corpus -experimental housing-

diploma thesis Tetsujiro Kyuma

Aalto University
School of Arts, Design and Architecture
Department of Architecture
2015

corpus

[kˈɔːpəs]

Latin

From Proto-Indo-European *krep - ("body") [1]

1. body, substance, material

2. the felsh of an animal's body

3. a lifeless body, corpse

4. the trunk or shaft of something

5. a frame, body, system, structure, community, corporation

6. (figuratively) the wood under the bark of a tree

7. (Medieval) a collection of writings by a single author or addressing a certain topic

[2]

Author: Tetsujiro Kyuma
Title of thesis: corpus -experimental housing-
Date: 12.5.2015
Department: Department of Architecture
Academic chair: Building Technology
Chair code: A-09
Supervisor: Professor Antti-Matti Siikala
Drawing Panels: 7
Models: 1
Number of pages (report + annexes) 56 + 10
Language: English
Keywords: caly, clay block, masonry, housing, Otaniemi, access corridor

Abstract

This is an experiment to build a three-storey extension to the existing three-storey housing in Otaniemi using thermal clay block masonry structure.

Burnt clay is one of the oldest and most used materials in human history. Its use in architecture has been developed through the course of time. It started from monumental masonry structure in Mesopotamia and developed further in Roman era thanks to the invention of arch structure. The evolution of masonry structure reached its peak in Gothic architecture. After the Gothic period, the evolution of masonry structure almost stopped. It was Gaudí who succeeded in developing masonry structure further, eventually continued by Dieste.

The use of burnt clay changed radically when wall and facade became free from structure in modernist architecture. Meanwhile in Finland traditional massive masonry construction survived until 1960s when industrialization and the new thermal insulation regulations made massive masonry quite uneconomic and unrealistic. Thermal clay block masonry construction has been developed since the air quality in buildings came to be discussed in 1990s.

As examples of use of the thermal clay block consturction I present two buildings. One from Finland cladded with hand-made bricks to adapt to the surroundings. The other from Croatia with a crystal-like shaped outer shell supported by steel frame hanging out from the main clay block volume. The space in between the volume and the skin is actively functioning as a mediator between the volume and the external environment. I found that the space between the

volume and the facade presents many possibilities.

Then I present the use of brick in Otaniemi. There is a certain idea of use of brick by Alvar Aalto in the sense of weight and permanence. I also present the idea of relationship between interior and exterior in architecture of Alvar Aalto before I finally present my own design for the experimental housing.

In my design the core of the building is monolithic thermal clay block construction, which is supported functionally and environmentally by the access corridors and the balconies. The building is cladded with clay shingles to adapt to the surroundings.

Contents

Beginning

I used to live in an Jugend style apartment in Helsinki constructed in 1903. It has certain atmosphere of both dignity and comfortness. The service systems such as electricity, water piping, heating, window profiles are updated to contemporary standards. On the other hand, the massive masonry construction has been always the body of the building. The special atmosphere of the building is literally constructed by the massive body of masonry construction.

Buildings embrace historical narrative. Knowing about history of architecture can lead to the discovery of essence inherited from generation to generation. It is the nutrition from the site where architecture grows from. In other words, the primal attributes for the local architecture. I believe in the primal attributes which has been inherited from generation to generation. It is "the concentrated substance".[3]

No matter how great architecture the building is, it is the next generation who decides the future use of the building. The use and the condition of the building is the reflection of the lifestyle and common sense of the time. Good implementation of architecture is revealed by the original idea of architecture which is remaining through the course of time. The essence of architecture which is good enough to be understood by people continues to be there. It was, it has been, it will be...

Construction workers of Läntinen Viertotie 20 (Mannerheimintien 44)- In courtyard of Dunckerinkatu 2 in 1922
possibly for Topping out ceremony

source: Marja Heikkilä-Kauppinen, Saanko luvan?, Helsingin kaupunki Rakennusvalvontavirasto, 2012 p.302

Burnt clay

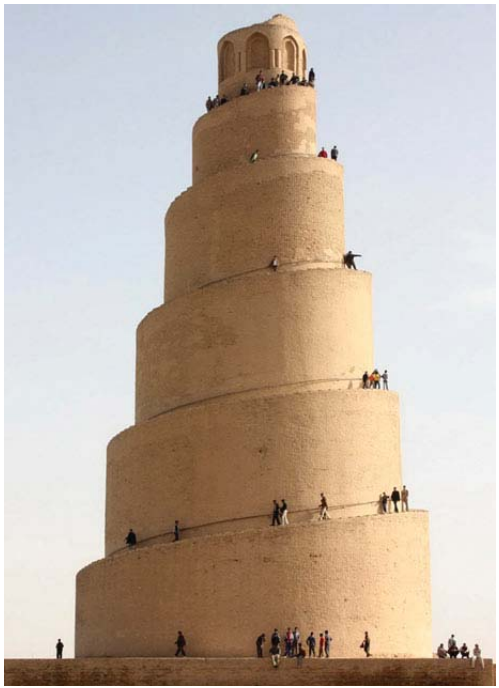
The first of Aristotle's fundamental elements of earth, air, fire, and water, soil is the root of our existence, essential to life on Earth.[4] Burnt clay is "the only building material obtained from those four elements".[5] Its basic materials, clay and loam, were ultimately created by flooding and depositing caused by the energy of the sun. Their extraction generates very little spoil and consumes very little energy. "They are a piece of purity that has been wrested from nature."[6]

Burnt clay is one of the oldest and most used materials in human history. Its use has been developed through the course of time. The tradition has been inherited from generation to generation. At the same time, innovation has always been accomplished as the result of experimenting when reacting to new demands of the time and situations. Nevertheless, the essence has never changed. It is its body which consists of clay and loam. On the other hand how it is burnt and treated has been changed (see image). Sometime without finishes, sometime with various kind of coatings. It has been evolving all the time.

left and centre: clay pottery by 10th Ohi Chozaemon (1927 -)

right: clay pottery by Ohi Toshio (1958 -)

photograph: Tetsujiro Kyuma



Monumental effect

The forbidden southern deserts in Eribu. Sand-covered remains of one of the world's first cities. "The earliest examples of brick structures made by man are the spiral mounds built in ancient Mesopotamia." (See image.) "They are demonstrative of man's ability to arrange an artificial landform. While their ancient ritual purpose is harder for the contemporary world to understand, what is still overwhelmingly clear is the physical effort involved in their making." "The modular use of brick is metaphorically potent representing political ability to organise multitudes and preserve order at an extraordinary scale." [7]

The evolution of monumental masonry brickwork continued in Ancient Rome. The greatest invention of the time was the arch structure. The existing ancient Roman architecture has no problem in terms of structural property although the buildings have been used almost for 2000 years. In this sense the massive masonry structure is incredibly durable. Although the massive masonry structure may seem to be an old solution, the time it has been facing is far longer than that of modern technology.

Malwiya minarets of Samarra's Great Mosque, Iraq 848AD

source: www.theguardian.com/artanddesign/2012/feb/12/glancey-passport-planet

photograph: reuters

From structure to ornament

After the Roman era, which was continued by Romanesque style, the evolution of masonry structure reached its summit in Gothic architecture. The space created by pointed arches is reminiscent of coniferous forest in Northern Europe. This magnificent space was made possible by the invention of flying buttress which also made the openings larger. The beautiful sunlight comes into the space through stained glasses installed in the large openings.

After the Gothic the evolution of masonry structure almost stopped and ornaments started to play a major role in architecture. Even the extremely fine brickwork was concealed beneath the layers of render or plaster work. One of the unique examples of fair-faced brick masonry construction of that time is Oratorio dei Filippini (1637 - 1650) in Rome by Francesco Borromini (1599 - 1667). "Brick is handled in a manner that is extremely plastic. The expression of the material creates a sculptural complexity normally achieved through plaster work. Borromini rubs and shapes bricks to a point where their dimensions as modular units are lost. Brick has become a small-scale component that can be carved in a similar manner to stone and which contributes to the manipulation of the classical order."[8]

Oratorio dei Filippini, Rome, Italy 1637-1650 Francesco Borromini

source: www.artandarchitecture.org.uk

Organic figure

In Borromini's Oratorio dei Filippini brick (see image p.15) is visually contrasted with stone ornaments. By rubbing and carving bricks, modular use of brick is blurred and surface and the geometry of entire construction is revealed.

Same kind of effect can be found more clearly in some Art Nouveau style architecture. In Finland "industrialization in the 1870s speeded up the building of stone houses".[9] Relatively new Art Nouveau style apartments were built in Helsinki district in the beginning of 20th century. They are also called 'Jugend style' in Nordic coutries. The structure is massive stone and brick masonry construction. Skilful carpentary and metalwork used on the doors and other fittings are visible on exterior.[10] Stairwells have painted decorations and stained glass windows. Brick masonry construction with organic figure is another feature of those apartments. Although both curves and straight lines are used asymmetrically, plastering on massive brick walls is giving the building monolithic appearance of the construction. This must be one of the reason to avoid fair-faced brick walls. Handicrafted appearance of the modular use of brick wouldn't have gone well with the carpentary and metalwork of the doors and fittings.

Tehtaankatu 26 - Huvilakatu 27, Helsinki, Finland 1903 Mauritz Gripenberg

photograph: Tetsujiro Kyuma

Antoni Gaudí (1852 - 1926)

Gaudí is one of the greatest architects of Art Nouveau style. He also created architecture with organic figure with the idea based on geometry. He is also the first architect who suceeded in developing masonry structure which almost stopped after Gothic architecture. He thought that pointed arch of Gothic was incomplete because it needed flying buttress to support the high space. This thought led him to the famous 'chain' method and the use of catenary arch in architecture. Use of brick in Crypt of the Colònia Güell (1908 - 1918) reveals his understanding of loading capacity of gravity (see image). Modular use of brick depicts how force is transmitted from one brick to the other. The brick he used is a traditional local product in the region of Catalunya where most of his works are situated. This brick is famous for its thinness which made the elegant curves of his architecture possible. In Finca Güell (1884- 1887) he used recycled bricks and iron for part of the construction.[11] His awareness of use of materials is derived from his respect and admiration of nature as the origion of his creation.

Crypt of the Colònia Güell, Santa Coloma de Cervelló, Spain 1908 - 1918 Antoni Gaudí
photograph: Yoshie Narimatsu

Complete geometrical shape

After Gaudi, evolution of masonry structure stopped again. Complete geometrical shapes emerged as a new feature. "Nordic classicism started to appear in Nordic countries in 1920s. Buildings are often faced with light-coloured stucco to give the monolithic effect to the building with the same kind of technique used in the 'Jugend style' apartments." It was also a reaction to National Romantic granite and the brick architecture of 1910s.[12] Another new feature, which occured in Nordic classicism is the lighter ornamentation which gives more sense of immateriality to buildings.

