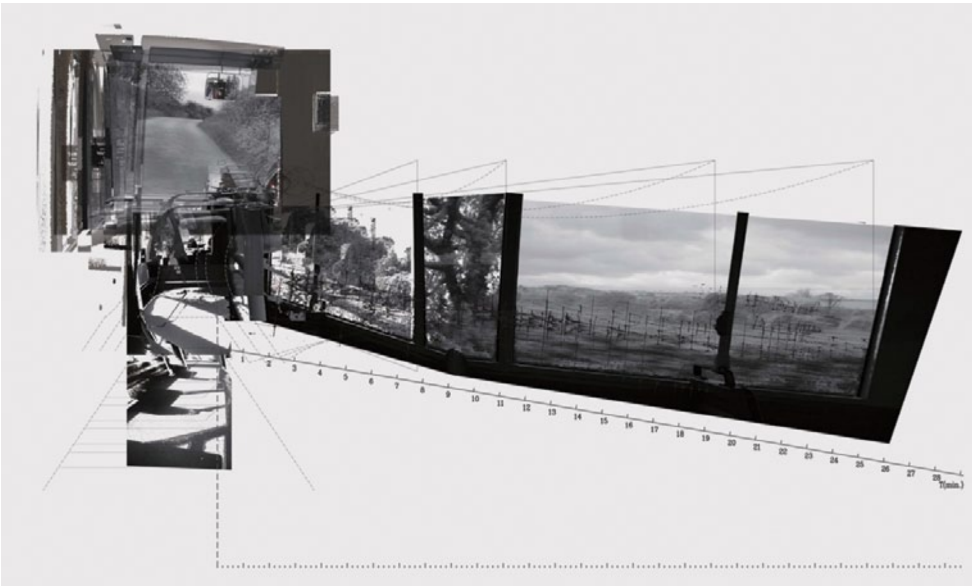
Illustration of the principle of the ground source heat pump system
Fenster-preise, 2013

12
Saul Steinberg,
***The Line* (1954)**



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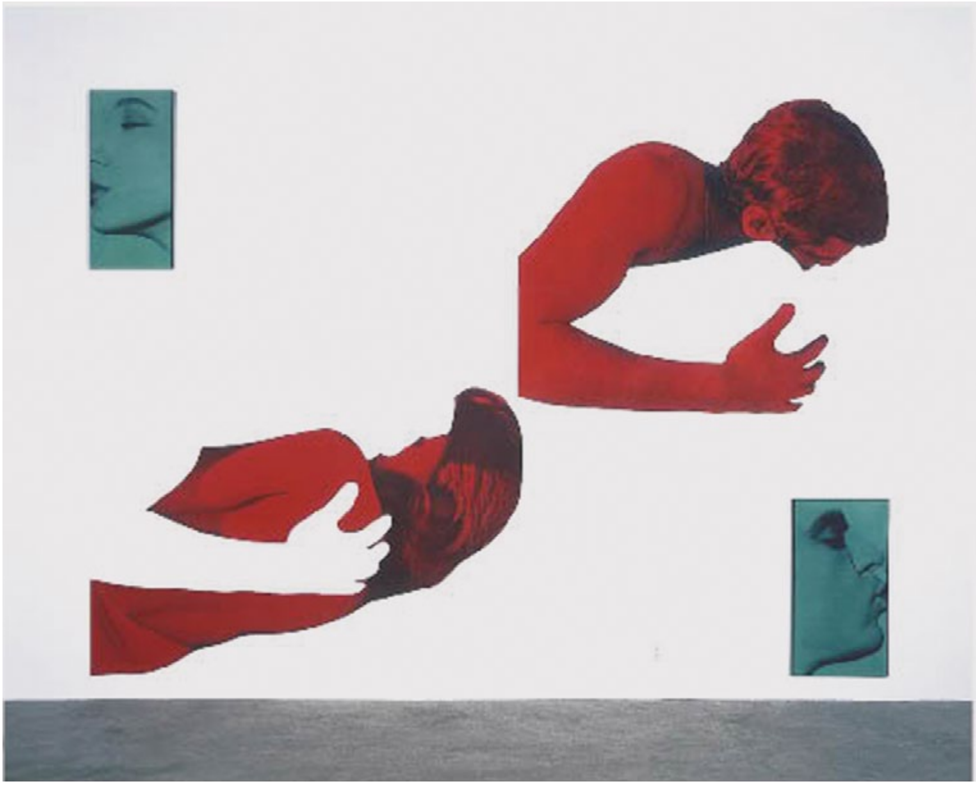
Collage drawing by Diller & Scofidio, case no. 00-17163 (1992)
Reproduced by permission of Diller Scofidio + Renfro



