

INFLUENCE OF ARCHITECTURE ON WOODEN HORIZONTAL CONSTRUCTION INSULATED BY STRAW BALES

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Abstract

Already at the beginning of the project is architect exposed to questions about construction. Accurate prepare reduces construction failures by assemblage and on the other hand helps to articulate architectonic meaning of concept. Wooden skeleton compared to brick-concrete building offer more occasions to expose construction members, at some common techniques it's a must. Present wooden structures insulated with straw bales as standard practice turning into scientific structures designed with relation to interior and exterior design. Wave of ecology architecture supports development of these straw structures and the number of these way considering investors is raising. Horizontal constructions represent three classes: basement slab (first floor), first floor ceiling (second floor), roof (maximum angle 5°). On the ground of construction types: heavy wooden construction, light wooden construction and prefabricated panels (pre-insulated, on site insulated).

Perception of exterior horizontal construction depends on overhang of construction elements over closed perimeter. Overhang of second floor and roof takes the main influence of overall appearance mainly leaving construction visible without lathing. Perception of interior horizontal construction depends on material composition and required properties of these layer. Exposed beams and joists are evidence of construction type, enrich form and color palette of interior and facade. Dimension of exposure determine perception, that is affected by number of story's, position in terrain, size, color and technique of realization.

Keywords: straw, architecture, straw construction, horizontal construction.

INTRODUCTION

Every type of wooden construction insulated with straw bales has a system of element configuration that primary respects statics demands and overall architectonic concept. Allow functional disposition of all floors and create adequate spaces for insulation bale. It's very useful to secure straw bales already in time of projecting or enquire dimensions of future bales in advance. Any later bale cutting is time consuming. Type and position of wooden construction affects insulation properties and composition of used materials in walls, floors and roof.

Heavy wooden construction

Less and more worked raw tree trunk (log) presents choice of nature inspired builders usually connected with eco lifestyle, natural architecture, original folk architecture – historic wooden blockhouse. Heavy lumber is more sophisticated building member, common used in all kind of wooden structures. Both types are massive, robust, blending a part of

romanticism, middle age and fairy tale. Visible constructions in interior and exterior is expressive, becoming characteristic feature and optically scale down dimension of the building. Using less worked tree trunks raises need to level finished horizontal plane with joists or cut one side of the trunk because of irregular nature of this wooden members.

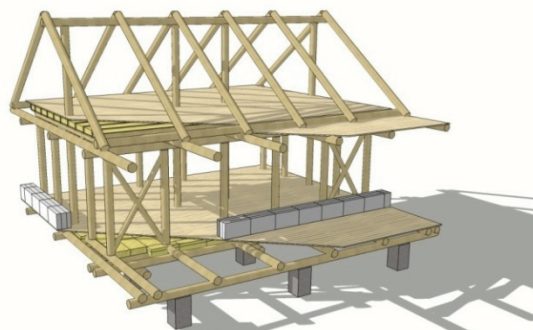


Figure 1. Example of heavy wooden construction

Light wooden construction

Planks, laths and boarding joists are assembled to create suitable basic grid with accurate spacing for considered straw bales. Usually bales are available in various lengths enabling

to adjust construction spacing in relation to openings (windows, doors etc.). These construction members are subtle and light-handed, that means higher density of construction, easy assemblage and higher working safety on site.

In case the horizontal member is part of premanufactured frame (manufactured on site or under controlled conditions) and vertical members are the same design of the same frame, it is considered as prefabricated building system. Regular emplacement of frames raising simplicity of the building process what is inappropriate by irregular loading on horizontal plate.

Prefabricated panels

Recent popular system of wooden construction is prefabricated panel, manufactured under controlled conditions according precise designed project. These panels are insulated and finished (façade surface) on site or in assembly hall, what takes great influence of the panels weight mainly providing heavy finishing materials like a clay and earth. Using panels is common praxis in western countries and the number of these kind buildings is rising. Horizontal panels (floor panel, roof panel) lie on vertical panels and on supporting beams and joists. Vertical panels are installed to basement slab, basement panels are very odd.



Figure 2. Wooden panel insulated with straw bales

Without basement slab, there is no flat area to storage panels, assemble panels and place for safety work and movement. Basement slab is under irregular load pressure (chimney, hot water storage, photovoltaic batteries etc.) and need to correctly serve demands of main connections transferring this layer. Concrete base slab works like a thermal accumulating mass with no need of additional thermo

accumulating layers in perimeter or interior walls (panels). Establishment of the base panels on the base beams is sensitive to damp conditions and accuracy of these joints.

Visual aspect

Exposed beams and joists are evidence of construction type, enrich form and color palette of interior and facade. Dimension of exposure determine perception that is affected by construction type, number of story's, position in terrain, size, color and technique of realization.