Stockholm Public Library (1918 - 1928) designed by Gunnar Asplund (1885 - 1940) is one of the finest examples of the time with complete geometrical shape and axial symmetry. The monumental staircase with polished black stucco contrasts well with the rough white stucco surface structure of the cilinder shaped wall of main space full of light through the high clerestory windows.[13]

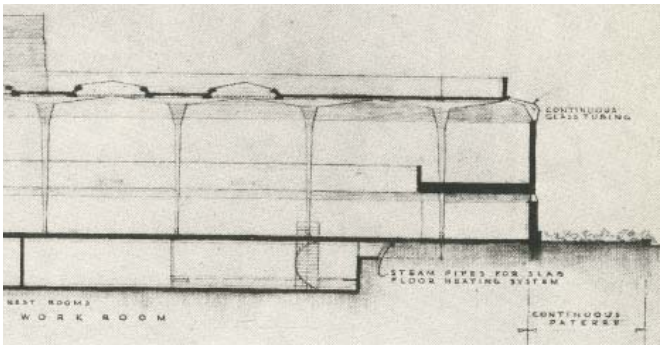
Aira House (1924 - 1926) designed by Alvar Aalto (1898 - 1976) in Jyväskylä with the distinctly object-like rectangular shape, which is one of the essential element of 1920s Classicism, has new and interesting surface. Facade is finished with thin layer of plaster, like thick paint, beneath which one can distinguish the unevennes of the modular use of brick surface.[14]

Stockholm Public Library, Stockholm, Sweden 1918 - 1928 Gunnar Asplund

Materials in immateriality

International Modernism came to Finland in the end of 1920s under the name of Functionalism.[15] It wasn't difficult for architects to adapt to Functionalism from the spirit of Classicism. "Erik Bryggman (1981 - 1955), one of the greatest architects of the time, believed in proportions as the essence of architecture, not in stylistic features."[16] Concrete pillars are new feature and used in structure of the buildings of the time but in many cases walls or some part of the building are made of massive brick construction plastered white. Usually those brick walls are plastered thickly to show the geometry of the whole building clearly in white mass. However, you can find exception in Lasipalatsi (1936) in Helsinki designed by Niilo Kokko (1907 - 1975), Viljo Revell (1910 - 1964), and Heimo Riihimäki (1907 - 1962). The massive brick wall on north side of the building is thinly plastered and modular use of brick is visible especially in sunlight while the whiteness of the entire wall is still a part of the clear geometry of the whole building complex. This kind of technique which can also be seen in Aira House by Aalto provides a stronger sense of presence than the abstracted surface of typical functionalism. This could be the beginning of the shift of modernist idiom towards the use of more tactile materials and vernacular traditions.[17]

Lasipalatsi, Helsinki, Finland 1936 Nilo Kokko, Viljo Revell, Heimo Riihimäki
photograph: Atsushi Takano


CONTINUOUS
GLASS TUBING
STEAM PIPES FOR SLAB
FLOOR HEATING SYSTEM
REST ROOMS
WORK ROOM
CONTINUOUS
PATTERN

Brick as a skin

In Imperial Hotel Tokyo (1923), designed by Frank Lloyd Wright (1867 - 1959), brick is a massive pure construction to which is attached Oya-stone's ornaments. In contrast the main theme of Johnson Wax Building (1936) is reinforced concrete pillars reminiscent of lotus leaves on water with sunlight shining through. Use of brick is natural considering the surrounding brick factory buildings, on the other hand making the presence of new Modernist architecture is visually special in the area. Non-bearing brick walls look like they are free from gravity. They function as a mere division between inside and outside. The 'lightness' of brick is expressed by pyrex tubes installed on top corner between brick walls and floor slabs. In this building there is no sense of weight nor craftman's hand in the walls of standardized bricks.

In Villa Tugendhat (1930), designed by Ludwig Mies van der Rohe (1886 - 1969) "the construction of the plastered structure consists of a steel skeleton, reinforced concrete slabs and brick masonry".[18] 'Flowing' living area supported by columns of cross-shaped profile contrasts with the service facilities supported by masonry construction. Here a steel skeleton and massive brick masonry are nonhierarchically juxtaposed. Houses at Krefeld (1927-30) are "among the first modern buildings where the brick construction has been utilized for something other than load bearing purposes."[19] "By employing a steel frame for the whole structure the architect is allowed to compose elevations more freely and make window openings that are contemporary in their expression. The brick has become a skin supported by steel."[20]

left: Lange and Esters House, Krefeld, Germany 1927 - 1930 Mies van der Rohe

copyright: Shaqspeare

right: Part of the section on center line of building (not in scale), Johnson & Son, Administration Building and Research Tower, Wisconsin, USA 1936 - 1939 Frank Lloyd Wright

source: Yukio Futagawa, Arata Isozaki, GA 1 (Global Architecture) - Frank Lloyd Wright; Johnson & Son, Administration Building and Research Tower, Racine, Wisconsin. 1936-9, A.D.A.EDITA Tokyo Co., Ltd., Tokyo, 1970, p.45

Weight and permanence

For Baker House Dormitory building (1946 - 1949) in Boston, Alvar Aalto used brick which is linked to the existing tradition of campus buildings in Cambridge and Harvard. "He felt that quality of American bricks was too standardized, which made a wall lifeless and mechanical."[21] This is why he wanted especially handcrafted appearance on brick.[22]

After coming back to Finland Aalto started to explore the expression of weight and permanence by using brick. Town Hall in Säynätsalo (1949 - 1952) is one of the best examples of this exploration. It is obvious also from the competition entry's pseudonym 'Curia', "a reference to the monolithic brick form of the Senate of Ancient Rome"[23], that he was looking for the image of endurance and sense of time. He even sent each of the six bricklayers the following letter of thanks:[24]

"Helsinki, April 3rd, 1951

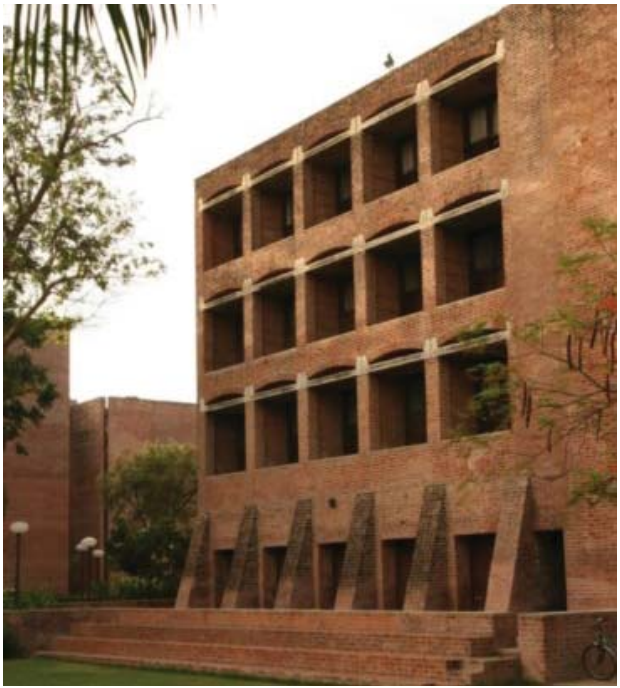
The masonry at Säynätsalo Town Hall, which I consider to be, architecturally speaking, one of the most important pieces of masonry, has been carried out by Toivo Nykänen, Paavo Asplund, Yrjö Marjamäki, Aimo Renlund, Väinö Puolanen and Sakari Sundvall. To me, as an architect, it is of utmost importance to develop the culture of masonry in our country. It is for this reason that the masonry at Säynätsalo is fiar-faced brick in the facades and almost everywhere in the interior. I have to say that I am extremely pleased with the result of our cooperation and that an exemplary case of Finnish brick culture has been achieved.

Alvar Aalto"[25]

Town Hall in Säynätsalo, Jyväskylä, Finland 1950 - 1952 Alvar Aalto

photograph: Tetsujiro Kyuma


ENICO'S



Economy vs Ideality

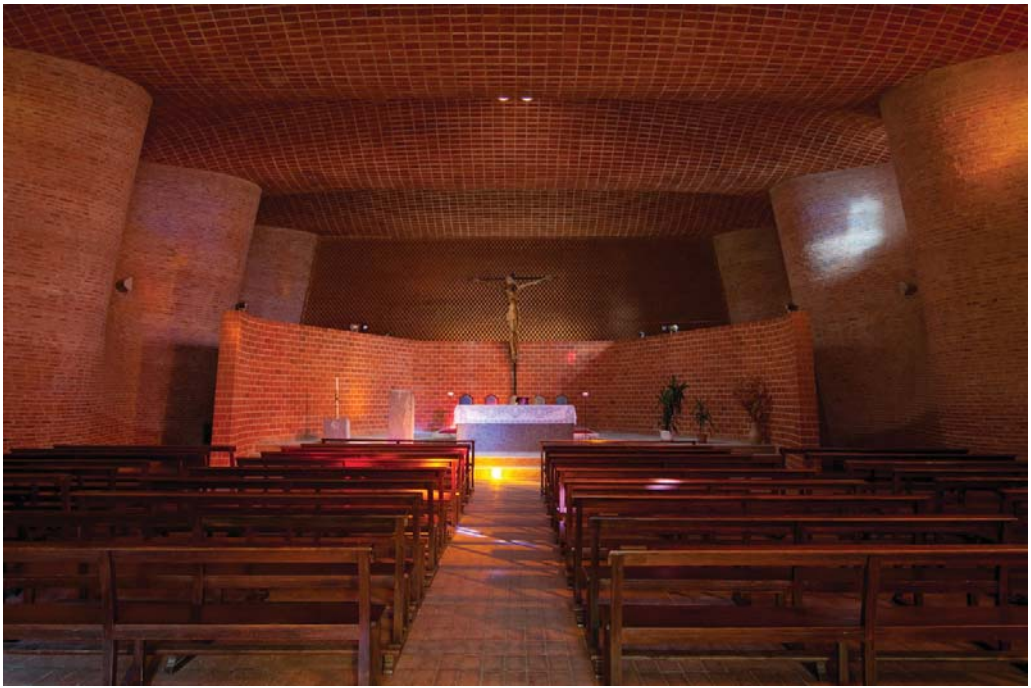
In 1960s structure of economic life in Finland changed and massive housing shortage in urban centres occured. "Vast numbers of homes were needed quickly and cheaply. The solution was found in industrialisation and suburban development." Constructivism and rationalism of the time produced CES (concrete element system) in 1960s and "the column and flat slab system, CFSS, which remained minimal in apartment building in 1971 - 1972." [26]

In Olarinmäki housing area (1969 - 1973) designed by Simo Järvinen (1938 - 1997) and Eero Valjakka (1937 - 2002) the column and slab system is used for apartment buildings. In this system red brick has become mere filling between colums and slabs.

Meanwhile, the monumental effect of massive brick masonry was not lost on Louis Kahn (1901 - 1974) "in his search for the primitive element in modern architecture. But when he was "asking a brick what it wanted to be", he was pragmatic enough to know that the arch could be much more versatile if it could work with the structural properties of concrete. The buildings he realised as part of the Indian Institute of Management, Ahmedabad, India (1962 - 1974) could be achieved because labour costs were not high. These structures would be prohibitively expensive in current western construction terms. In this project and at Dhaka, Bangladesh (1962 - 1983), Kahn is working at a big scale with a geometric investigation." He is clearly drawing upon ancient massive masonry but comes to employ reinforced concrete to support the massive presence of brick architecture. [27]

left
Olarinmäki, Espoo, Finland 1969 - 1973 Simo Järvinen, Eero Valjakka
copyright: Antti Sunell

right
Indian Institute of Management, Ahmedabad, India 1962 - 1974 Louis Kahn
copyright: Bird_dream



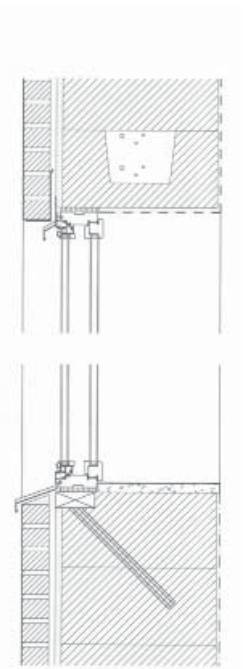
Eladio Dieste (1917 - 2000)

Dieste developed a vocabulary of structural forms of masonry following in the footsteps of Antonio Gaudí's. "The essence of Dieste's design is a way of thinking about 'the best method for form to resist force'." This can naturally applied to Gaudí's way of thinking.[28] Gaudi was always referring to the form and the composition of nature for his creation.