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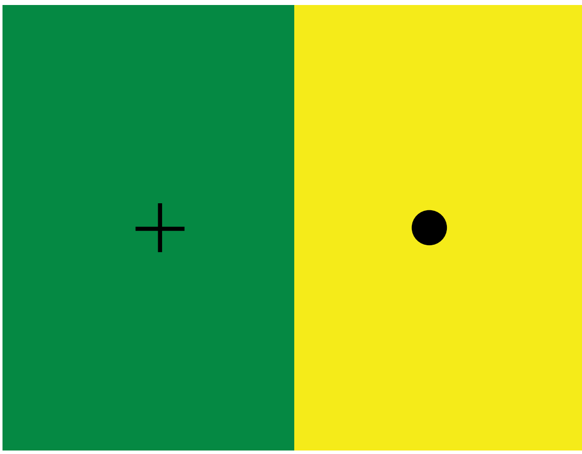

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2. Liz Diller and Ricardo Scofidio's *Slow House* (1989) describes a carefully planned route, from the entrance door to a large window frame. Through a simple spatial manoeuvre – a bend in the plan of the house – the view towards a river is not immediately visible but discovered by walking towards it.

   The interior promenade of the Blind Spot House echoes the conceptual structures of these projects, inviting the occupants to move through the house by interacting with seven major windows/viewing frames. [fig. 13]

3. Philosophical and visual art analyses which reflect physiological and neurological understandings of 'lost' visual information (the point at which the optical nerve is connected to the brain in the retina). Yet the brain is able to interpolate and to reconstruct what is hidden, replacing the 'hole' in the perception of the visual field with false information. Artist John Baldessari employs masking to block out certain elements of popular imagery. These 'blind spots', although no longer visible, can still be deciphered by looking at their actual outline and the context within which they are situated. Philosopher Maurice Merleau-Ponty has discussed how objects that are out of our visual field are not necessarily imperceptible (*The Visible and the Invisible,* 1968). [fig. 14 & 15]

14
ohn Baldessari, Green kiss, Red Embrace (1988)
With kind permission by John Baldessari and Marian Goodman Gallery

15
Blind spot test card

Methods

Energy Efficiency

1. Geometry and orientation
   Various designs were tested to investigate the overall shape of the building in order to avoid heat loss and ensure heat gain at different places and times of the day. As the location of the building was dictated by the local planning regulations, adjustments had to be made in the shape of the building to optimise the orientation. While working with the engineers, we identified that the isosceles trapezoid shape in plan was the most suitable configuration. This shape has its smallest face orientated towards the north-east, away from the path of the sun. This side has no openings and is only one storey high. At the same time a trapezoid section with the smaller side facing north benefits from reduced heat loss on the north side. Here the single-storey configuration reduces the area of the exposed face. The elevation facing north presents only 23.6m^2 towards due north compared to a 42.1m^2 for a full double-storey elevation face. The trapezoid shape of the building in plan and section results in less exposure to the colder north-facing sides. The three façades facing away from the sun would result in a traditional rectangular building with a wall surface of 249.8m^2. The trapezoid shape reduces this to 187.1m^2, a reduction of approximately 25%.

   The main bedroom is orientated towards the rising sun to allow the occupant to experience sunrise and to maximise the heat gain during the morning period. The bathroom and the breakfast room face towards the sun for the morning and lunchtime period, while the main living spaces are orientated towards the setting sun to the west/south-west of the building. [fig. 18, 20–26]

2. Building materials and insulation
   The building is constructed from high-performance Porotherm blocks. These clay building blocks are lightweight and energy-efficient. The blocks' cavities make it unnecessary to use further internal or external insulation to achieve the desired U-value required for the *KfW60* house. The full wall depth is merely 350mm, finished as a monolithic construction with internal and external rendered surfaces. The chosen product was the Wienerberger Plan T10-30 (Wienerberger 2013).

   The clay bricks themselves have a U-value of 0.1W/m^{2}K. (By including the thin-bed mortar used to glue the brick courses, the system can archive an overall value of 0.12–0.15W/m^{2}K on a typical wall.) The overall standard was achieved by insulating the whole structure, including the basement floors and the roof, with an extensive green roof cover and low-E (low emissivity) double-glazing. [fig. 16 & 17]

