

Which one of the typical „seven steps to passive house“ has a linkage to construction of elements?

It demands several steps to realize a Passive-House

The construction of elements are mainly influenced by doubling the thickness insulation, the optimized installation of windows and the excellent air tightness of the building envelope.

The precise design and accomplishment of the building envelope has the deciding influence to the following steps of ventilation, heating und cooling and there efficiency .

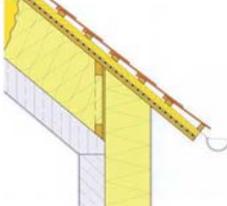
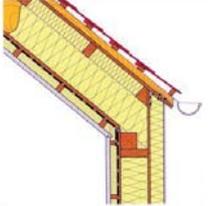
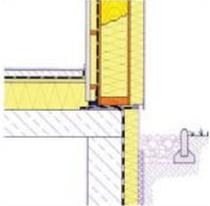
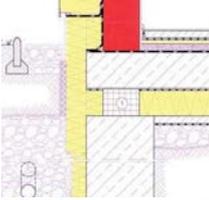
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Construction of Elements

Wood-panel or Wood-frame Construction



Solid Construction
Concrete - Masonry



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The “Construction of Elements” module combines the topics

- Design principles
- Building physics
- Eco-materials

Passive houses can be built using different building methods.

Wood-panel or wood-frame construction is the favourite choice. This is so because the thermal insulation can be integrated into the load-bearing wall structure, and thus all thermal bridges are minimized—without any additional efforts. The wall thickness is only about 4 cm greater than the thickness of the thermal insulation.

In the case of a solid construction, be it masonry or prefabricated concrete panels, thermal insulation has to be added to the load-bearing wall afterwards and thus increases the wall thickness for about 10-16 cm. Passive house construction has no thermal bridge so that no solid building component (rafter, concrete support, balcony) penetrates the insulation.

In order to eliminate the many thermal bridges in a solid construction in a very easy and cost-effective manner, the concrete is poured into prefabricated and insulated forms, or as an alternative the concrete foundation is placed on crushed foam glass.

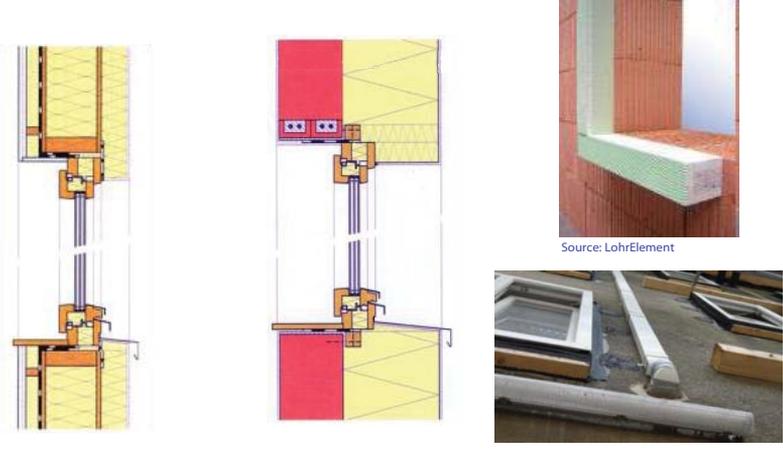
Solid walls are placed on a layer of foam glass insulation (levelling block) in the area of the basement ceiling or the foundation slab to avoid thermal bridges.

Using the above-shown planning examples, problems can be discussed and solutions can be optimised, including how to avoid thermal bridges, how to select and install insulating materials, how to determine the correct installation of vapour barriers and sealing tapes, airtightness, eco-materials.

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Construction of Elements

Structural Window Attachment



Quelle: Passivhausbaukatalog

Source: LohrElement

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Within the wall structure, the window should be placed in the centre of the insulation layer. This is easily accomplished in wood construction. In solid construction, however, the window is placed for economic reasons as shown in the picture above. Windows are fastened with metal brackets or on window beams, which are attached to the exterior wall. In all construction types, the window frame is covered with insulation material.

The picture above shows an exterior wall seen from the outside that has windows and ventilation ducts installed. The wood joists serve as a support for the window frame. The window is attached to the exterior wall with metal brackets, and an airtight seal is applied from the outside. The next step is to install a 24 cm thick insulation on the existing wall.