Heavy and light constructions

Perception of exterior horizontal construction depends on overhang of construction elements over closed perimeter. Overhang of second floor and roof takes the main influence of overall appearance mainly when leaving construction visible, without lathing. Dimension of overhangs depend on architectural concept of building, orientation, design, shading system and functional disposition connection with nearby surrounding.

Wooden frame base floor need not to be noticeable by building on foundation slab, which is poured under grade level. High of the finished floor by using pier foundation without perimeter siding may be evidence of thick insulation in wood-frame floor. Equally the pier foundation system is possibly construct under grade level thatbring linear opening between the structure and surrounding terrain needing particular solution.

Perception of interior horizontal construction depends on material composition and required properties of these layer. Generally, there is no influence of basement wooden slab construction on interior. This layer is built in and the only way to show raster of this construction is to use transparent flooring put right on the bearing system though it is very unusual. Ceiling construction is familiarly exposed to interior for its esthetic value, historical usage and common layer composition. Visual perception is sensitive to dimension, character and density of components along with height and light conditions of the room. There is heavy interior (constructed of log wood or good-sized timber), traditional (constructed of common timber in regular distances), expressive (higher members

and artistic designed timber), frisky (irregular distances and irregular dimension of members), fine (low exceed to interior). All visible constructions are permanent characteristic, need detailed elaboration according to observers standing very close.

Irregular disposition of horizontal members may be quite visual attractive and recent together with optimal disposition according to irregular load on the horizontal layer. High density of members in places with higher load and reversal, means no additional support system. Various distances need accurate prepare amount of correct dimension straw bales. There is usually changing just length of the straw bale and that's easily adjustable on most harvesters. Irregular construction should take position considering position of partition walls, windows and doors.

Prefabricated panels

Visual perception of panels in horizontal layer is largely limited. Construction hid in premakeready panels has almost any chances to expose its character. In the cases leaving ceiling without soffit it is possible to identify panels jointing. Other possibilities of getting additional design value of this construction depend on specific type of panel and possibilities of panel anchoring. Much better design possibilities have panels used as vertical construction members.

RESULTS AND DISCUSSIONS

Exposed horizontal construction of second floor and the roof in interior has long history and differ under cultural tradition. Exposed roof overhang construction in exterior is common though covering lathing is also used often. In terms of architecture, dynamics and design the greatest possibility to expose construction is in member crossing perimeter wall and continue the same feeling of the structure from interior to exterior. This approach includes present minimalistic, clear and truth design not hiding structure character. Ceiling beams in width of the building with overhang over perimeter are historically well-known due to static advantages and speeding up the building process. Nowadays in the age of low-energy and passive structures is perimeter wall crossing member usually the

thermal bridge. In the case of the straw bale wall with the final width about 60 cm it's already not such a problem as by thinner wall. There is need of exact calculation of thermal insulation properties of this wall and confront it with other advantages according architecture and structure simplicity. Another approach to this detail is to intercept construction member in perimeter wall and continue with the new one with the same dimension and position in exterior that bring building up complications and particular deception for observer.

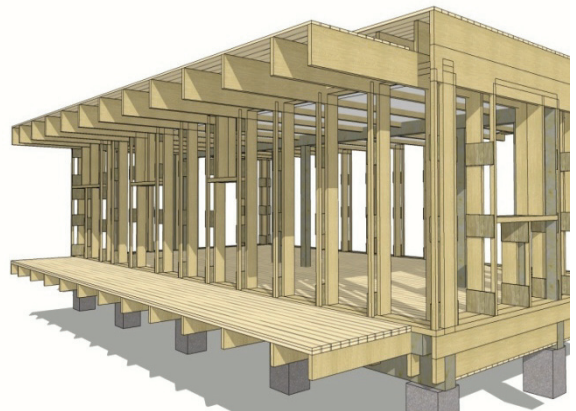


Figure 3. Example of regular wooden construction member disposition

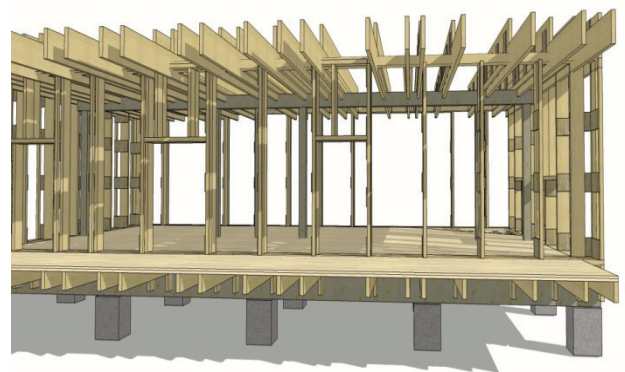


Figure 4. Example of irregular wooden construction member disposition

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