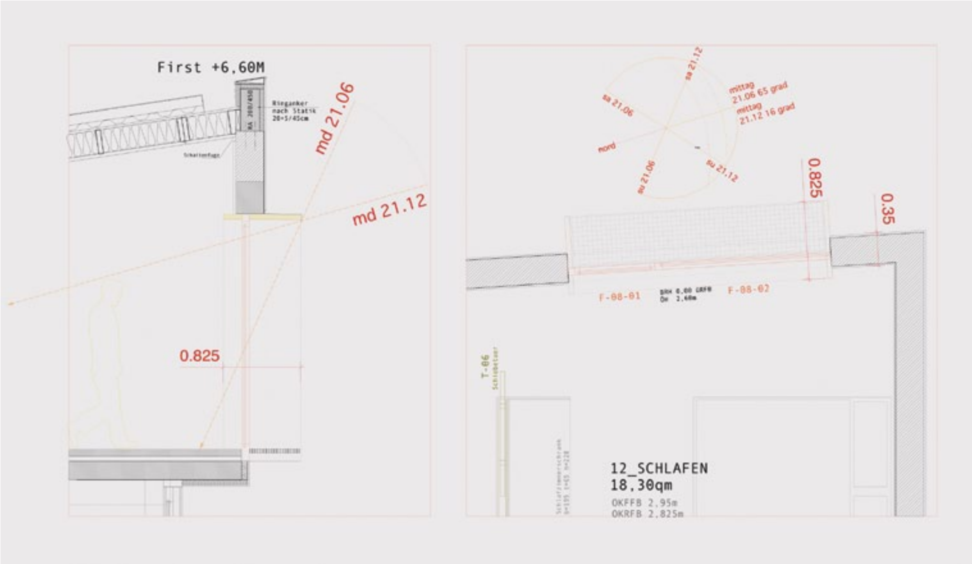
17

16 ***(previous page)***
Building site.
View taken from
the east towards the
double height space

17
Building site.
View taken on the
ground-floor level
towards the south

18

18
Plan options comparing south wall surface (for sun exposure) versus north wall surface (for heat loss)



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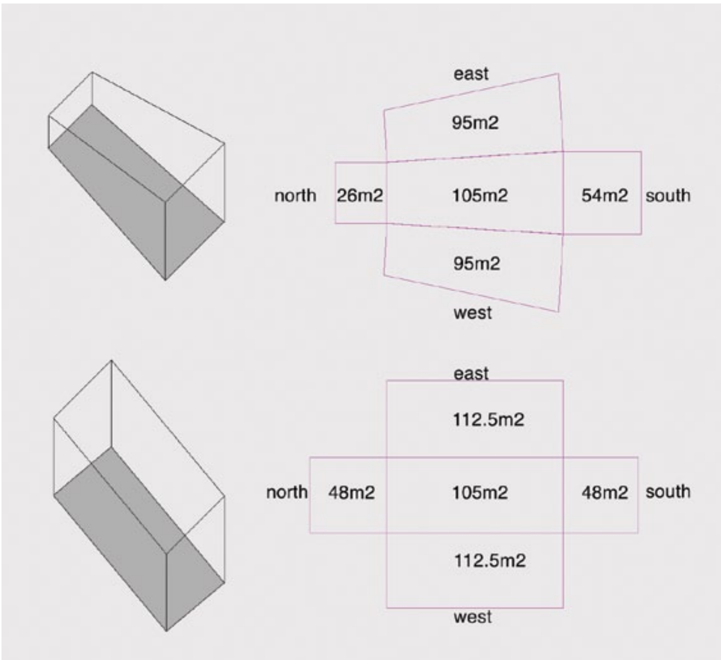

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19
Plan and sectional detail of the Kerto wooden window boxes

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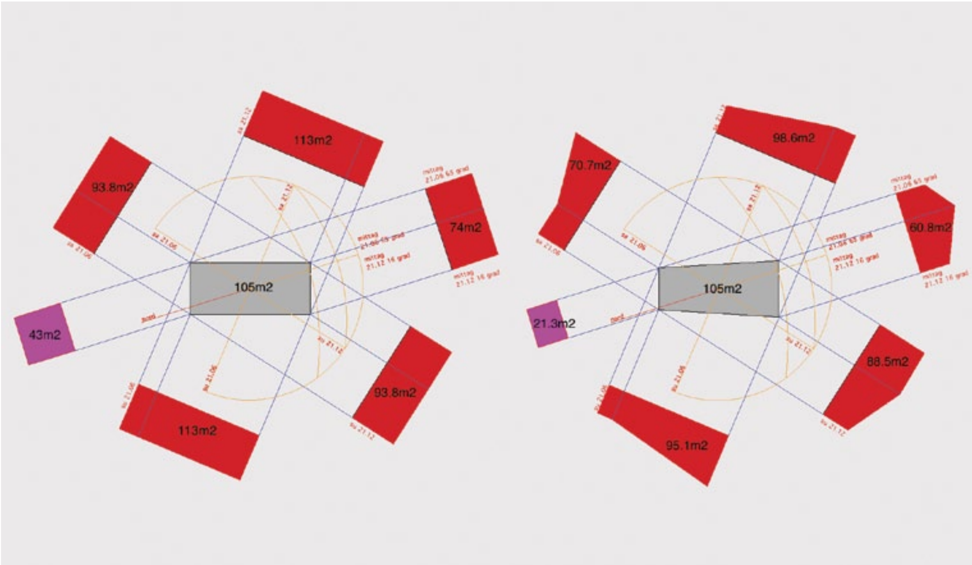
Two different volume options exploring surface areas for the individual façades



