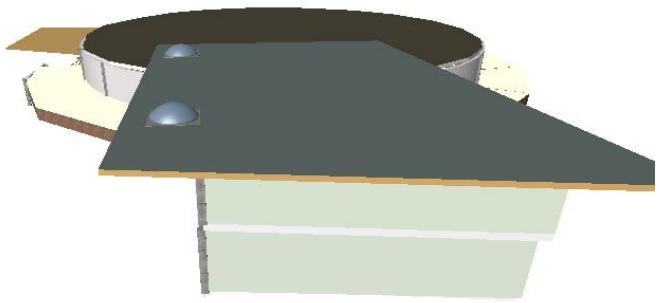
V. CHRISTIANTO & F. SMARANDACHE

FIRST LUNAR SPACE BASE 2009

PROPOSAL ENTRY FOR HOLCIM AWARDS 2008

CONTACT ADDRESS:
F. SMARANDACHE
DEPT. MATHEMATICS & SCIENCE
UNIVERSITY OF NEW MEXICO
GALLUP, NEW MEXICO, USA
EMAIL: FSMARANDACHE@YAHOO.COM OR VXIANTO@YAHOO.COM



FEBRUARY 2008

FIRST LUNAR SPACE BASE 2009

PROPOSAL ENTRY FOR HOLCIM AWARDS 2008

By V. Christianto & F. Smarandache

INTRODUCTION / MOTIVATION

We interpret 'Sustainable construction' theme in its widest possible meaning, i.e. the preservation of sustainability of environment to support mankind. In this regard, it is realized that this Earth is likely to continue to deteriorate and therefore its capability to sustain mankind is diminishing.

Therefore some institutions have begun to study possibility to send mankind to space for long-time period. A year long experiment of mankind capability to survive in space has been conducted by International Space Station.

Then the next logical step would be how to find good location of international space base, possibly in the Moon surface. Therefore we design an imaginative concept for the First Lunar Space Base 2009.

We acknowledge that according to the competition rule, a design shall have 'high probability' to construct. But considering this program is likely to yield great interests not only for government and private sectors, therefore it is possible to conduct auction to put this design into reality. Alternative method to finance is to use some 'roof space' of this proposed space-base for advertising space. We expect that plenty of corporations would like to get their ads printed on the First Lunar Space Base, just like corporations put ads in the body of Russian space rocket.

PROPOSAL SUMMARY

Entry name : First Lunar Space Base 2009

Authors : V. Christianto, F Smarandache

Purpose : to put forward a realistic humanoid lunar-base within 2-3 years

Possible project financing: if no government support is available, financing may be obtained by selling wall space to become advertising display for supporting corporate.

CONCEPTUAL DESIGN

While it seems everybody knows that lunar base is the most logical first destination in new space exploration programs [1], apparently not so many people realize that it is dangerous place for some obvious and not so-obvious reasons, i.e. no water, no oxygen, no atmosphere, risk of asteroid shower, risk of lunar earthquake, risk of extreme exposure of sunlight including ultraviolet ray etc.

Therefore in this proposal we consider these risks in the design.

The conceptual idea came from some places, but one of the most intriguing source is what people call as 'Crop Circle', see Figure 1. [2] It's full of mysteries, yet it seems to offer a kind of 'hidden' geometry.

Then we modify this crop circle idea (see right image), and combine it with the 'Enterprise' starship in Star Trek movie, then we get the view as follows (see Figure 2,3 & 4)