In the Atlántida Church (1958 - 1960) "the walls of the church are a series of curves, conoidal ruled surfaces that rise from a straight line at ground level to a series of deep sinusoidal curves at the top of the wall. The roof is a continuous double curvature vault, calculated such that the curves of roof and wall meet one another in a level plane."

Another fundamental to Dieste's structural principles is his concern with surface. "Dieste virtually invented, and certainly made himself the master of building in reinforced ceramics." "Dieste did not adapt what he had learned of reinforced concrete design to reinforced ceramics out of nostalgia or sentiment for bricks. Production of ceramic materials was an appropriate industry for Uruguay. Dieste conceived how to use these materials efficiently from a structural pint of view; he also invented, and realized through his own construction firm, how to build quickly and economically." "To the unity of building, engineering, and architecture, we can attach the wisdom of how to work effectively - pragmatically, but also socially and culturally, in the situation he confronted."[29]

The Atlántida Church, Atlántida, Uruguay 1958 - 1960 Eladio Dieste



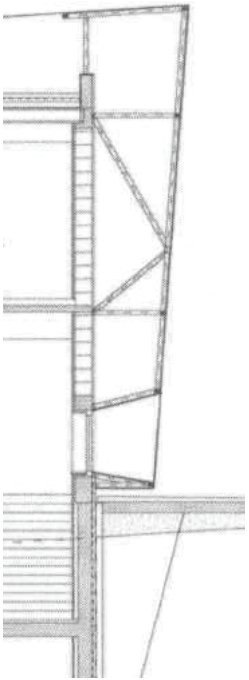
Massive clay block construction in Finland

The massive brick masonry construction started to be used again in Finland in 1990s because of its good energy efficiency of mass storage capacity, for example in Allergiatalo (1998) in Helsinki by Arkkitehdit Ky Gullichsen Kairamo Vormala. In As Oy Tuusulan Lottakoti (2001) by Arkkitehtitoimisto Larkas & Laine Oy 600mm two-brick thick *in situ* masonry with triple layered render exterior wall is employed. Using the same kind of bricks used in housing up until 1960s, the resulting U-value is slightly better than apartments in 1960s 0.85 W / m2K.[30]

Kellokas Housing (2011) in Helsinki by Arkkitehtitoimisto Karin Krokfors is built *in situ* out of honeycomb brick building blocks and faced with red hand-made bricks. The U-value required by regulation in Finland (0,17 W/m2K) is attained. The architect explains the benefit of construction: "The trend today is to make heat insulation layers thicker and thicker, which may lead to problems with mould and mildew. This kind of masonry wall allows the structure to breathe, and the indoor air will remain healthy. (...) I wanted to live in a house that would last to accomodate my great-grand-daughter and burden the environment as little as possible. Kellokas is not perfect, but it is a good effort at breaking away from the mainstream of construction today." [31]

left
Kellokas Housing, Helsinki, Finland 2011 Arkkitehtitoimisto Karin Krokfors
copyright: Jussi Tainen

right
exterior wall structure 1:100
source: Arkkitehtilehti 4/2011



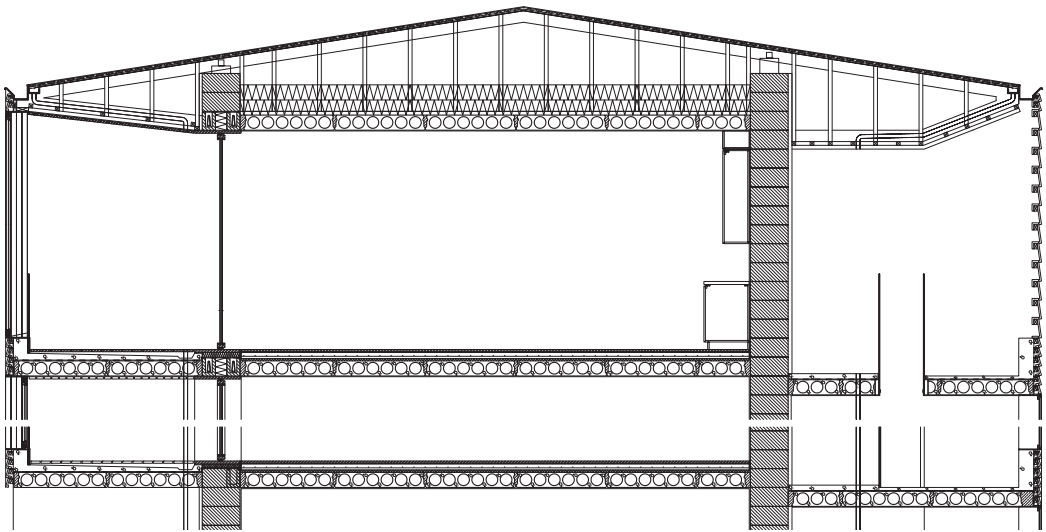
Clay block and possibilities

Lumenart - House of light (2012) by Rusan Architektura has a cube-shaped functional structure made of clay blocks. The clay block structure also functions as the structure for the outer shell. Because the building material functions as an absorbent body, the clay block construction also affects the interior climate. It can absorb the warmth and moisture then release it again at the later time. In contrast to the cubic core of the building, "the 'crystal shaped skin' is the creative solutions generated through inspiration and the greatest possible artistic freedom which is the architectural philosophy of the architect." [32]

The crystal shape is realised by the steel frame sub-structure attatched to the massive clay block construction. Although space between the clay block structure and the skin is not usable space, it is working as a mediator to control the micro climate around the building. This space is more environmental than something which is just massive or transparent. There may lie great possibilities in regards to relationship between architecture and environment when skin as a layer becomes a space.

left
Lumenart - House of Light, Pula, Croatia 2012 Rusan Arhitektura
copyright: Damir Fabijanic

right
exterior wall structure, not in scale
source: BRICK 14, CALLWEY, München, 2014



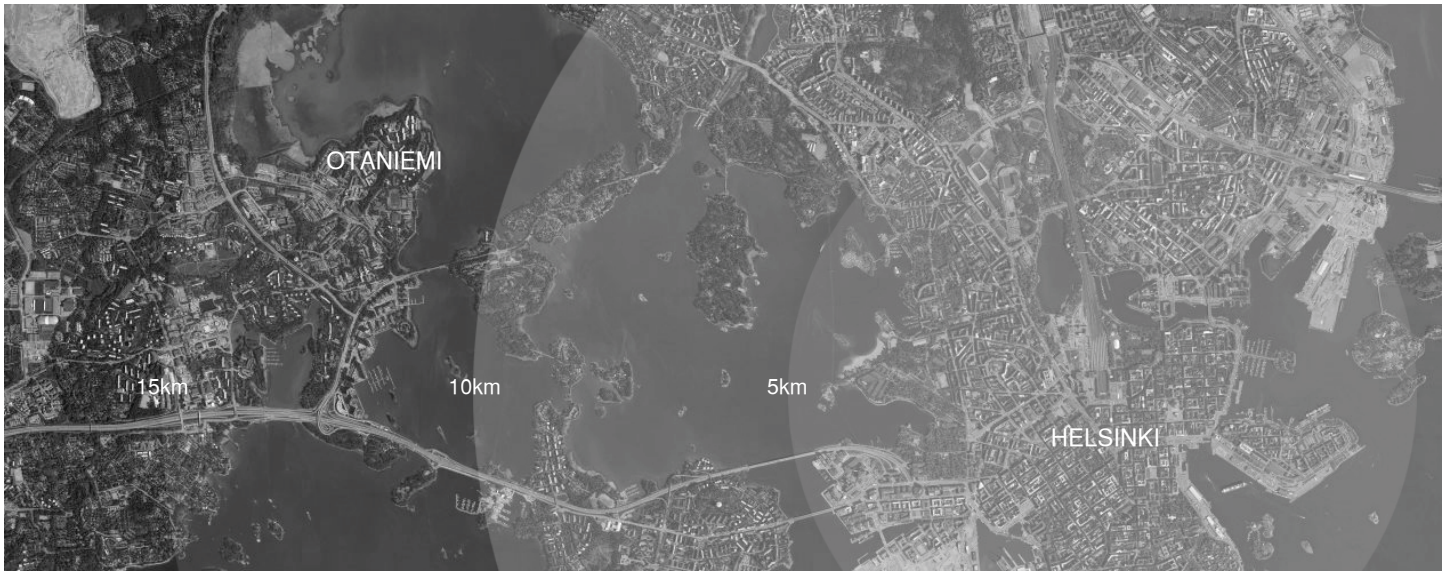
Experimenting with possibilities

In the course of time, architectural evolution has been most obvious in the change of proportion of structure to the whole building.[33] In ancient architecture structure was the building itself. Even when the ornament was more dominant than structure, ornament was just attached to or painted on structure. In modernist architecture proportion of structure changed radically. "Wall and facade was eliminated from the fundamental agents of the architectural space."[34] Modernists generally wish to break down the difference between interior and exterior.