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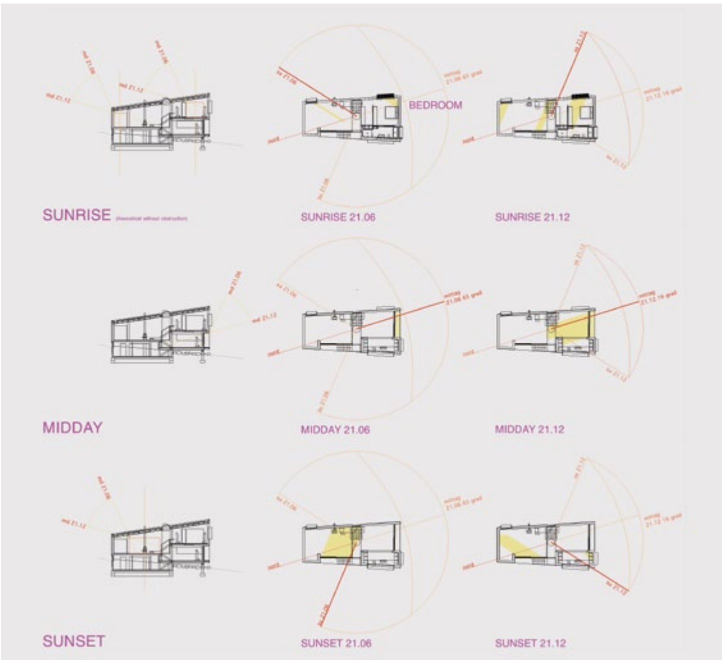

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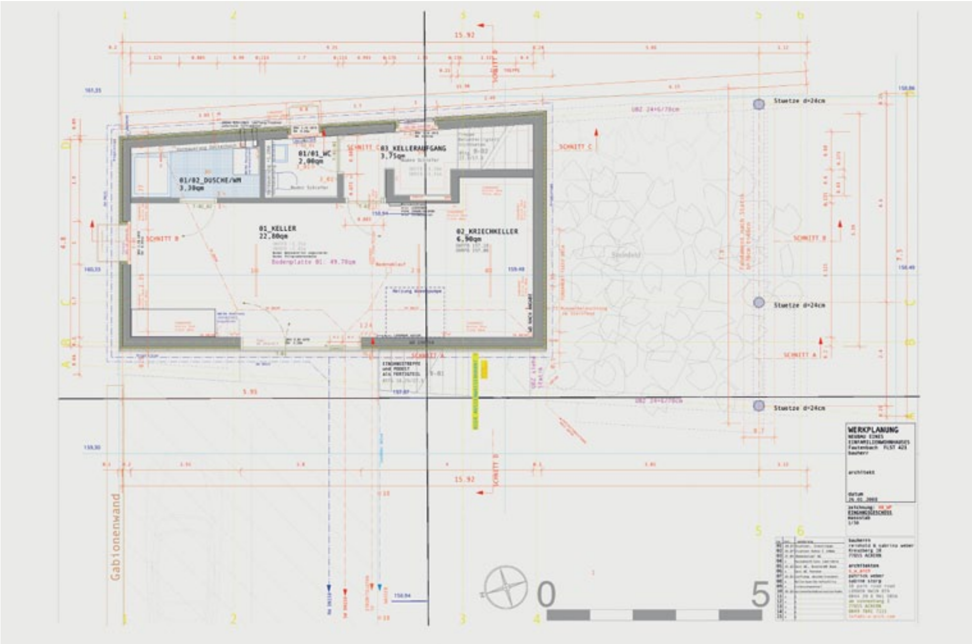
21
Two different volume options exploring sun exposure levels on different sides of the building at the summer and winter solstices

22
Drawing testing the exposure of the interior to the sun at different times of the year. Tracking the path of the sun over the course of a day at the summer and winter solstices