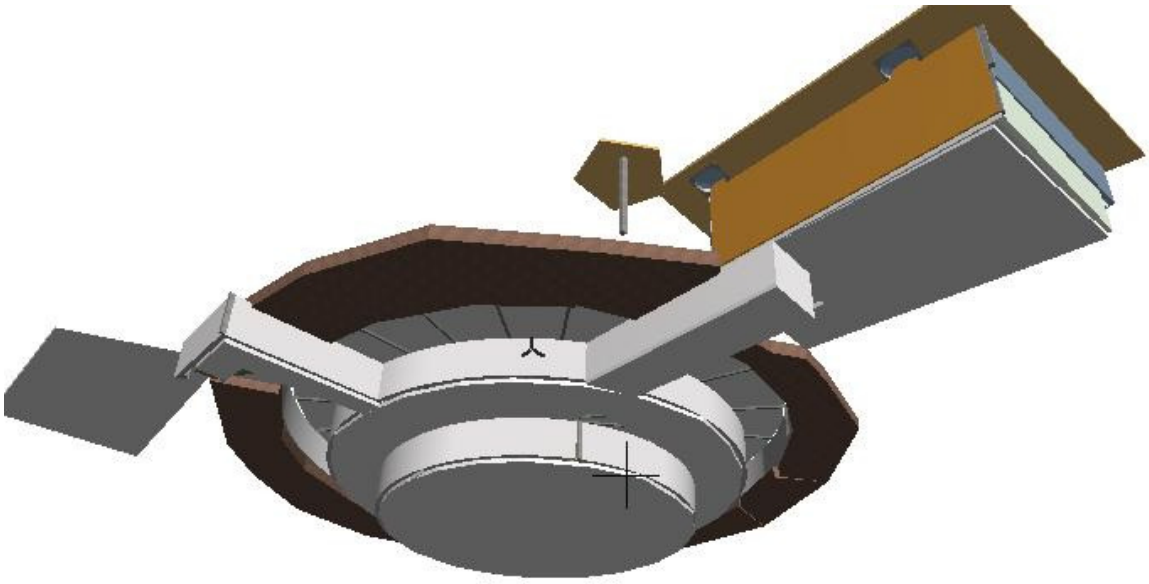


Figure 2: The proposed First Lunar Space base

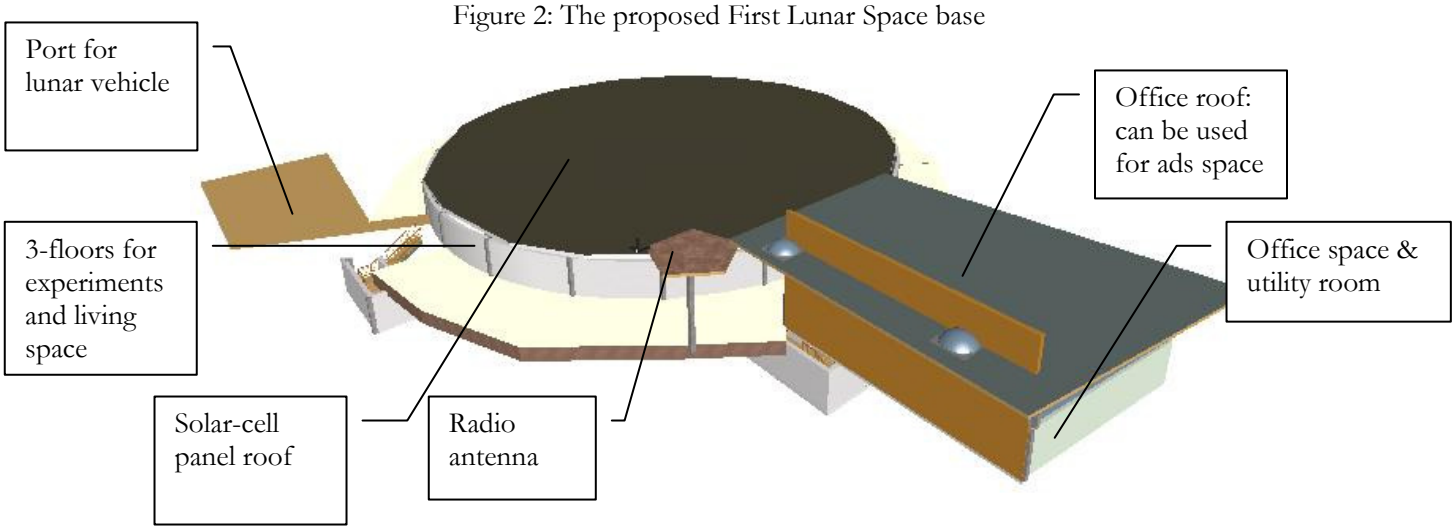


Figure 3. Top view of the First Lunar Space base

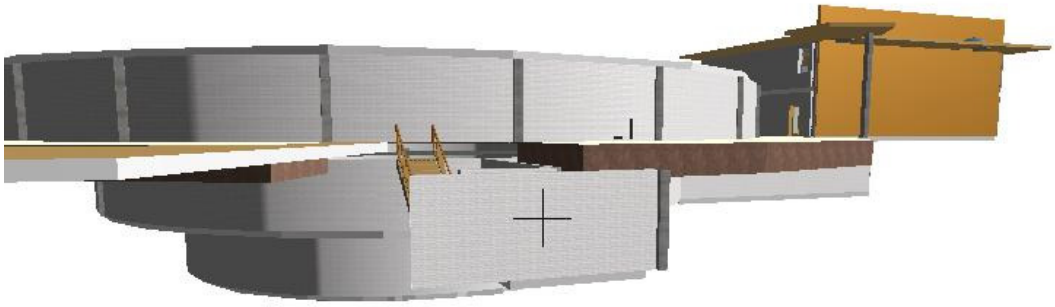


Figure 4. Side view of the First Lunar Space base

RATIONALE BASED ON DESIGN CRITERIA

As we write above, we interpret 'Sustainable construction' theme in its widest possible meaning, i.e. the preservation of sustainability of environment to support mankind. Nonetheless we describe here other considerations of design criteria:

1. Quantum change and Transferability

    1.1. We propose to use Lunar local material to as maximum as possible, therefore minimizing transportation needs to carry the raw material from Earth [1]. Even for concrete, we propose to use 'lunar concrete'. Of course, a particular construction obstacle would be how to guarantee that the process of concrete drying would be the same with process in Earth.

    1.2. Unlike 'standard' conventional design for Lunar space base in literature, in this design we propose to use 'regolith' to cover the roof. [1][3]

    1.3. The large flat-dome will be used for 'solar-cell panel' hence maximizing self-sufficient energy supply. Solar-cell panel can be applied using 'coating' (nanosolar-cell) method rather than having to carry and install complete solar-cell panels from Earth.

2. Ethical standards and social equity

    2.1. Detailed design and construction will maintain the highest ethical standard, for example it is not allowed to use processes that break human right. Also the use of local material is preferred in order to avoid prohibitive high-cost of material transportation from Earth to Moon.

3. Ecological quality and energy conservation

    3.1. By using the roof-space to be 'solar-cell panel' will ensure that energy usage is sustainable.

    3.2. Other technology which can be used is if possible to use 'hydrophonic' plant, therefore reduce using food coming from Earth.

4. Economic performance and compatibility