Construction of Elements

Legend (A) Basics

-  engineered timber board (rigid)
-  engineered timber board (soft)
-  planking
-  batten
-  gypsum board
-  plaster on plaster substrate
-  curtain wall
-  insulation (soft)
-  insulation (rigid)
-  mineral loose fill insulation
-  mineral loading
-  cement screed



Legend (C) Supplements

-  MDF board
-  roofing tile, radial
-  roofing tile, longitudinal
-  cellulose insulation
-  natural insulation (e.g. wool)
-  loam rendering
-  straw-loam
-  timber framing

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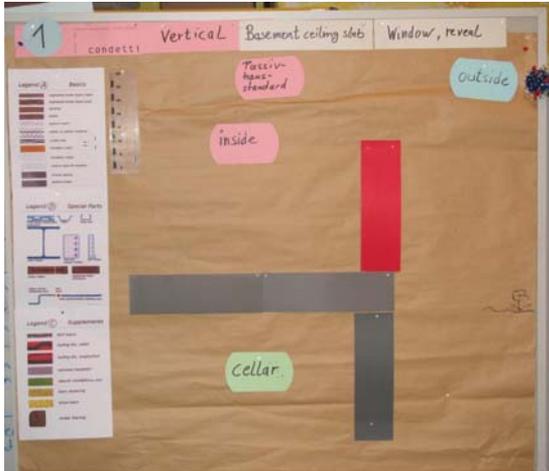
It is also possible to create a construction detail with the help of the pre-printed paper strips of the "Condetti System". The seminar participants are divided into teams that work on a detail in small groups of max. 5 persons and present their result to all seminar participants. This result of the small team can be discussed in the whole group and optimised even further.

The educational tool "Condetti" is very suitable and is used in Germany at trade schools, continuing education training centres, and even at conferences.

The Condetti Box contains five tableaus with colour strips for solid building materials (concrete, brick, aerated concrete, etc.) and building material cross-hatching (insulation, fibreboards, plasters, gypsum boards), joist cross sections, windows, and other building elements as well as pins, threads (vapour barrier), measuring scale, marker pens, scissors, and other accessories required for the display at the pinboard. The construction detail is pinned to the softboard at the scale 1:2.

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First situation of a new construction is given. We can see the concrete basement (cellar) and the brickwall (red). The task is to create a passive house and provide a solution for a window reveal.

The team discusses the situation, determines the materials and insulation thicknesses, and pins a joint solution to the softboard.

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The team presents the result:

The basement ceiling is insulated from below. The thermal bridge of basement ceiling/basement wall can be avoided by placing the concrete on a foam glass insulation. The thickness of the exterior insulation is specified with ca. 30 cm. The window is fastened to the exterior wall with metal brackets, covered with insulation and made airtight on the inside of the solid wall. The interior plaster is applied across the entire wall area up to the basement ceiling.

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Construction of Elements

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CONGOTTI

Vertical Flat roof Window, reveal

Taccuino house standard

outside

inside

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Second situation of a new construction is given. We can see a flat roof construction and the brickwall (red).

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Construction of Elements

2 condetti Vertical Flat roof Window, reveal

Passive house standard

λ=0.032

outside

inside

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The team presents the result:

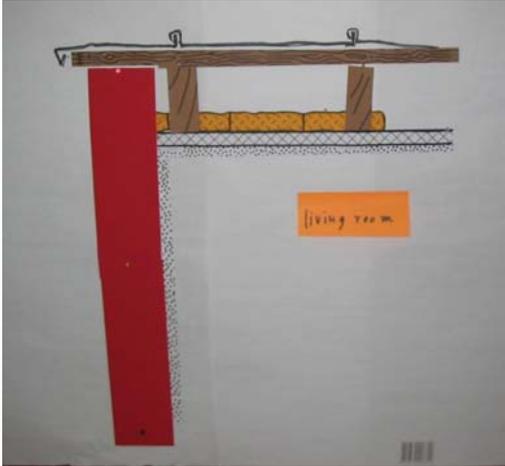
The exterior wall receives a 30 cm thick insulation on the outside and reaches without any gap to the roof insulation with 30 cm on top.

The vapour retarder (vapour retarders must change their sd-value, depending on the relative humidity) also acts as the air barrier, which is why the barrier is very carefully sealed. The vapour barrier must also form an airtight seal around all walls, ducts.

In order to ensure a fully functional roof structure, it must be checked if the flat roof needs to be ventilated. Depending on the outdoor climate of a given region, ventilation requirements can vary greatly.