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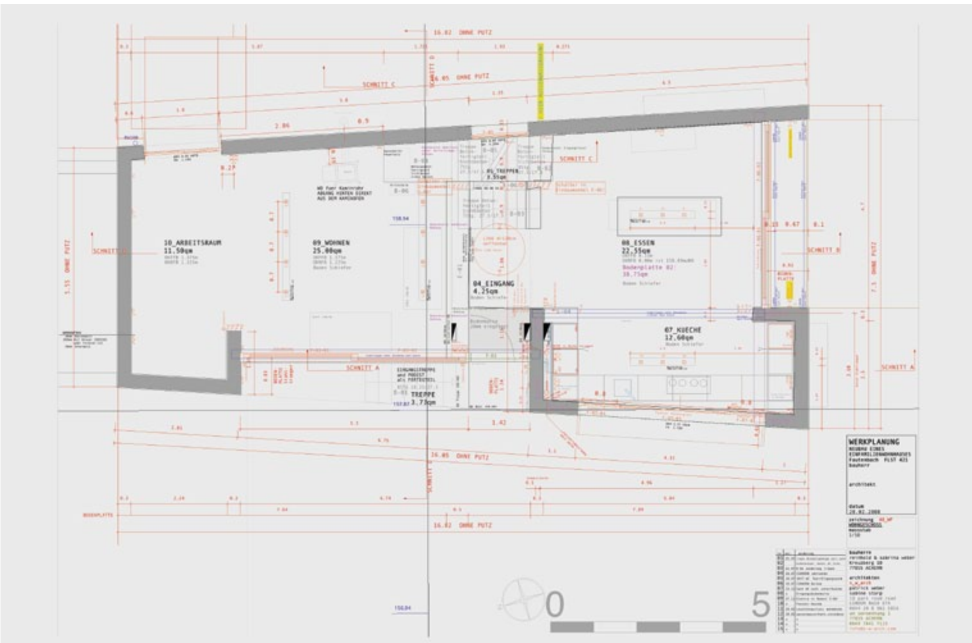

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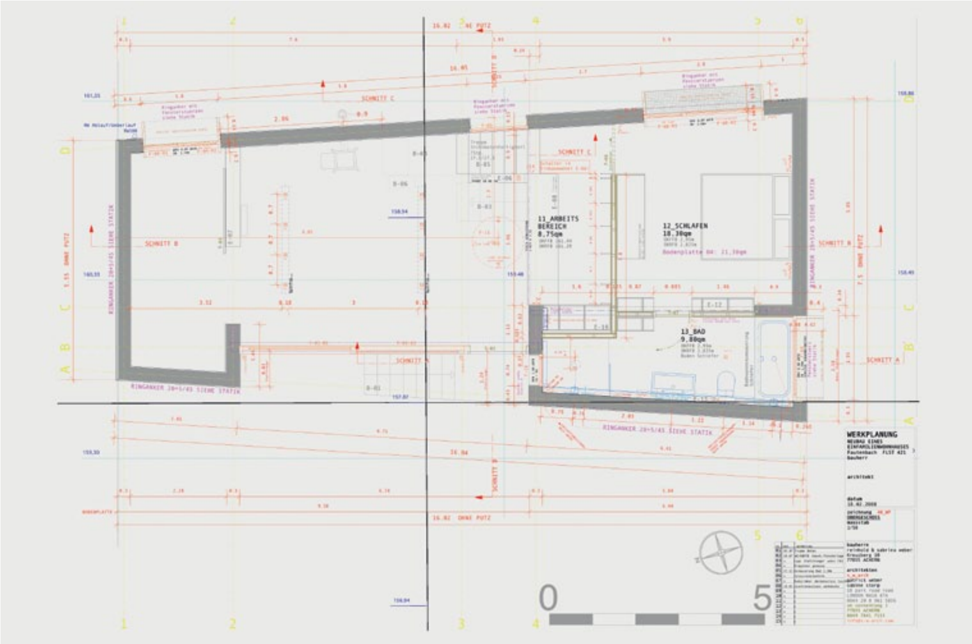
Working site drawings for the contractor: basement plan

24
Working site drawings for the contractor: ground-floor plan



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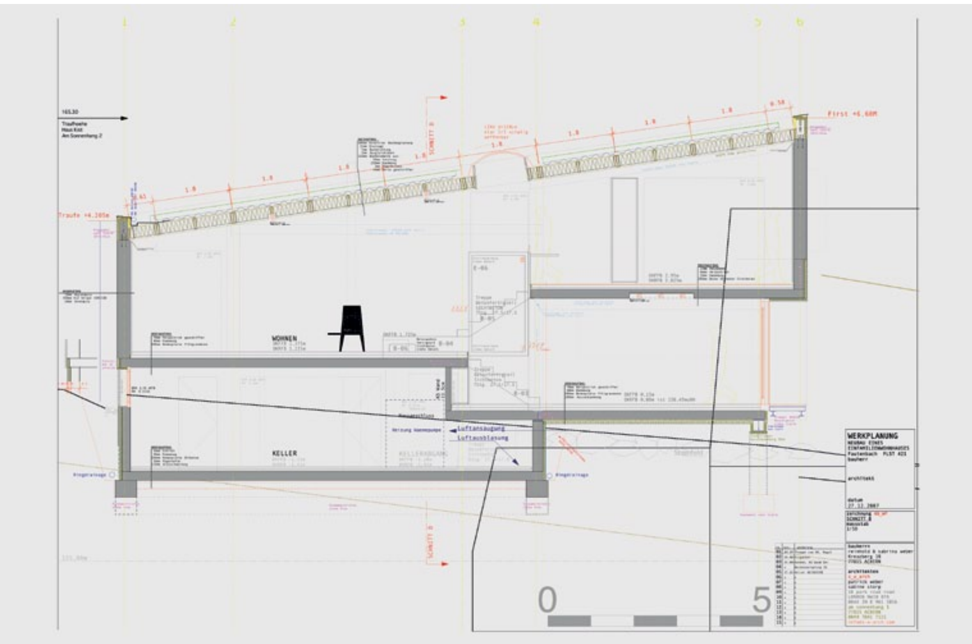