    4.1. Considering that it is likely that the cost to build this permanent base will be dominated by 'transportation cost', to bring the raw material to Earth, therefore economic efficiency /performance is directly proportional to percentage of local material that can be used instead of having to bring it from Earth.

5. Contextual and aesthetic impact

    5.1. With regards to the environment and physical context of Lunar surface (i.e. without atmosphere and risks of asteroid shower), then we put this safety and protection first over aesthetic consideration alone.

5.2. We also preserve the inherent quality of the landscape by using regolith and other local material as finishing, therefore aesthetically the proposed Lunar base will look 'compatible' with the surrounding environment.

5.3. Nonetheless, as a whole, we put aesthetic consideration from the viewpoint of basic concept (from Crop Circle and StarTrek) which can be noticed by anyone observing from distance. After all, who knows that someday there will be external cultures from outer space who may wish to stop by and look around?

In this regard, it is realized that this considering some obvious construction limitation, not all of the above critieria can be applied to a Lunar space base design. But we have done as far as possible to make this design a working example how a Lunar base can be designed with environment-sustainability in mind. In our opinion, the construction process itself is a kind of 'experimental research,' i.e. how to make sure that using present technologies we can build permanent Lunar base with minimum imported material as far as possible.

It is hoped that once this design can be put into reality, it can draw attention to sustainability construction.

SOME CONSTRUCTION OBSTACLES

There are obvious obstacles which may be considered. We list here only a few [1]:

(a) asteroid shower: may induce impact to the construction workers + machines. Perhaps need to build temporary (polycarbonate) shelter;

(b) no oxygen would mean that concrete drying process may not complete. Perhaps needs to bring oxygen chamber, and mixing concrete will be done inside the chamber;

(c) oxygen supply for the workers;

(d) design load shall take into consideration this asteroid shower and other possible impact load.