In Finland traditional massive masonry construction in housing survived until 1960s due respect to climatic and natural conditions.[35] However, industrialisation and demand for quickness and cheapness of construction of apartments changed the use of brick in construction. Moreover, the new thermal insulation regulations made massive masonry quite unrealistic. As thermal insulation became thicker and thicker, the air quality in buildings came to be discussed. Then traditional massive brick construction started to be reconsidered. The insufficient thermal insulating properties of massive brick construction was solved by massive clay block construction which also has an advantage in relation to air quality. This is the beginning of experimenting with the possibilities of using clay block in Finnish contemporary housing. Gaudí said "Originality consists in returning to origin." Architecture is more related to environment than ever before. The evolution of Finnish housing architecture continues with the supporting spaces next to the massive clay block volume (see image). The space between the thin layer of skin and the structure in modernist architecture becomes a space to mediate the relationship between the core mass of building and environment.

experimental housing section 1:100

-experimental housing-


OTANIEMI
15km
10km
5km
HELSINKI

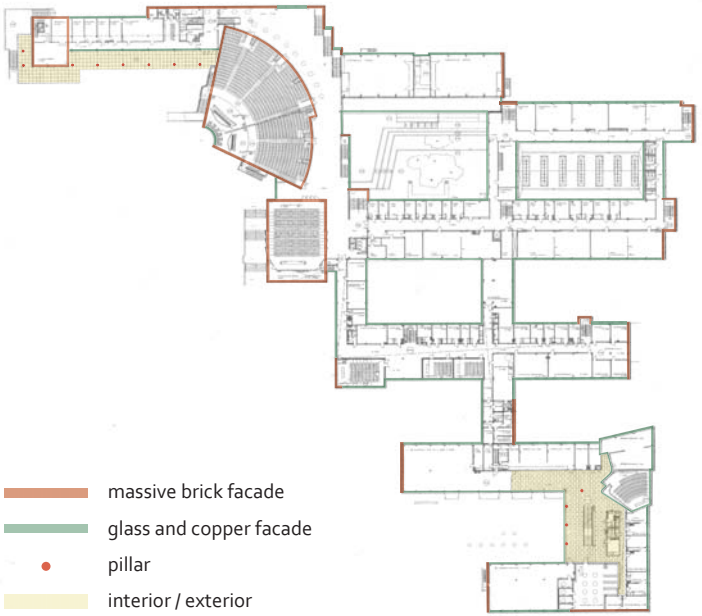
Otaniemi

"In 1949, the state purchased the grounds of Otaniemi Manor in Espoo in order to establish a new campus for Helsinki University of Technology and VTT Technical Research Centre of Finland" due to the necessity of large-scale laboratory facilities in a much freer and open environment than downtown Helsinki.[36] Alvar Aalto and Aino Aalto's proposal "Ave Mater Alma, Morituri Te Salutant" won the town planning competition held in 1949.[37]

The (former) main building of Helsinki University of Technology (1953 - 1964) was built on the hillside where Otaniemi Manor used to be situated.[38] It forms the "cultural centre" at the core of the campus together with the Main Library (1961 - 1970) adjacent to the (former) open spaces of the fields and meadows. In contrast, more technical and supportive buildings of the laboratory and institution are situated at the edges of the open spaces or among the trees. The residential buildings are built in the peaceful area surrounded by the trees and the sea.[39]

"On 1 January 2010, Aalto University began its operations. It was established at the initiative of its three founding schools the Helsinki School of Economics, the University of Art and Design Helsinki, and Helsinki Univerisity of technology."[40] The international architecture competition for the new campus design in 2014 was won by Verstas Architects. The new Aalto University building creats "new central plaza" together with the existing "cultural centre" of Aalto's buildings and the new metro station. "In the new millenium, Otaniemi provides a livelihood for approximately 16,000 employees and has 15,000 students."[41]

Situation Diagram of Otaniemi


massive brick facade
glass and copper facade
pillar
interior / exterior

Helsinki University of Technology Main Building

Without doubt the totality of the whole Otaniemi campus is realised by the uniform use of red brick facades although there are exceptions such as Otaniemi Sports Hall (1950 - 1952) by Alvar Aalto, Dipoli (1961 - 1966) by Reima Pietilä (1923 - 1993) and Raili Paatelainen (1926 -), and so on. Likewise in Town Hall in Säynätsalo (1949 - 1952) , planned in the same period, Helsinki University of Technology Main building (1953 - 1964) is the result of an exploration of the expression of weight and permanence by using brick. The Main Building consists of two types of architectonics although it has reinforced concrete frame as a whole structural system. One is functional straight-angled boxes for teaching and studying spaces with ribbon windows which is one of the main languages of modernist architecture. The other, on the contrary, is the spaces for festivities and formal occasions with monumental massive brick volume of various figures. The expression of weight is realised by juxtaposing the closeness of massive brick facade with the openness and lightness of copper and glass facade. The copper plates, that patinate gradually, mediates the language of different periods of architecture expressed by massive brick facades of pre-modern architecture and the ribbon windows of modern architecture.

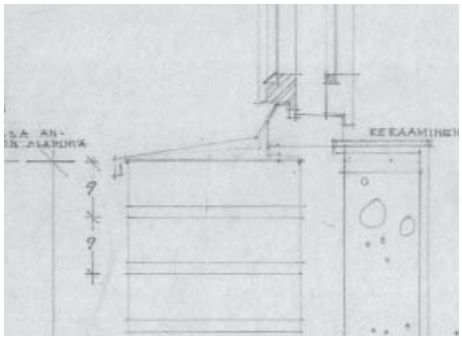
left: Helsinki University of Technology Main Building, Espoo, Finland 1953-1964 Alvar Aalto

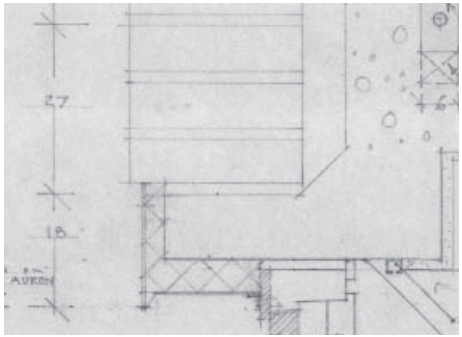
photograph: Hiroko Mori

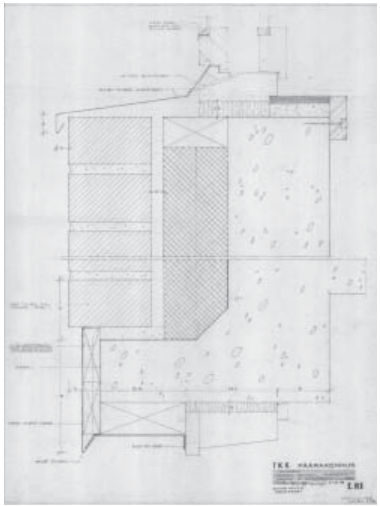
centre: The TKK Main Building under construction at the beginning of the 1960s: the western wing of the General Department

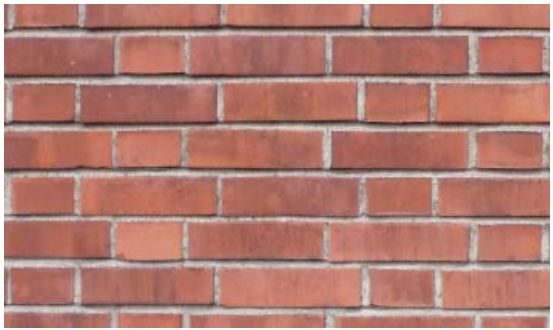
right: The main drawing, dated 12.6.1961 first floor of the Main Building of Helsinki University of Technology, AAA42-3211 (modified by author)

source: Mia Hipeli, alvar aalto ARCHITECT VOLUME 13 UNIVERSITY OF TECHNOLOGY, OTANIEMI 1949-74, ALVAR AALTO FOUNDATION ALVAR AALTO ACADEMY, Helsinki, 2008, p25, 59









Brick in Otaniemi

The buildings of the campus have "hierarchical differences in what at first sight are uniform redbrick facades". In the Main Building and the Main Library the massiveness of brick facades is expressed by using "the one-brick thick and decorative raking monk bond" (or gothic bond) brick laying despite the unnecessity in terms of structural properties. Actually in extensions to the Main Building, "a half-brick thick wall that imitates the monk bond" are used. More supportive buildings and residential buildings have "a half-brick thick wall and various different masonry bonds" mainly stretcher bond.[42]

Teekkarikylä student's village was the first project to be completed in the Otaniemi campus area. In Student Housing TKY 2-4 (1950) "the dormitories were eventually built according to principles designed by Aalto but the final drawings were made by architects Heikki Siren (1918 - 2013) and Martti Melakari".[43] One of the three volumes was constructed using recycled bricks from the Embassy of Soviet Union which was demolished.[44]

"Teekkarikylä also served as accomodation in the 1952 Olympic Games and 2005 International championship of athletics."[45] Building of the western metro line and the new Aalto University building will raise the housing needs of Aalto University.[46]

left: A section through the eterior wall of the Main Building of former Helsinki University of Technology, scale 1:10.27.4.-15.6.1962. AAA 42-3286.

centre: A section through the exterior wall of the extensions of the General Department and administration wing, scale 1:10.13.1.1973-11.1.1974. AAA 42-5096.

source: Mia Hipeli, alvar aalto ARCHITECT VOLUME 13 UNIVERSITY OF TECHNOLOGY, OTANIEMI 1949-74,ALVAR AALTO FOUNDATION ALVAR AALTO ACADEMY, Helsinki, 2008

right top: Raking monk bond of Helsinki University of Technology Main Building, Espoo, Finland 1953-1964, Alvar Aalto

right bottom: Stretcher bond of Student Housing Servinkuja 2, Espoo, Finland 1963, Kaija and Heikki Siren

photograph: Tetsujiro Kyuma


massive brick facade
openings
pillar
interior / exterior

Interior / Exterior

Aalto wrote an essay for *Aitta* magazine in 1926, named "From doorstep to living room", about the relationship between interior and exterior in Finnish architecture. [47]

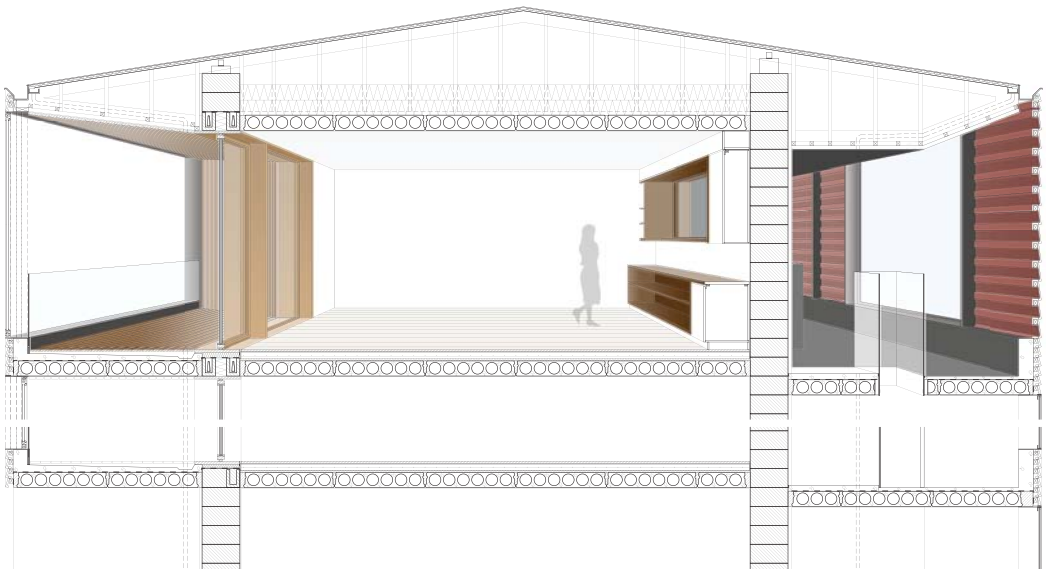
He tried to re-consider "a sharp differentiation between the warm interior and the surroundings", which is required in the Nordic climate, by using "the long-depised corridor". His trial can be seen in the drawings. Floor texture on the corridor and the area near the entrance are drawn both inside and outside (see image p.43 and 47). This proves how important corridor was for Aalto to relate interior and exterior. He also applied different structure to corridors than to other parts of the building. In Säynätsalo Town Hall the post and beam structure of the corridor with its glass facade is attached to the massive brick facade with its concrete wall structure. In Helsinki University of Technology Main Building pillars are integrated with the facade to support the heavy massive brick facade (see image p. 41). In contrast, pillars in foyer-like broad corridor space in the architecture department are separated from the facade to make a larger window surface area.

left: Corridor in Town Hall in Säynätsalo, Jyväskylä, Finland 1950 - 1952 Alvar Aalto

photograph: Tetsujiro Kyuma

right: Diagram of the main level plan of Town Hall in Säynätsalo (modified by the author)

source: Yukio Futagawa, Muto Akira, GA 24 (Global Architecture) - Alvar Aalto; Town Hall in Säynätsalo, Säynätsalo, Finland. 1950-52, Public Pension Institute (Kansaneläkelaitos) Helsinki, Finland. 1952-56, A.D.A. EDITA Tokyo Co., LTD, Tokyo, 1973, p.43



From complexity to more complexity

Le Corbusier's (1887 - 1965) contribution to modernist architecture is immense. Modernism spread to the world because of invention of dom-ino system. Dom-ino system spread to the world because of its simpleness and flexibility. Aalto created some modernist architecture but this period didn't last long for Aalto. After a while he started to combine post and beam structure with massive wall structure. He used massive wall structure because of the Nordic climate but he was never against "a sharp differentiation between the warm interior and the surroundings"[47]. This is why he integrated post and beam structure with massive wall structure although it could have been much simpler to apply post and beam structure to the whole building. This is possibly where rather more complex architecture of Aalto has derived from.