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This example shows an exterior wall (gable wall) with a roof (metal roofing). The room is occupied and shall not be disturbed during the renovation. The pitch of the roof features wood wool panels and cement plaster. There is some insulating material between the rafters.

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Construction of Elements

Legend Basics

Legend Special Part

Legend Supplements

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The team presents the result:

The roof is insulated from the outside. The total thickness of the insulation is 30 cm. The old insulating material is used and put over a variable vapour barrier, which is put across the insulation and the rafters. The vapour barrier also acts as the air barrier, which is why the barrier is very carefully sealed. The vapour barrier must also form an airtight seal around all walls, ducts. In order to increase the insulation thickness, an additional layer of insulation is put across the rafters above which the metal roof is installed.

The exterior wall receives a 24 cm thick insulation on the outside, and the top of the wall must also be covered with insulation.

In order to ensure a fully functional roof structure, it must be checked if the metal roof needs to be ventilated. Depending on the outdoor climate of a given region, ventilation requirements can vary greatly.

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Construction of Elements

① eave / pitched roof

② retrofit to reach low energy standard and additional window

cold loft

Living room

Legend Basics

- Structure
- Roof
- Wall
- Floor
- Window
- Door
- Other

Legend Special Parts

- Roof
- Wall
- Floor
- Window
- Door
- Other

Legend Supplements

- Roof
- Wall
- Floor
- Window
- Door
- Other

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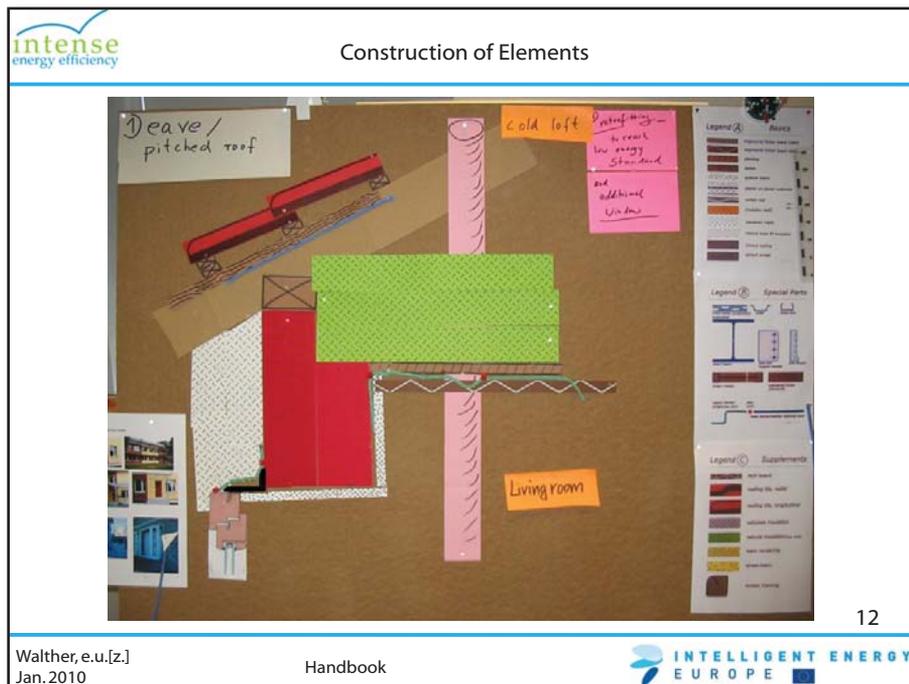
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This is an old building situation that is to be modernised. As a next project, a window needs to be installed and we need to find a solution for the sealing of the ventilation duct between the living space and attic.

Other additional planning requirements include:

- Low-energy standard
- Attic will not be used as living space in the future
- Window is to be installed without any thermal bridges



The team presents the result:

The uppermost ceiling is insulated; the old clay infill between the rafters is removed and then a 30 cm thick insulation is installed.

With metal brackets, the window is installed in the centre of the future insulation plane. Airtightness is created from the outside (green line) by gluing a plastic tape along the window frame and the exterior wall (red dots).

The exterior wall is insulated with a thickness of 24 cm, and the window is installed. The interior ceiling cover is taped with an air barrier attached to the duct, and below that an insulating fibreboard is installed. The air barrier membrane is also glued to the interior plaster.

The Condetti material also allows for a very detailed planning. On paper cards materials can be identified with thick felt pens, adding notes about the installation or the order of individual installation steps.