POSSIBLE RAW MATERIALS

MATERIALS THAT CAN BE USED IN THIS PROPOSED LUNAR BASE [1].

1. Steel: for columns and beams, are recommended if no concreting is allowed.

2. Aluminum. Very versatile and light material, suitable for inner utilities).

3. Fabric, can be used in various places, for instance: room separation, cladding (protection against extreme UV), and other function. Membrane can also be used for roof instead of rigid roof, but with greater risk of 'puncture' because of impact loads.

4. Compacted regolith, can be used to cover the roof.

5. Lunar concrete: can be used for slabs and beams, if concreting is allowed. Otherwise, slabs may use aluminum.

6. Glass: shall be used in minimum because of possible scratch or puncture under impacts.

7. Inflatable material can also be used, but in our opinion it is also suitable for temporary building, not a permanent space base, which is expected to be more durable and high-load resistance.

FURTHER READING

1. Ruess, F., J. Schaenzlin, and H. Benaroya, "Structural design of a Lunar habitat," J. Aerospace Engineering, Vol. 19 No. 3, July 1st (2006).

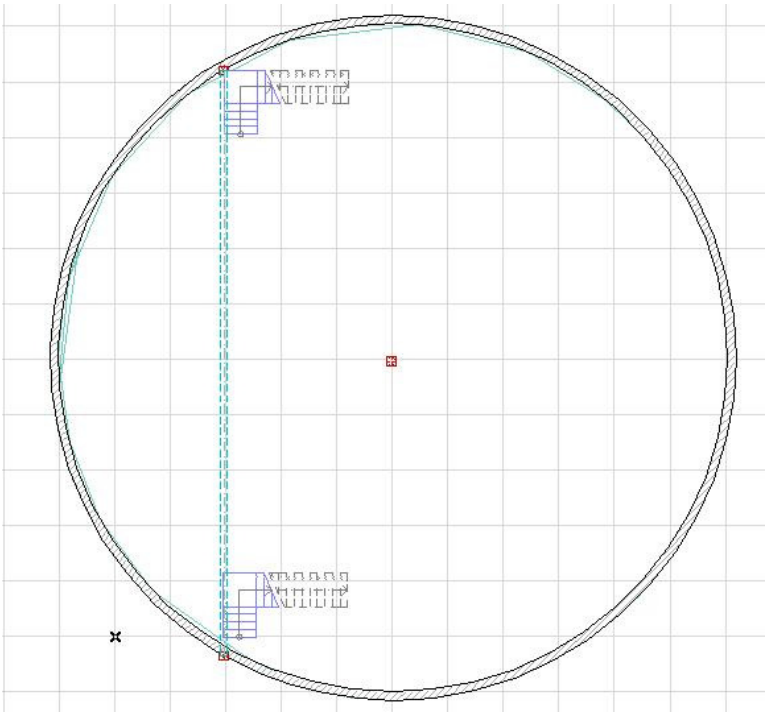
2. Silva, F., "The history of Crop circles - 1995," URL: http://home.clara.net/lovely/crop_circles_history95.html

3. Jarvstrat, N., & C. Toklu, "Design and construction for self-sufficiency in a Lunar Colony," ASEM2004, URL: www.moon-isru.com/information/ASEM2004.pdf