Contemporary architecture needs to be more complex than that of modernist architecture because of the complex relationship between building and environment today. The complexity of Aalto's architecture could be a good start point for contemporary Finnish architecture. By developing Aalto's complex structure system, it is possible to adjust the building more intricately to the environment.

Massive clay block volume possibly lasts for some hundred years. It also functions as an absorbent body, although there is a limit what monolithic wall can deal with environment. Supporting spaces next to the massive clay volume can function as climate control space while functioning as access corridor and balcony.

experimental housing sectional perspective 1:100

references

1. Julius Pokorny, Indogermanishes exymologisches Woerterbuch, Bern : Francke, 1959, p620

2. eije.weblio.jp/content/corpus

3. Peter Zumthor, Thinking Architecture, Birkhäuser, Basel; Boston; Berlin, 1999, p27

4. Dr. David Montgomery, Dirt : The Erosion of Civilizations, University of California Press, 2007, p2

5, 7, 8, 20, 27. Peter Salter, Stephen Bates, Jonathan Sergison, Brick-work - Thinking and making: Sergison Bates Architects, gta, Institute for the History of Architecture, Dept. of Architecture, ETH Zurich, 2005, p9, 14, 15

6. Günther Moewes, Of Brick: Ecology and Diversity, brick 08, CALLWEY, München, 2008, p193

9, 26, 35. Olli Lehtovuori, The Story of Finnish Housing Architecture, Ministry of Environment, The Finnish Building Centre Ltd, Helsinki, 1999, p42, 102-103,

10, 15, 16. Riitta Nikula, Wood, Stone and Steel Contours of Finnish Archtecture, Otava Publishing Company Ltd, Helsinki, 2005, p96, 133, 141

11. Takehiko Inoue, Pepita Takehiko Inoue meets Gaudi, Nikkei Business Publications, Inc. Tokyo, 2011, p94

12, 17, 21, 22, 23, 24. Alvar Aalto Museum Alvar Aalto Foundation, Alvar Aalto The Brick, Alvar Aalto Foundation, the authors, Helsinki, 2001, p43, 57, 50, 9, 29

13. AD Classics: Stockholm Public Library / Gunnar Asplund, www.archdaily.com

14. Jari Jetsonen and Sirkkaliisa Jetsonen, Alvar Aalto Apartments, Rakennustieto, Helsinki, 2004, p22

18. Villa Tugendhat, www.tugendhat.eu/en/the-building/ the-structure.html

19. Lange & Esters House, en.wikiarquitectura.com/

25. Göran Schildt: Inhimillinen tekijä, Alvar Aalto 1939 - 1976, Otava Publishing Company Ltd, Helsinki, 1990, p161

28. Mamoru Kawaguchi, The Structural Design of Eladio Dieste, a+u #395, A+U Publishing Co., Ltd. Japan, 2003, p130

29. Stanford Anderson, Eladio Dieste: Principled Builder and Master of Structural Art, a+u #395, A+U Publishing Co., Ltd. Japan, 2003, p64-75

30. Juha karilainen, Tiili - ekologinen ja energiatehokas ulkoseinärakenne, RY Rakennettu ympäristö 4/2006, Rakennustieto, Helsinki, p27

31. Arkkitehtilehti 4/2011, Suomen Arkkitehtiliitto - Finlands Arkitektförbund SAFA, Helsinki, p41-45

32. BRICK 14, CALLWEY, München 2014, p36-37

33. Eduardo Sacriste, Building Footprints, Editorial Universitaria de Buenos Aires, 1962

34. EL Croquis 166 Caruso St John, Pier Vittorio Aureli, The Thickness of the Facade, EL CROQUIS editorial, Madrid, 2014, p23

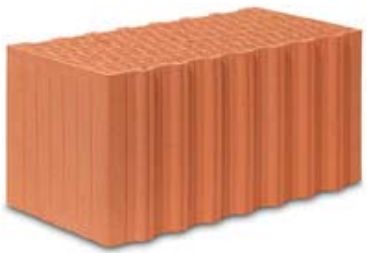
36, 38, 40, 41, 46. Aalto University Properties LTD, CAMPUS 2015 Competition Programme, p16, 20, 14, 19, 24

37, 39, 42, 43. Mia Hipeli, alvar aalto ARCHITECT VOLUME 13 UNIVERSITY OF TECHNOLOGY, OTANIEMI 1949-74, ALVAR AALTO FOUNDATION
ALVAR AALTO ACADEMY, Helsinki, 2008, p7, 56, 57-58, 146

45. Aalto Univeristy Properties LTD, Campus stories, http://aaltonet.fi/en/44. Arkkitehtilehti 1950, Suomen Arkkitehtiliitto - Finlands Arkkitektförbund SAFA, Helsinki, p65

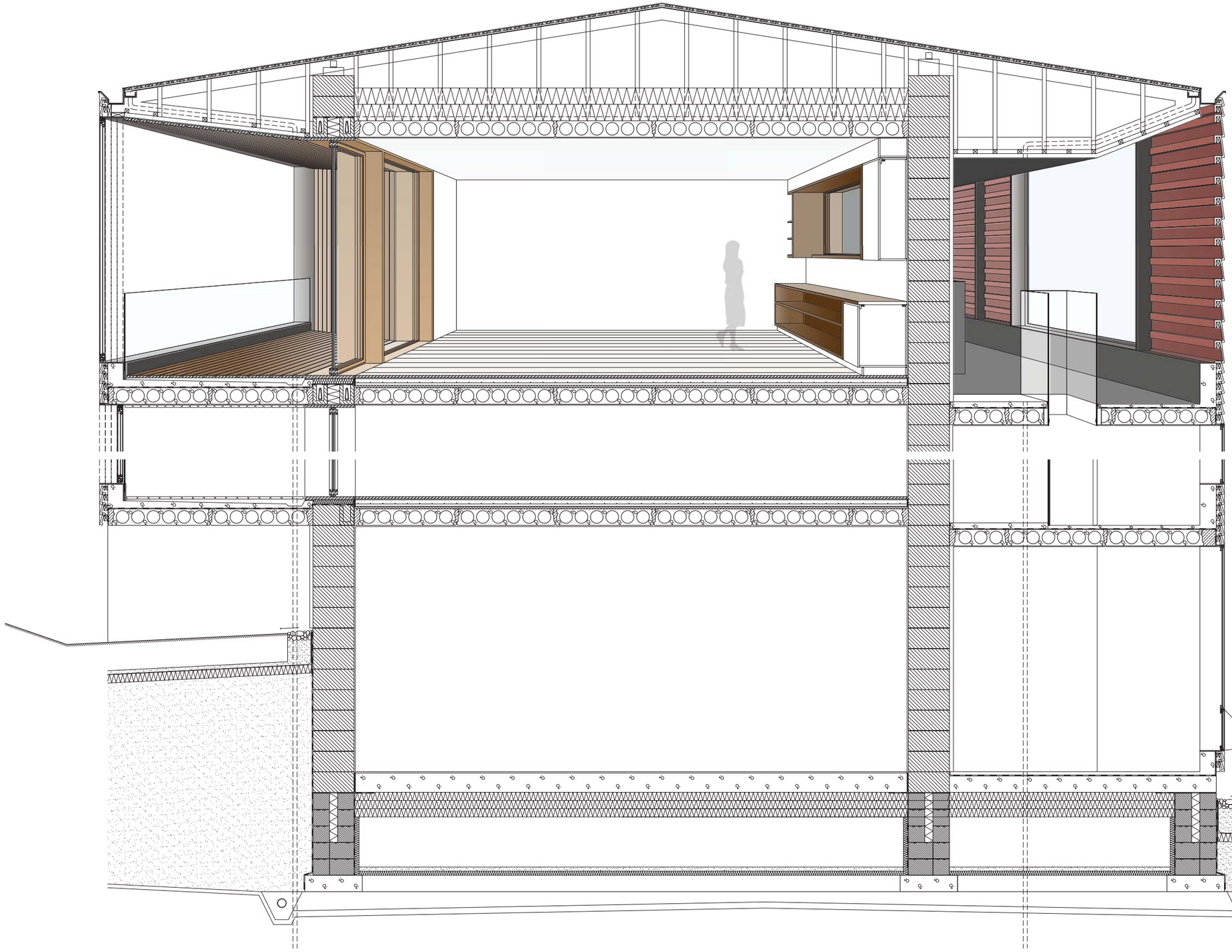
47. Göran Schildt, Alvar Aalto in His Own Words, Ottava Publishing Company, LTD. Helsinki, 1997, p49-55

annexes



Dimensions	50.0 x 25.0 x 24.9 cm
Compressive strength	8 N/m2
Weight	20.2 kg/piece
Density	0.0015 m3/kg
U-value	0.16 W/m2K (plastered)
Notes for U-value	Built with 1mm bed joint without perpendicular joints, 4cm high thermal insulating plaster on exterior and 1.5cm plaster on interior

example of thermal clay block: Porotherm H.i 50 Plan, Wienerberger Oy Ab



roof consturction

1: sheetmetal roofing
22 mm open boarding
100 x 22 mm furring @1200
underlay
100 x 150 mm roof beam @1200
50 x 50 mm batten @600
50 mm cement board for rendering
dark venetian stucco rendering

2: sheetmetal roofing
22 mm open boarding
100 x 22 mm furring @1200
underlay
100 x 150 mm roof beam @1200
200mm x 2 thermal insulation
200 mm hollow-core concrete slab
bonding coat
10mm interior plaster

3: sheetmetal roofing
22 mm open boarding
100 x 22 mm furring @1200
underlay
100 x 150 mm roof beam @1200
50 mm x 50mm batten @600
50 mm x 50mm batten @600
30 mm timber boarding

wall construction

4: clay shingles
45 mm x 70 mm horizontal battening @250
10 mm x 200 mm steel flat bar @830

5: dark venetian stucco rendering
40 mm thermal insulating plaster
500 mm x 250 mm thermal clay block
15 mm interior plaster