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Working site drawings for the contractor: upper-floor plan

26
Working site drawings for the contractor: section

3. Windows

All windows in the house use double-glazing with 4/16/4mm glazed units. Their overall performance is 1.1W/m^{2}K. This solution presented the best balance between cost and value. The glass has an energy-reflective coating that allows heat to transmit from the outside to the inside, therefore effectively acting as additional heating, while this coating reflects heat from the room back into the space, avoiding excessive heat loss.

A further design component was the very deep 850mm windows sills. Windows were placed in niches and, where this was impossible, projected out of deep plywood frames. Through this simple measure the low sun enters the spaces during the colder winter months, while during the summer months the window frames block out the direct sun before it heats up the interior of the building. The house only needs one blind on the south-facing window to control the sun in June/July during sunset. [fig. 19 & 27]

4. Ventilation and cooling

The use of a forced ventilation system with a heat recovery system was avoided because of the high installation costs. Instead, a vertical space with a skylight at the top was designed, regulated by a heat sensor to allow hot air to evacuate the building at a high point through the stack effect. During the summer months the building can be ventilated through the colder basement with an air intake on the north side of the building facing away from the sun. There is no need for any further mechanical cooling. [fig. 28–31]

5. Heating

The building qualified for additional funding benefits guaranteed by the German government because it fulfils the *Passiv Haus Energiesparhaus KfW 60* standard, requiring a minimum U-value of 0.48W/m^{2}K for the whole building, with maximum energy consumption of 6,600kWh per year.

The Blind Spot House currently achieves 56kWh/m^2 energy consumption: 56kWh/m^2 × 110m^2 or 6,160kWh per year (energy certificate Sterk Ingenieure, 3 June 2008). In comparison, the UK average for heating and hot water energy use is 20,500kWh per year (Ofgem 2013). The underfloor heating throughout the building is running on the lower temperature of 45°C (compared to the 65–70°C of a radiator), an increase in efficiency due to the lower temperature difference required to bridge the intake and output.

Originally the building was heated through an air source heat pump. In summer 2012 it was upgraded with a new ground source heat pump through two 80m drill holes. This uses on average 2,500kWh of electricity annually, resulting in running costs of approximately €230–270 per year. (Electricity for heat pumps is cheaper by between 10% and 20% depending on the energy supplier. In comparison, the UK average for energy cost for gas is £729 per year: Ofgem 2013.)

This approach also makes it possible to provide effective cooling when heat is extracted from the building via the underfloor heating and reintroduced into the ground through two drill holes (this recent installation has not yet generated enough data). [fig. 32]

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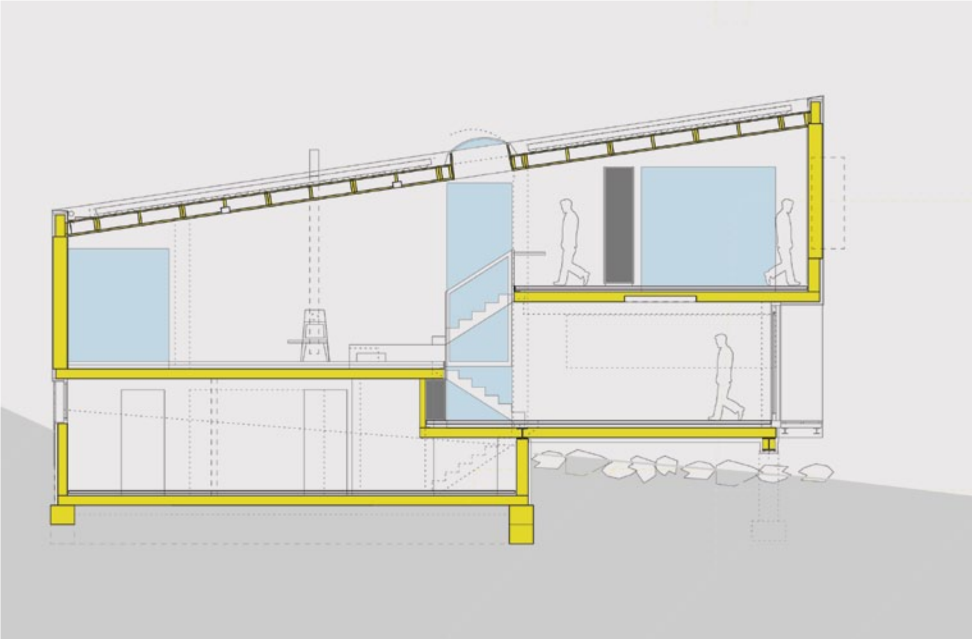
27
South view of building. The function of the deep window frames can be seen by the length of the shadow across the façade. Right: June 2012; left: December 2012