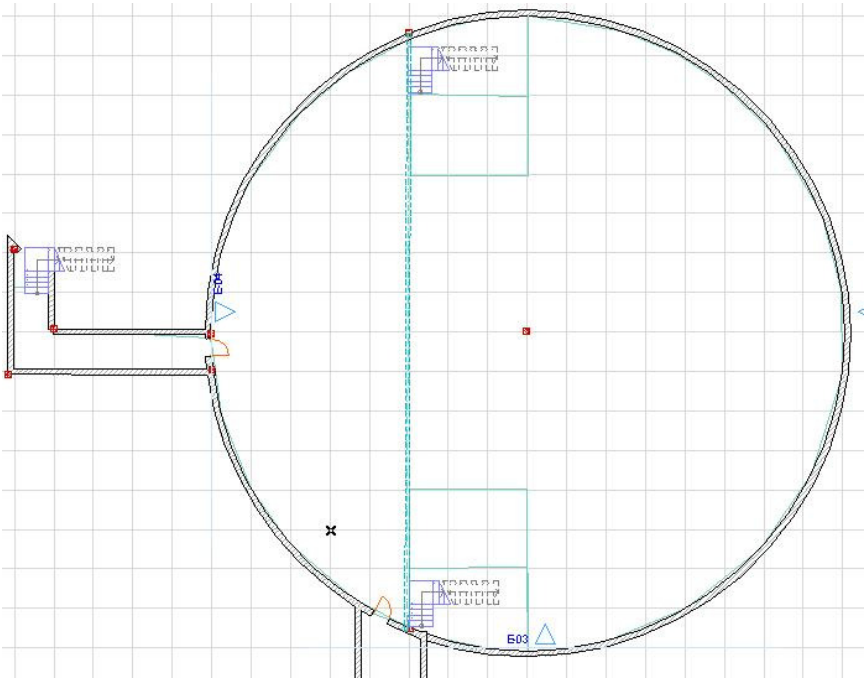
4. Khalili, E. Nader, "Lunar structures generated and shielded with on-site materials," J. Aerospace Eng, Vol. 2 No. 3, ASCE (1989)

Created 1st: 28feb 2008. VC & FS, vxianto@yahoo.com & fsmarandache@yahoo.com

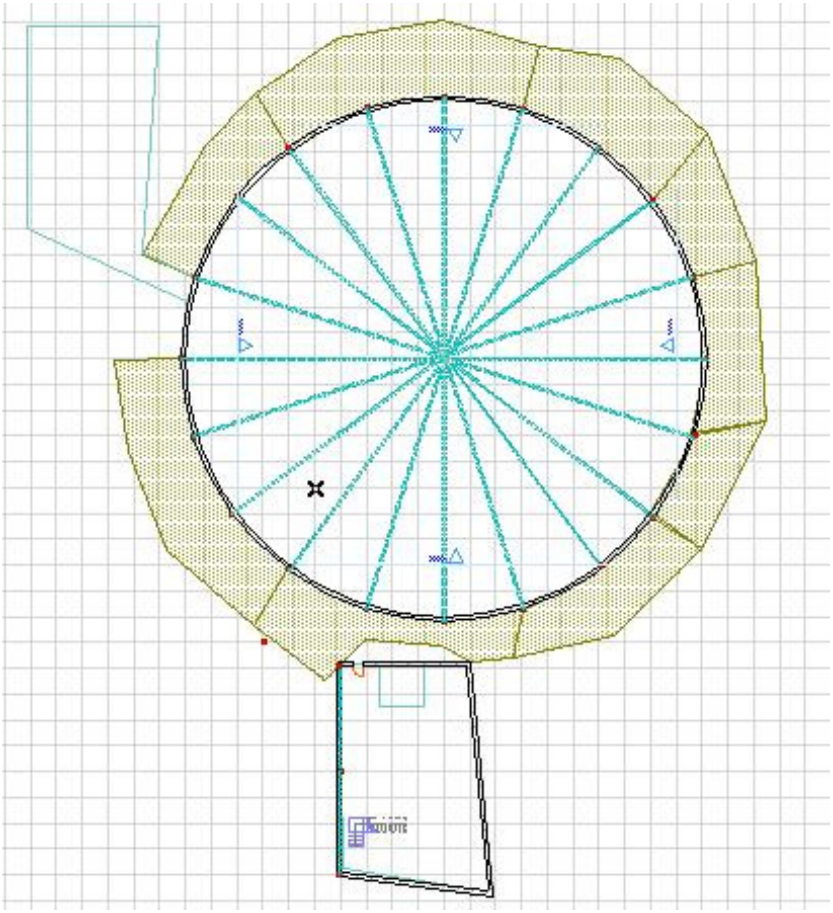
(a) Basement 2 level:



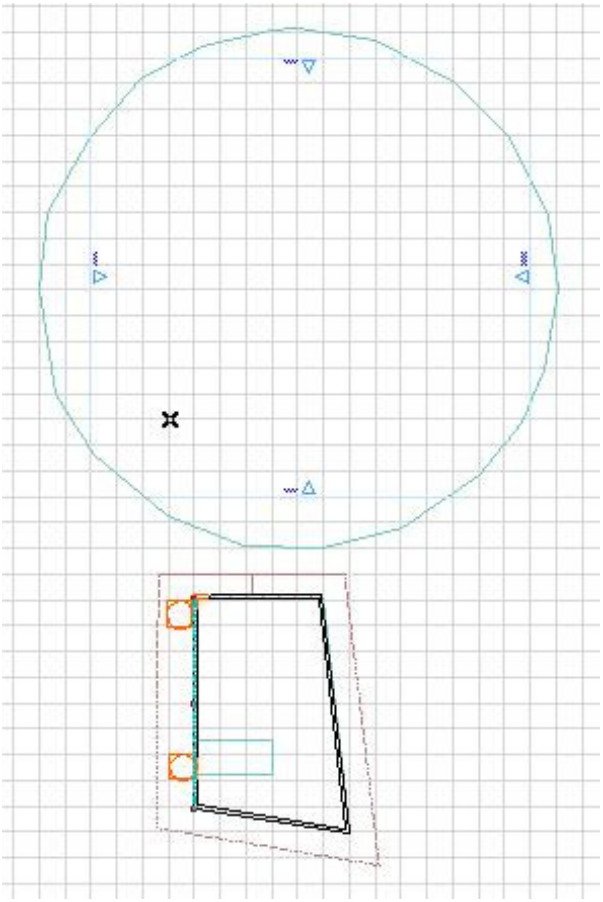
(b) Basement 1 level:



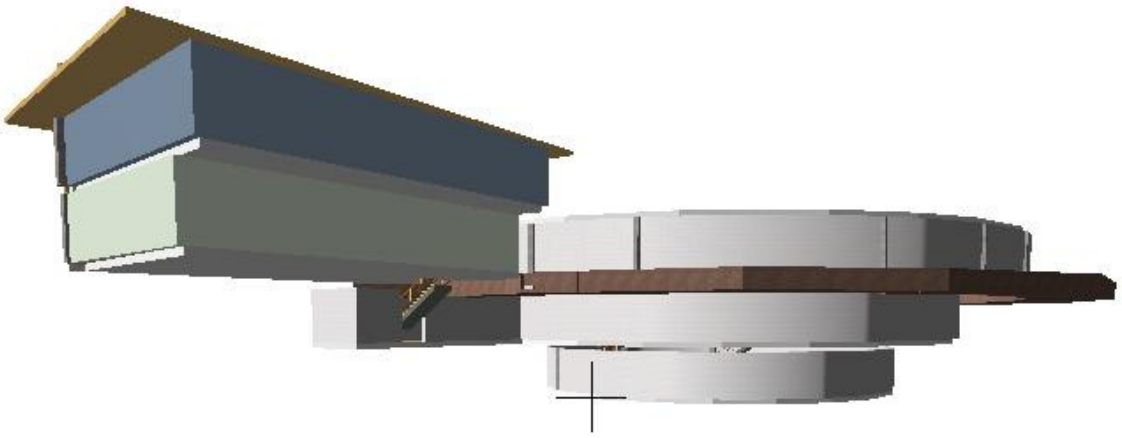
(c) Groundfloor level:



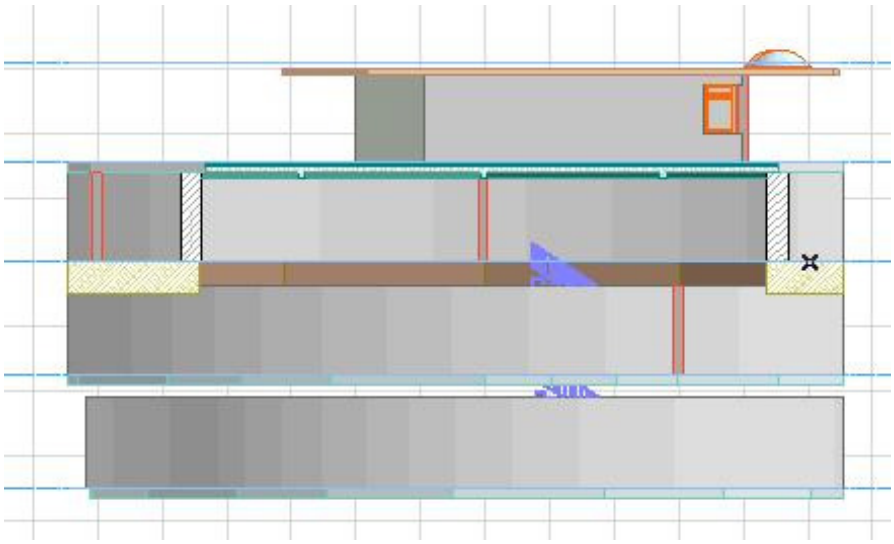
(d) Level 1:



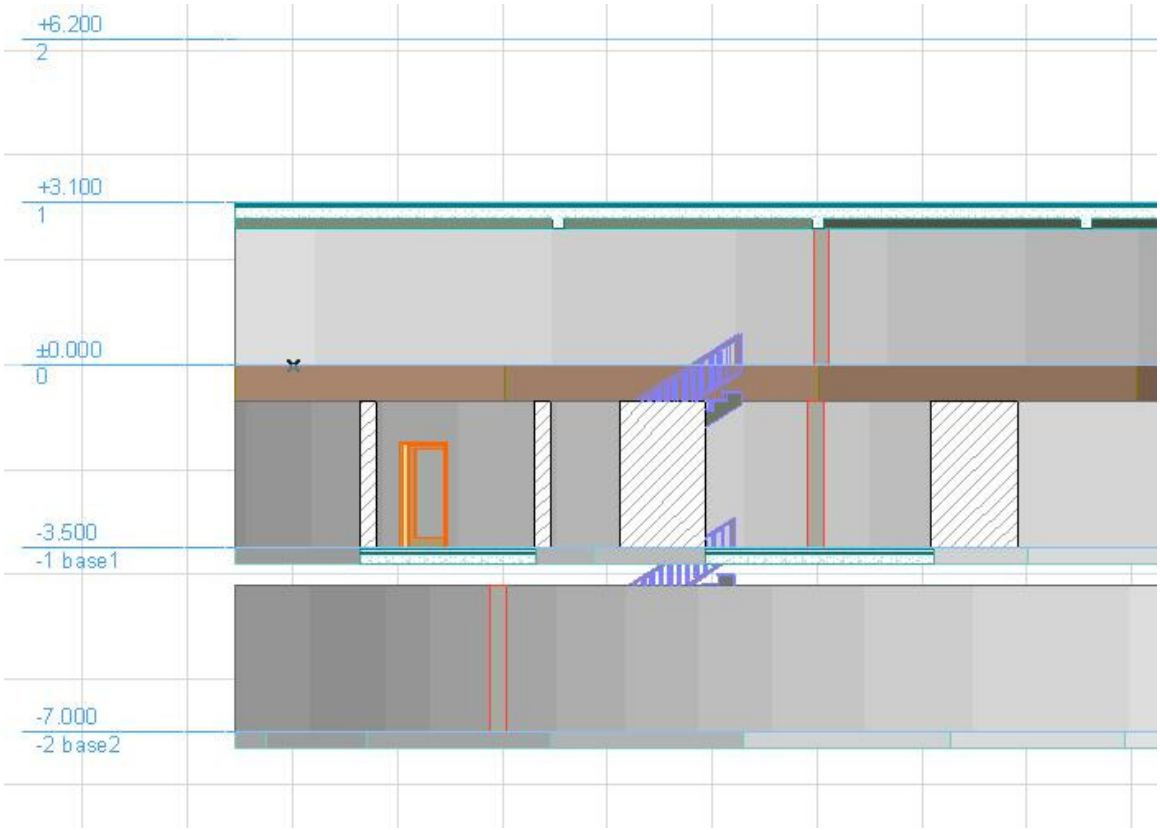
(e) Sideview



(f) North section



(g) South section



(h) East section