6: clay shingles 10 mm steel flat bar
45 mm x 70 mm horizontal battening @125
190 mm concrete
10 mm steel flat bar
6+6 mm glass railing
10 mm steel flat bar

floor construction

7: 50 mm concrete slab with dark surface
waterproofing : bitumen membrane
200 mm hollow-core slab
dark venetian stucco rendering

8: 30 mm plank flooring
10 mm levelling compound
80 mm reinforced concrete with underfloor heating
separating layer
30 mm impact sound insulation
200 mm hollow-core concrete slab
bonding coat
10mm interior plaster

9: 30mm timber decking
50-70 mm concrete slab laid to falls
waterproofing : bitumen membrane
200 mm hollow-core slab
30 mm timber boarding

10: 50 mm concrete slab with dark surface
waterproofing : bitumen membrane
100 mm x 3 insulation

11: 250 mm concrete
100 mm x 3 insulation

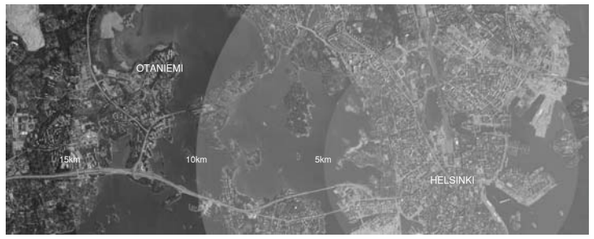
Dimensions	50.0 x 25.0 x 24.9 cm
Compressive strength	8 N/m2
Weight	20.2 kg/piece
Density	0.0015 m3/kg
U-value	0.16 W/m2K (plastered)
Notes for U-value	Built with 1mm bed joint without perpendicular joints, 4cm high thermal insulating plaster on exterior and 1.5cm plaster on interior

example of thermal clay block: Porotherm H.i 50 Plan, Wienerberger Oy Ab

sectional perspective 1:25

corpus -experimental housing-
diploma thesis
Tetsujiro Kyuma

Aalto University
School of Arts, Design and Architecture
Department of Architecture
A03: Building Technology
Supervisor: Professor Antti-Matti Siikala
2015



Beginning

I used to live in an Jugend style apartment in Helsinki constructed in 1903. It has certain atmosphere of both dignity and comfortness. The service systems such as electricity, water piping, heating, window profiles are updated to contemporary standards. On the other hand, the massive masonry construction has been always the body of the building. The special atmosphere of the building is literally constructed by the massive body of masonry construction.

Buildings embrace historical narrative. Knowing about history of architecture can lead to the discovery of essence inherited from generation to generation. It is the nutrition from the site where architecture grows from. In other words, the primal attributes for the local architecture. I believe in the primal attributes which has been inherited from generation to generation. It is "the concentrated substance".

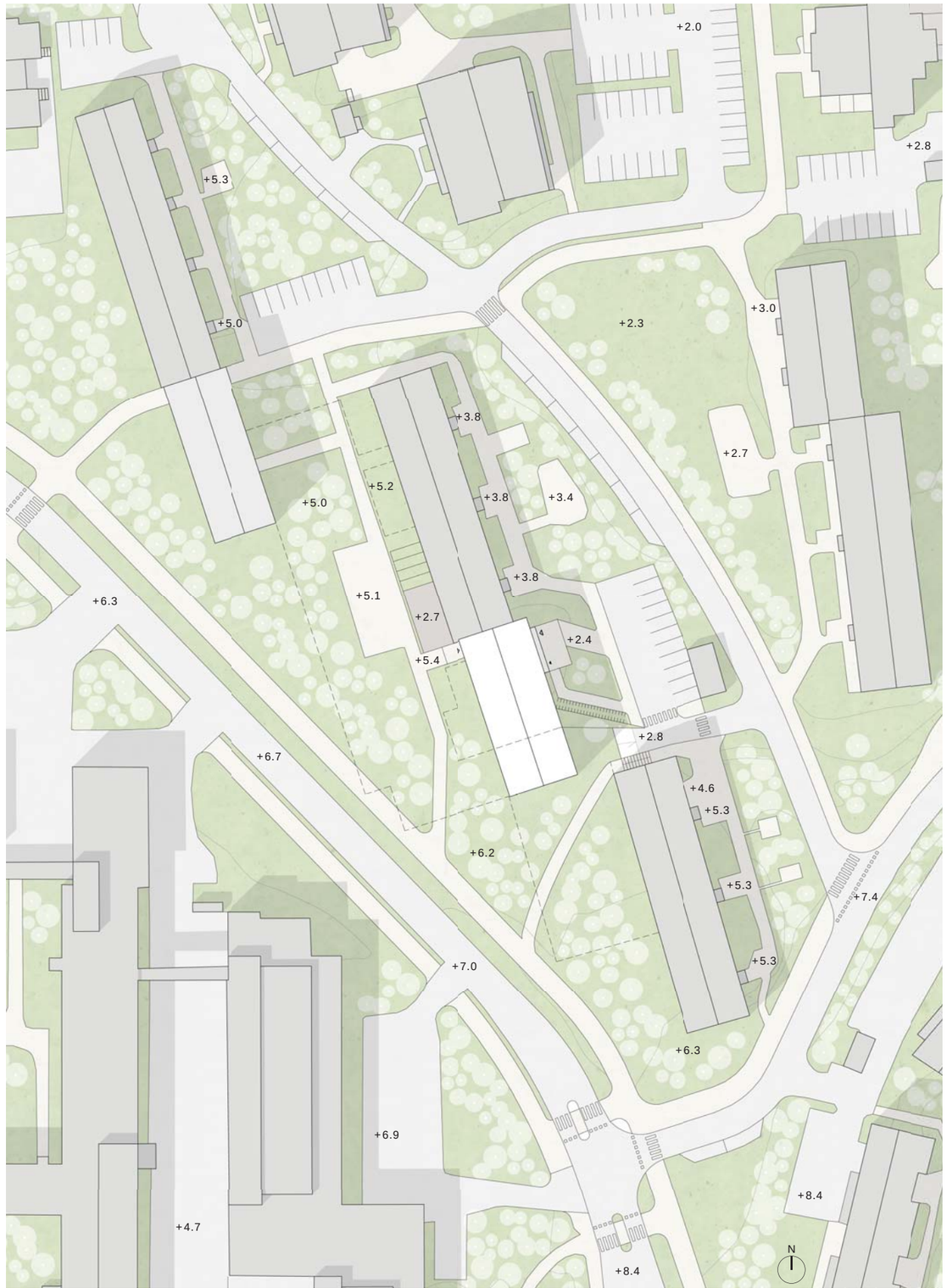
No matter how great architecture the building is, it is the next generation who decides the future use of the building. The use and the condition of the building is the reflection of the lifestyle and common sense of the time. Good implementation of architecture is revealed by the original idea of architecture which is remaining through the course of time. The essence of architecture which is good enough to be understood by people continues to be there. It was, it has been, it will be...

Helsinki University of Technology Main Building

Without doubt the totality of the whole Otaniemi campus is realised by the uniform use of red brick facades although there are exceptions such as Otaniemi Sports Hall (1950 - 1952) by Alvar Aalto, Dipoli (1961 - 1966) by Reima Pietilä (1923 - 1993) and Raili Paatelainen (1926 -), and so on. Likewise in Town Hall in Säynätsalo (1949 - 1952) , planned in the same period, Helsinki University of Technology Main building (1953 - 1964) is the result of an exploration of the expression of weight and permanence by using brick. The Main Building consists of two types of architectonics although it has reinforced concrete frame as a whole structural system. One is functional straight-angled boxes for teaching and studying spaces with ribbon windows which is one of the main languages of modernist architecture. The other, on the contrary, is the spaces for festivities and formal occasions with monumental massive brick volume of various figures. The expression of weight is realised by juxtaposing the closeness of massive brick facade with the openness and lightness of copper and glass facade. The copper plates, that patinate gradually, mediates the language of different periods of architecture expressed by massive brick facades of pre-modern architecture and the ribbon windows of modern architecture.

situation plan 1:2000

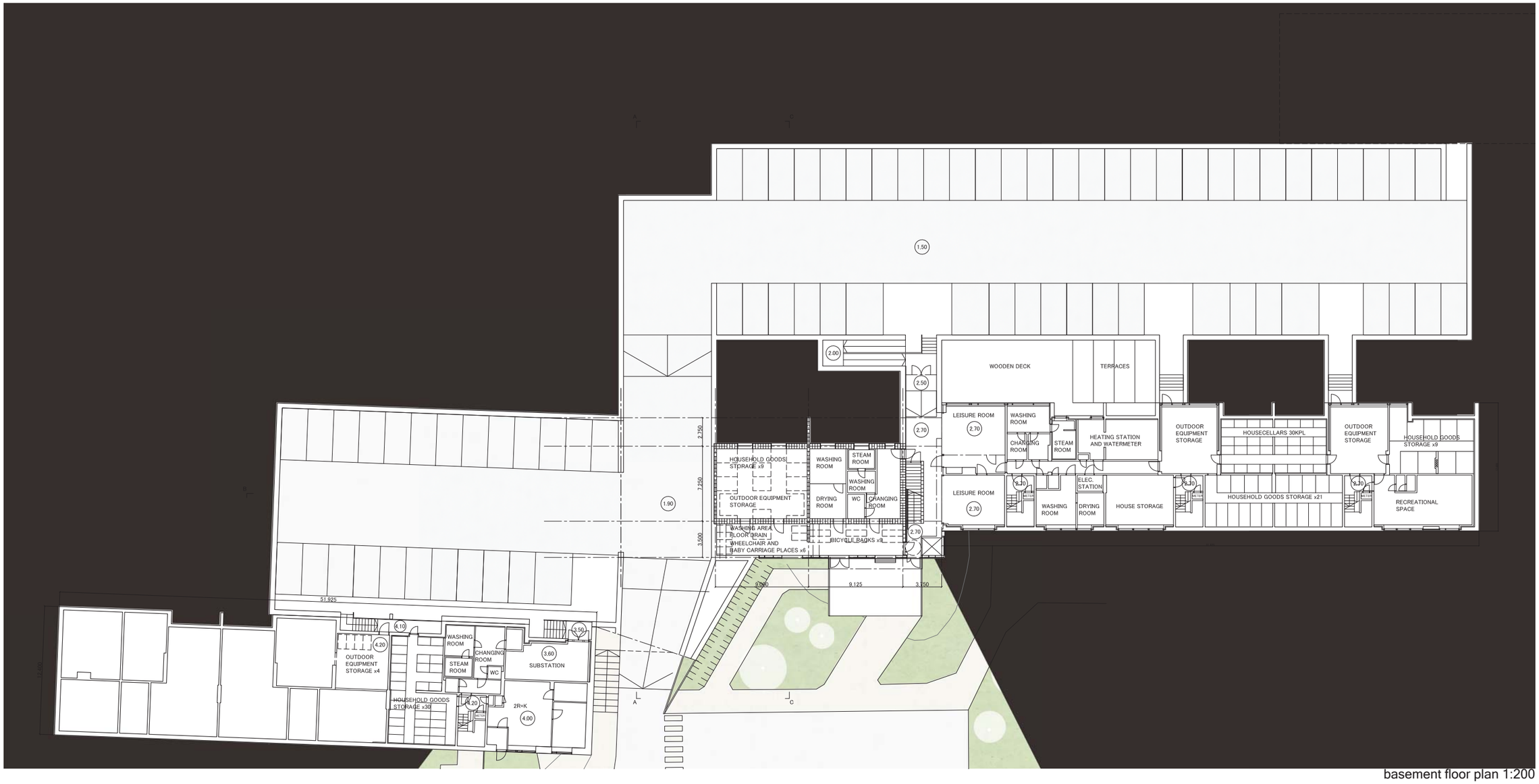
existing brick buildings
existing buildings with other materials
existing streets
existing paths
new buildings
experimental housing