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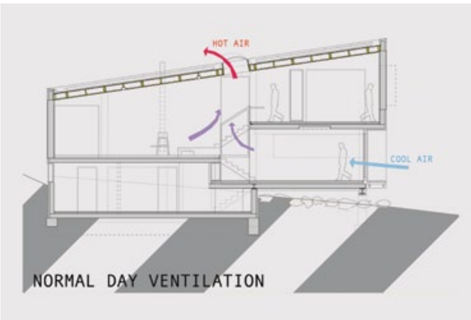

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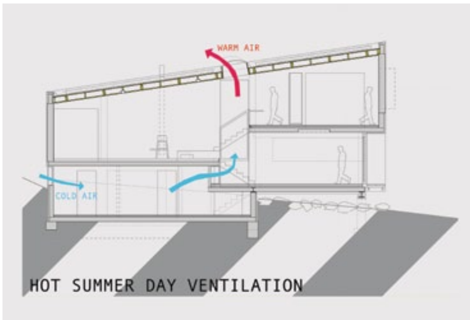

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28
Cross section showing the location of the windows on the eastern walls

29
Ventilation diagram across the double-height space on a typical day

30
Ventilation diagram across the double-height space on a hot summer day

Promenade

A detailed site investigation was employed to establish a sequence of views towards the horizon and the blind spots of the neighbouring buildings. The blind spots suggested sections of walls which should act as ‘masks’ to hide the undesired context of the neighbouring buildings.

The iterative design research process was supported by physical models and drawings that tested with precision the visual fields. Following the conceptual strategy of Steinberg’s *The Line,* the viewer in the Blind Spot House has to be active to experience the space. The interior promenade stitches different domestic experiences together and provides a continuous datum of site- and time-specific views:

1. View opposite the main entrance door towards the east: a narrow slice connecting the foreground of the surrounding green meadow to the sky, leaving out the middle ground.
2. Turning right, the main eating area has a wide-open floor-to-ceiling and wall-to-wall window facing south: a raised level with a suspended sun deck looking towards the middle ground of a steep bank falling down the hill as a ha-ha and concealing one whole part of the village.
3. Main living area (one level up): the view reaches west towards the horizon through a gap between two neighbouring buildings.
4. Working area views east: connecting the foreground to the middle ground.
5. Entrance view from first-floor window: the exterior is seen from above, almost in a plan view.
6. Bedroom view to the east: through rows of fruit trees and towards the rising hills of the Black Forest, a view of the morning sun.
7. Master bathroom: view far south into the Rhine Valley, towards France. No foreground, no middle ground, a true horizon line can be seen.

This sequence of views demonstrates an interplay between occupant, distance and view: ‘closeness’ is followed by ‘farness’. Some of the window openings have fixed blinkers installed to focus the view even more onto the selected part of the vista. [fig. 33–36]

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31
Interior view of the double-height volume between the different split levels of the building

32
The underfloor heating/cooling system being installed throughout the house

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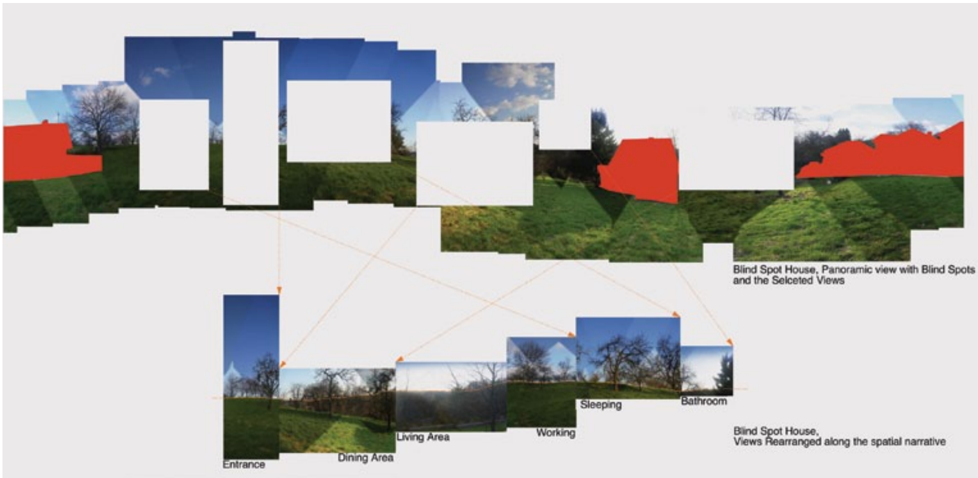