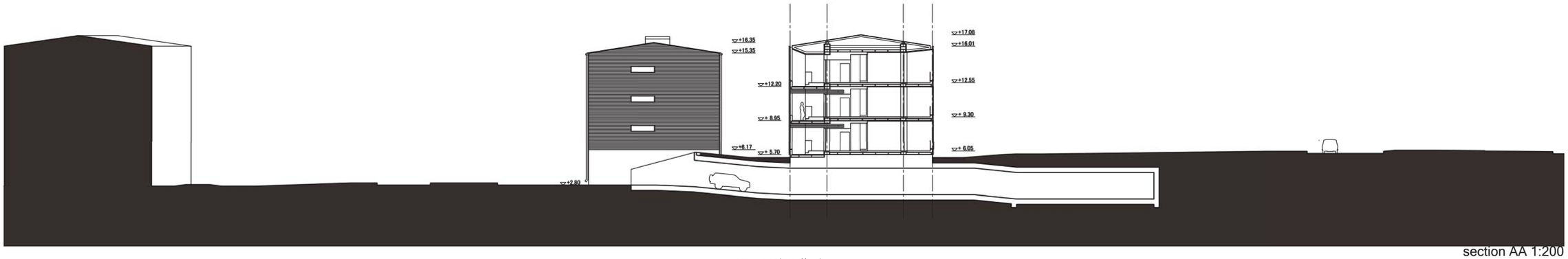
site plan 1:500

corpus -experimental housing-
diploma thesis
Tetsujiro Kyuma

Aalto University
School of Arts, Design and Architecture
Department of Architecture
A09: Building Technology
Supervisor: Professor Antti-Matti Siikala
2015



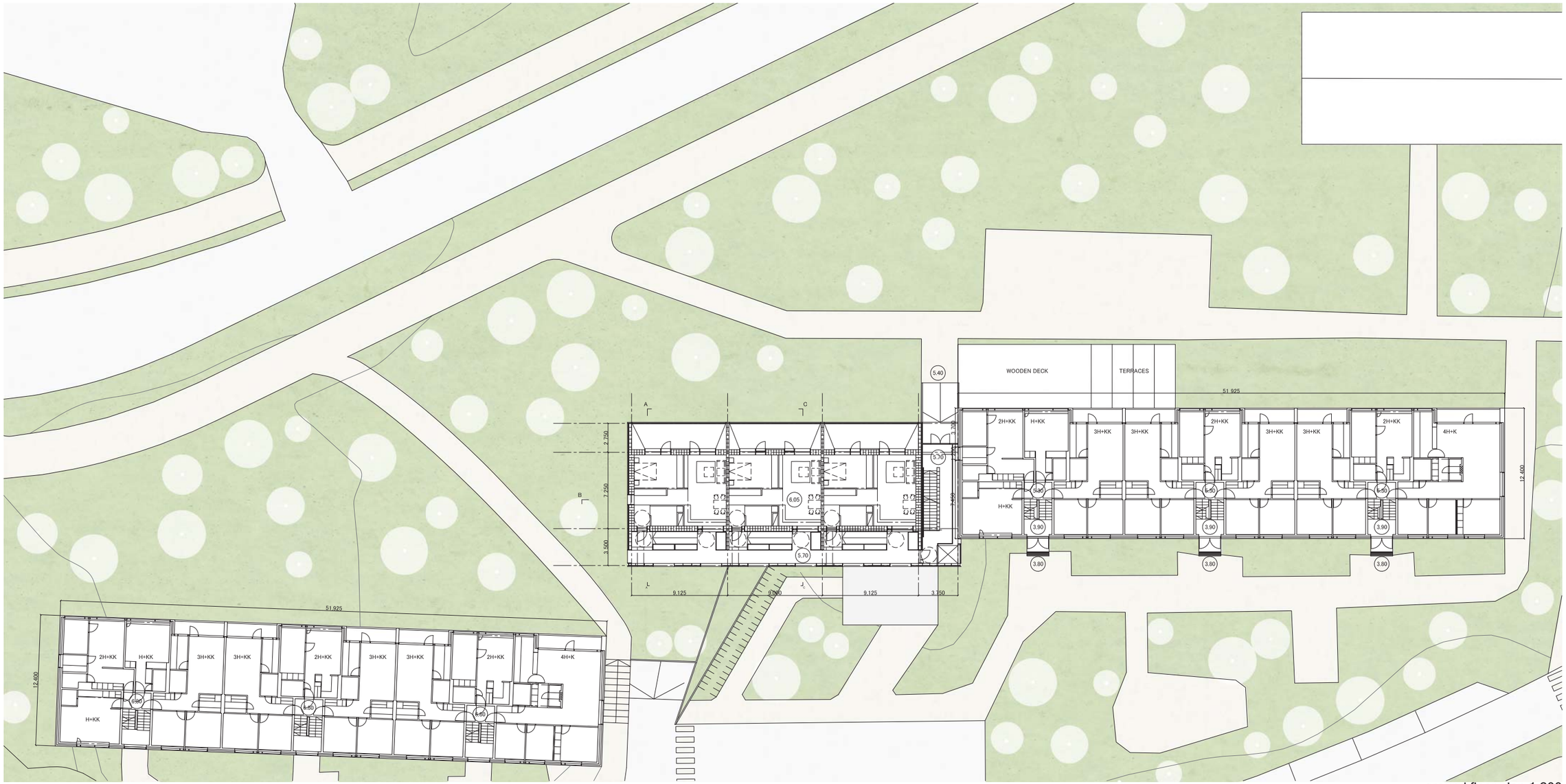
basement floor plan 1:200



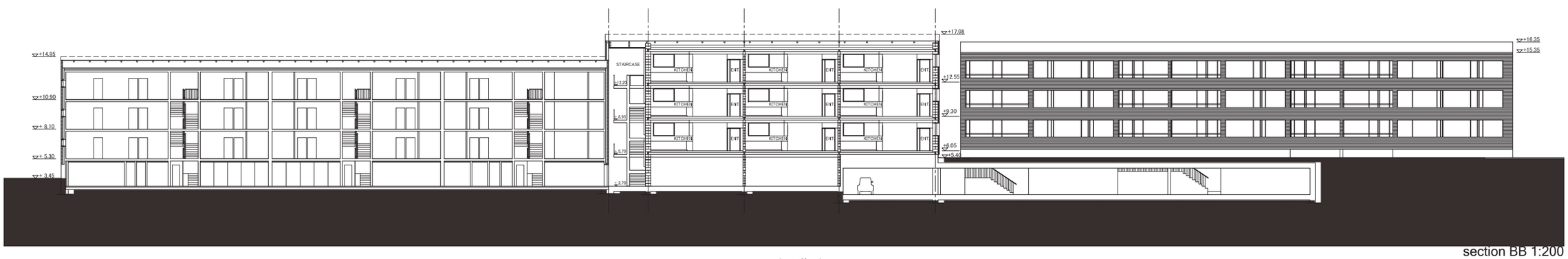
section AA 1:200

corpus -experimental housing-
diploma thesis
Tetsujiro Kyuma

Aalto University
School of Arts, Design and Architecture
Department of Architecture
A09- Building Technology
Supervisor: Professor Antti-Matti Siikala
2015



ground floor plan 1:200

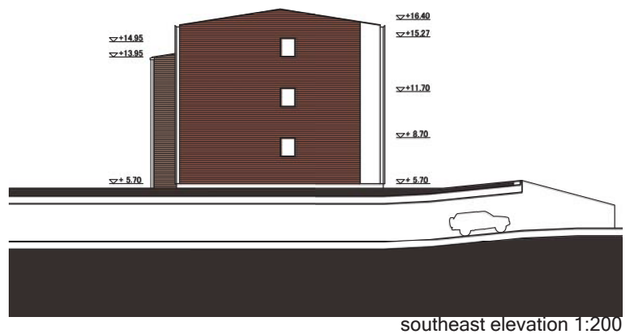


section BB 1:200

corpus -experimental housing-
diploma thesis
Tetsujiro Kyuma

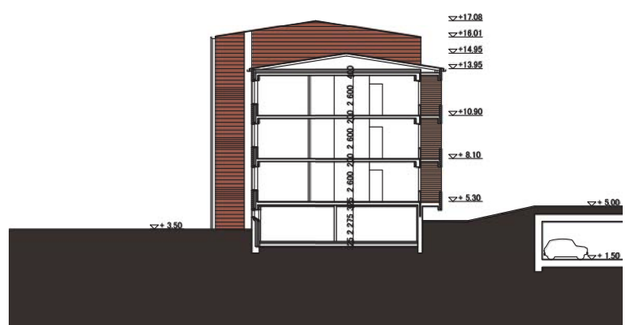
Aalto University
School of Arts, Design and Architecture
Department of Architecture
A09: Building Technology
Supervisor: Professor Antti-Matti Siikala
2015

northeast elevation 1:200



southeast elevation 1:200

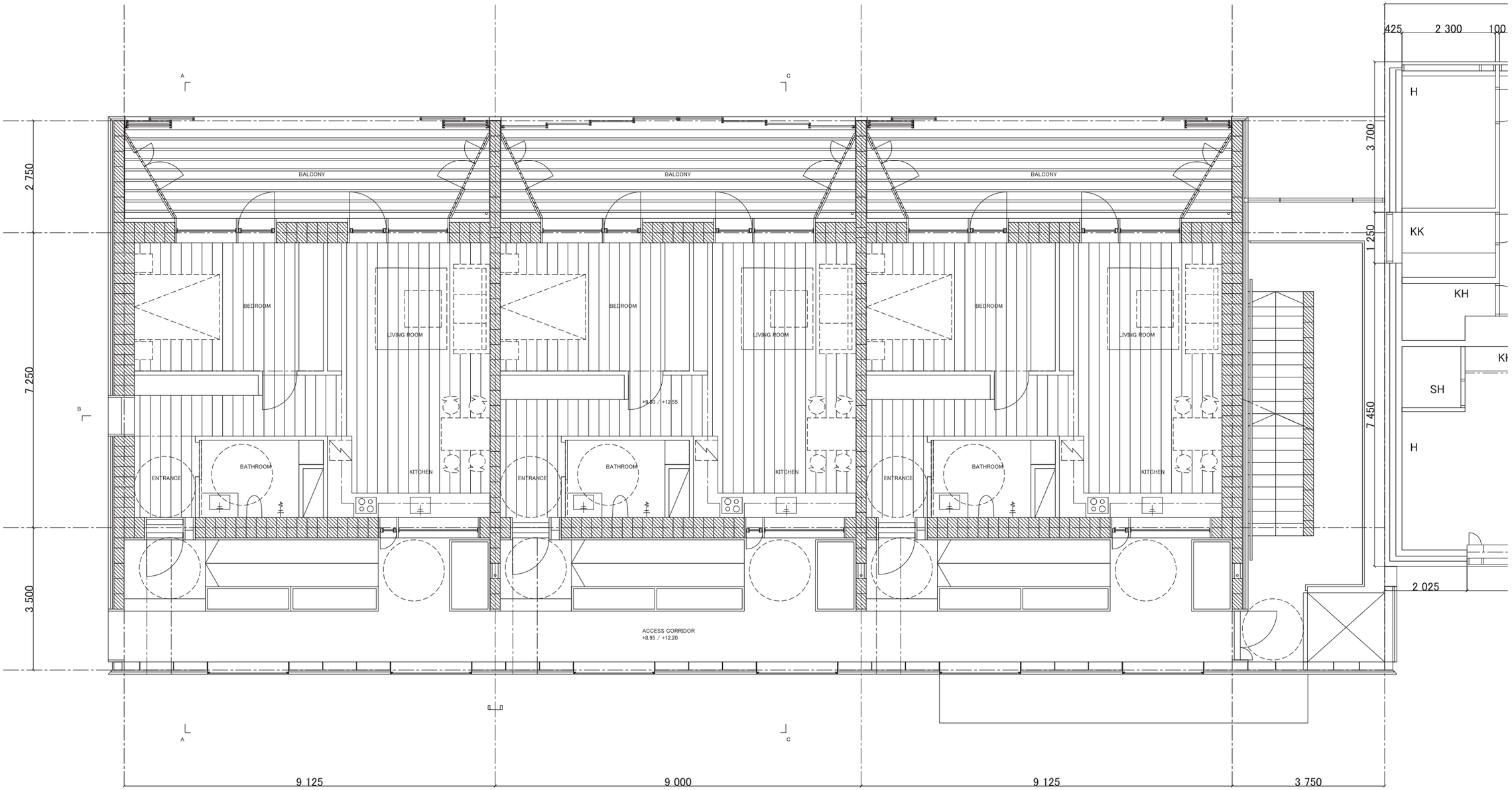
southwest elevation 1:200



northwest elevation 1:200

corpus -experimental housing-
diploma thesis
Tetsujiro Kyuma

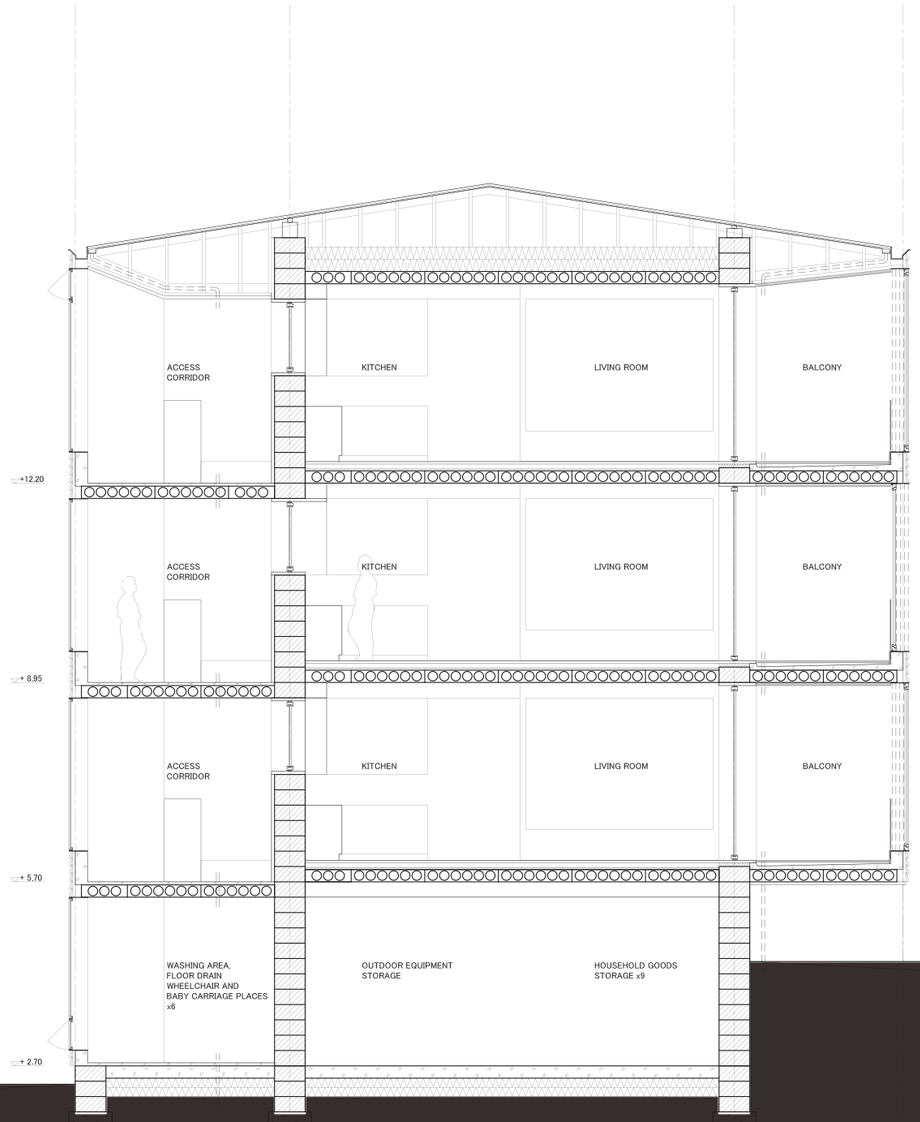
Aalto University
School of Arts, Design and Architecture
Department of Architecture
A03: Building Technology
Supervisor: Professor Antti-Matti Siikala
2015



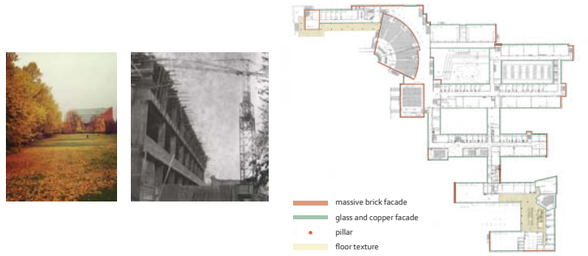
first and second floor plan 1:50

corpus -experimental housing-
diploma thesis
Tetsujiro Kyuma

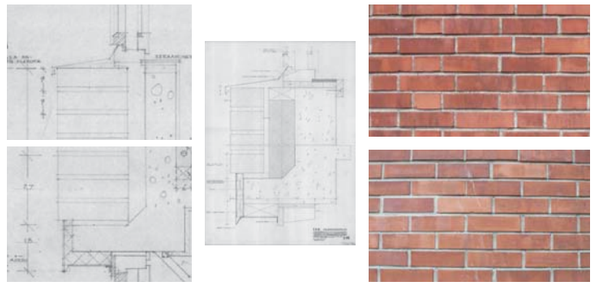
Aalto University
School of Arts, Design and Architecture
Department of Architecture
A03: Building Technology
Supervisor: Professor Antti-Matti Siikala
2015



section CC 1:50



left: Helsinki University of Technology Main Building, Espoo, Finland 1953-1964 Alvar Aalto
photograph: Hiroko Mori
centre: The TKK Main Building under construction at the beginning of the 1960s: the western wing of the General Department
right: The main drawing, dated 12.6.1961 first floor of the Main Building of Helsinki University of Technology, AAA42-3211 (modified by author)
source: Mia Hipeli, alvar aalto ARCHITECT VOLUME 13 UNIVERSITY OF TECHNOLOGY, OTANIEMI 1949-74, ALVAR AALTO FOUNDATION ALVAR AALTO ACADEMY, Helsinki, 2008, p25, 59



left: A section through the eterior wall of the Main Building of former Helsinki University of Technology, scale 1:10.27.4.-15.6.1962. AAA 42-3286.
centre: A section through the exterior wall of the extensions of the General Department and administration wing, scale 1:10.13.1.1973-11.1.1974. AAA 42-5096.
source: Mia Hipeli, alvar aalto ARCHITECT VOLUME 13 UNIVERSITY OF TECHNOLOGY, OTANIEMI 1949-74,ALVAR AALTO FOUNDATION ALVAR AALTO ACADEMY, Helsinki, 2008
right top: Raking monk bond of Helsinki University of Technology Main Building, Espoo, Finland 1953-1964, Alvar Aalto
right bottom: Stretcher bond of Student Housing Servinkuja 2, Espoo, Finland 1963, Kaija and Heikki Siren
photograph: Tetsujiro Kyuma

Brick in Otaniemi

The buildings of the campus have hierarchical differences in what at first sight are uniform redbrick facades. In the Main Building and the Main Library the massiveness of brick facades is expressed by using the one-brick thick and decorative raking monk bond (or gothic bond) brick laying despite the unnecessity in terms of structural properties. Acturally in extensions to the Main Building, a half-brick thick wall that imitates the gothic bond are used. More supportive buildings and residential buildings have a half-brick thick walls with various different masonry bonds mainly stretcher bond.
Teekkarikylä, student's village was the first project to be completed in the Otaniemi campus area. In Student Housing TKY 2-4 (1950) the dormitories were eventually built according to principles designed by Aalto but the final drawings were made by architects Heikki Siren (1918 - 2013) and Martti Melakari. One of the three buildings was constructed using recycled bricks from the Embassy of Soviet Union which was demolished.
Teekkarikylä also served as accomodation in the 1952 Olympic Games and 2005 International championship of athletics. Building of the western metro line and the new Aalto University building will raise the housing needs of Aalto University.

Interior / Exterior

Aalto wrote an essay for *Aitta* magazine in 1926, named "From doorstep to living room", about the relationship between interior and exterior in Finnish architecture.
He tried to re-consider "a sharp differentiation between the warm interior and the surroundings" ,which is required in the Nordic climate, by using "the long-depised corridor". His trial can be seen in the drawings. Floor texture on the corridor is drawn both inside and outside. This proves how important corridor was for Aalto to relate interior and exterior. He also apllied different structure than other part of the building to corridor. In Säynatalo Town Hall post and beam structure of corridor with glass facade is integrated to massive brick facade with concrete wall structure. In Helsinki University of Technology Main Building pillars are integrated to facade to support the heavy massive brick facade. In contrast, pillars in foyer like broad corridor space in architecture department are separated from facade to make larger window surface area.

From complexity to more complexity

Le Corbusier's (1887 - 1965) contribution to modernist architecture is immense. Modernism spread to the world because of invention of dom-ino system. Dom-ino system spread to the world because of its simpleness and flexibility. Aalto created some modernist architecture but this period didn't last long for Aalto. After a while he started to combine post and beam structure with massive wall structure. He used massive wall structure because of the Nordic climate but he was never against "a sharp differentiation between the warm interior and the surroundings". This is why he integrated post and beam structure with massive wall structure although it could have been much simpler to apply post and beam structure to the whole building. This is possibly where rather more complex architecture of Aalto has derived from.
Contemporary architecture needs to be more complex than that of modernist architecture because of the complex relationship between building and environment today. The complexity of Aalto's architecture could be a good start point for contemporary Finnish architecture. By developing Aalto's complex structure system, it is possible to adjust the building more intricately to the environment.
Massive clay block volume possibly lasts for some hundred years. It also functions as an absorbent body, although there is a limit what monolithic wall can deal with environment. Supporting spaces next to the massive clay volume can function as climate control space while functioning as access corridor and balcony.