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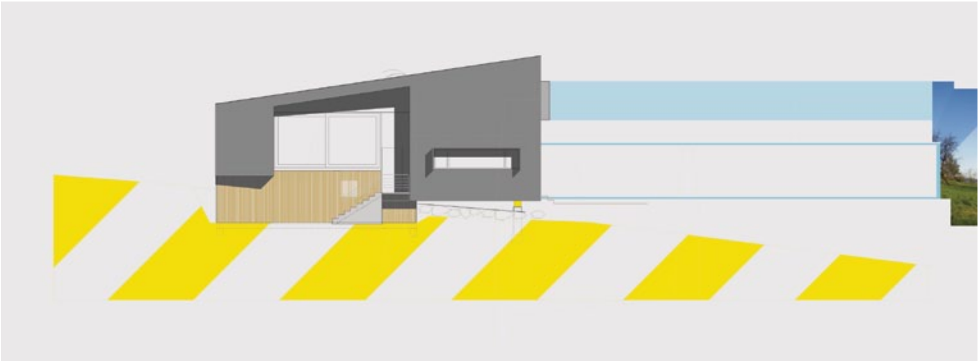
33
Collage exploring the 360-degree panorama. Top collage depicts the blind spots (orange). Bottom collage shows the reconstructed artificial horizon experienced when following the promenade set through the building.

34
West elevation

35
South elevation

36
Perspective study of interior space and views



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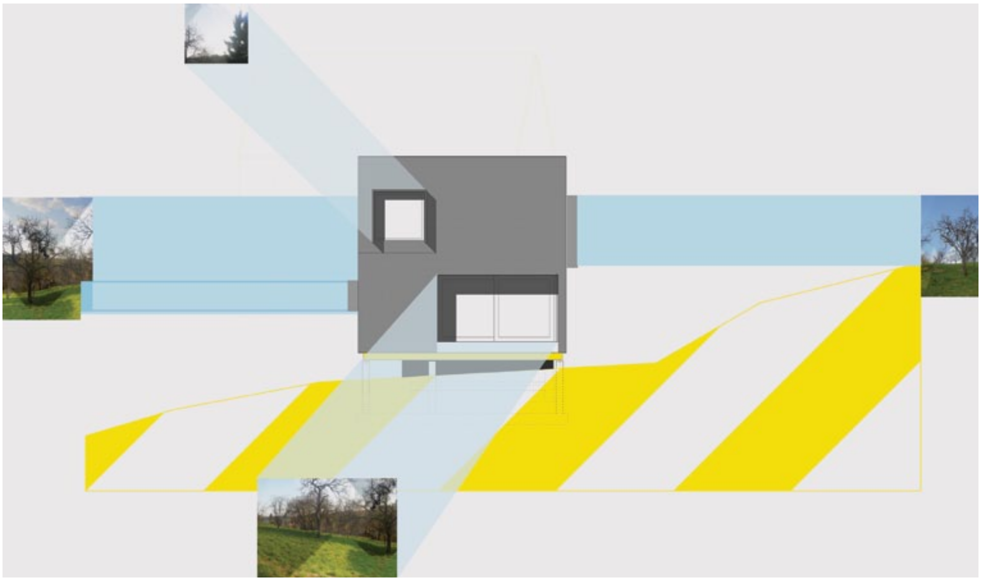

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Dissemination

Online reviews

The project has been reviewed on international design websites: *Designboom, Baunetz Wissen, Architecture News Plus, Architourist, Architectural, Magazine Domo.*

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Web

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by Kreider + O'Leary

Megaframe
by Dirk Krolikowski
(Rogers Stirk Harbour
+ Partners)

Seasons Through the Looking Glass
by CJ Lim

Agropolis
by mam

Alga(e)zebo
by mam

Chong Qing Nan Lu Towers
by mam

ProtoRobotic FOAMing
by mam, Grymsdyke Farm
and REX|LAB

Banyoles Old Town Refurbishment
by Miàs Architects

Torre Baró Apartment Building
by Miàs Architects

Alzheimer's Respite Centre
by Níall McLaughlin
Architects

Bishop Edward King Chapel
by Níall McLaughlin
Architects

Block N15 Façade, Olympic Village
by Níall McLaughlin
Architects

Regeneration of Birzeit Historic Centre
by Palestine Regeneration
Team

PerFORM
by Protoarchitecture Lab

55/02
by sixteen*(makers)

Envirographic and Techno Natures
by Smout Allen

Hydrological Infrastructures
by Smout Allen

Lunar Wood
by Smout Allen

Universal Tea Machine
by Smout Allen

British Exploratory Land Archive
by Smout Allen
and Geoff Manaugh

101 Spinning Wardrobe
by Storp Weber Architects

Blind Spot House
by Storp Weber Architects

Green Belt Movement Teaching and Learning Pavilion
by Patrick Weber

Modulating Light and Views
by Patrick Weber

The Bartlett School of Architecture

UCL